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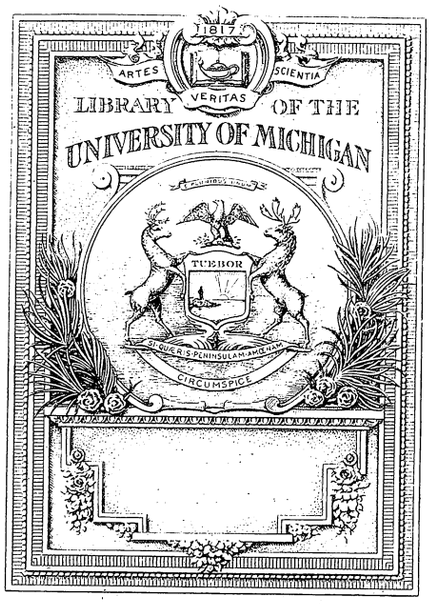
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ELECTRICAL ENGINEERING

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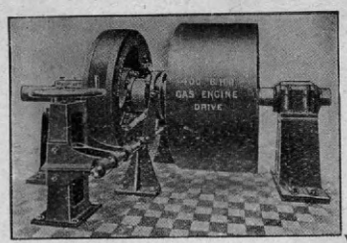
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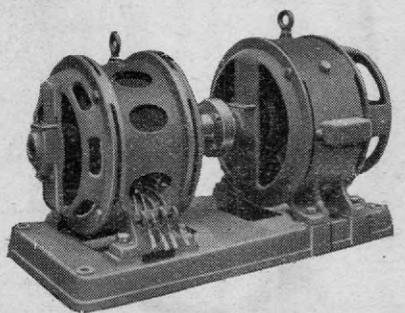
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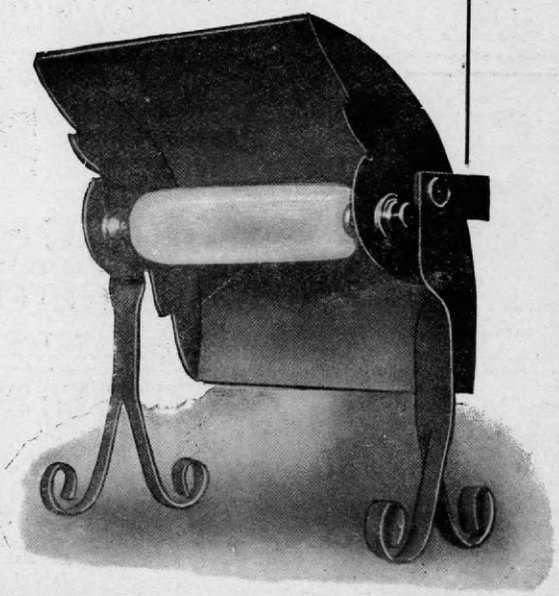
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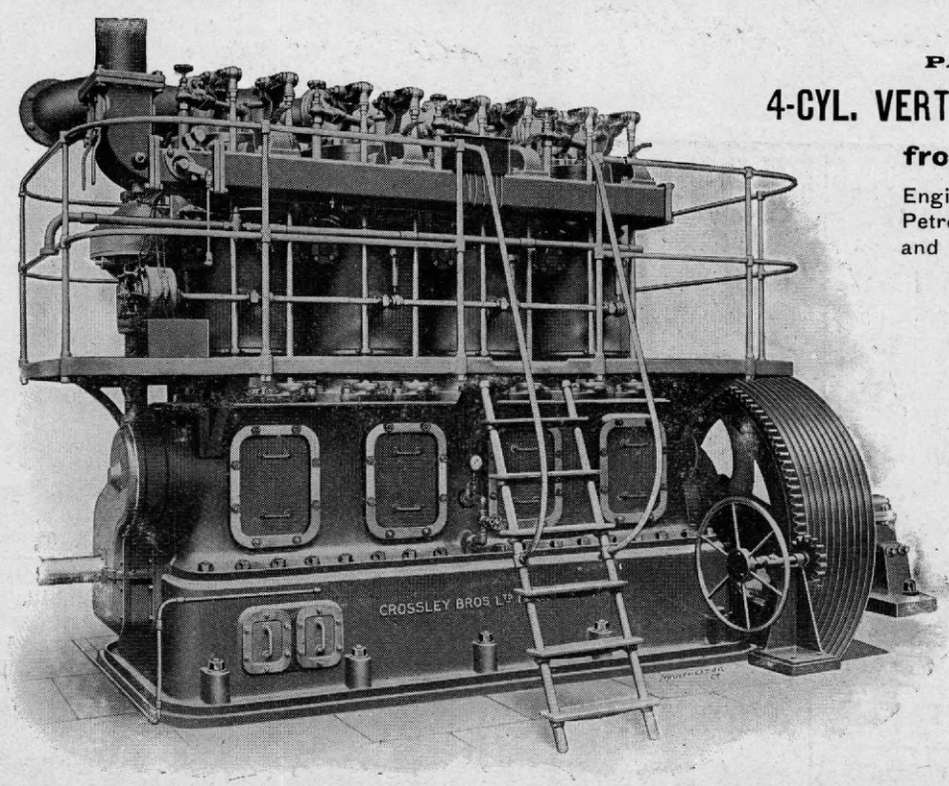
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A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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SUMMARY

OUR monthly supplement on "Electrical Engineering in Mines" is included in this issue. It opens with an abstract of a Paper on "Electricity in New South Wales Collieries," by Mr. E. K. Scott. Reports are given of discussions on electric winders before the Newcastle and Manchester Sections of the Institution of Electrical Engineers, at the latter of which a Paper by Dr. E. Rosenberg was read. A note is given on the possible cause of the explosion at Bolton, and discussions before two branches of the Association of Mining Electrical Engineers on a Paper by Mr. R. R. Smith on the care of underground plant are reported. Some notes are also given on mining patents published during December.

AN important Paper read last month by Mr. J. G. Lucas before the Institute of Post Office Engineers described some important investigations on the life of primary cells used for telephone purposes. Mr. Lucas found as the result of a long series of experiments that the substitution of powdered manganese dioxide for the granular form enormously increased the useful life of the cells, and he also recommended the employment of manganese chloride instead of salammoniac. He advocates the employment of the wet cell with the powdered depolariser for practically every purpose for which primary cells are now employed in telephony. (Page 3.)

THE Bills of electrical engineering interest which have been deposited in Parliament for the 1911 Session include a large number of proposals relating to the use of trolley omnibuses. Another Bill seeks to draw the District Railway and the allied tubes in closer union, and the Metropolitan Electric Supply Co. ask for powers to acquire the Acton electricity undertaking. (Page 4.)

A SHORT article takes up the subject of electric train lighting further, and contains a short summary of the state of affairs on British railways in this respect. (Page 4.)

A LETTER from Mr. G. Wilkinson points out that very little economy is to be derived from the use of a dimming resistance switch. (Page 5.)

AMONG the specifications published by the Patent Office on Thursday was one by the Felten & Guilleaume Lahmeyerwerke A.-G. for a subsidiary short-circuited winding on the stators of electrical machines to counteract the field fluctuations which induce currents in shaft and bearings. The Bergmann Elektricitätswerke A.-G. cover a process for effecting simultaneously the sealing in of the leading-in wires of metal filament lamps and the fusion of the central pillar to the foot of the bulb. Opposition has been entered to the grant of a patent to J. Neu for an arc lamp of the supported carbon type with a pivoted stop, and a patent by W. E. Bullock for an electrical treatment of iron and steel to prevent rusting is also opposed. (Page 7.)

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IT has been decided to run the two power stations in Leicester as one undertaking. The Hammersmith Council have applied to the Board of Trade to appoint an arbitrator in their dispute with the London United Tramways Co. The Chairman of the Worcester Electricity Committee has resigned owing to differences with the Council as to municipal wiring. (Page 8.)

EXTENSIONS involving new boilers, a 3,000-kw. turbo-alternator, mains, transformers, &c., to a value of £25,253, are recommended at Hammersmith. A number of new petrol-electric omnibuses on the Stevens system are to be put in service in London. (Page 8.)

THE capital of the Aron Electricity Meter Co. is to be increased by £100,000. The reduction of capital of the Cleveland & Durham Electric Power Co. from £1,000,000 to £700,000 is confirmed. (Page 10.)

Colliery Fatality.—Conflicting evidence was given at the inquest on December 13th, on F. Toseland, a motor attendant, who was killed at the Bond's Main Colliery of the Staveley Coal and Iron Co., Derbyshire, on the previous day. It appears that the deceased mounted a platform alongside a three-phase motor for driving a stamper, in order to oil the motor. He was heard to shout, and was then found in an unconscious condition holding on to some bare wires just above the motor. One witness, who attempted to pull him off, stated that he received a shock, while another, who did the same, said he received no shock. The first witness said that the switch was off and the wires should have been dead, while both stated that the motor was not running, and was making no noise. W. E. Chappell, electrical engineer to the company, stated that he had found the motor and gear in good condition, and that the switch must have been closed, or partly closed, for the deceased to have received a shock. A post-mortem examination of the body showed disease of the lungs and indications of pleurisy, and the cause of death was stated by the doctors to be heart failure, "quite possibly due to electric shock," though it might have been due to natural causes. The jury returned a verdict of accidental death by electric shock.

ARRANGEMENTS FOR THE WEEK

SATURDAY, JANUARY 7TH.

Association of Mining Electrical Engineers: Yorkshire Branch.
5 p.m. At Royal Victoria Hotel, Sheffield.

TUESDAY, JANUARY 10TH.

Institution of Electrical Engineers: Manchester Students' Section.
7.30 p.m. At Manchester School of Technology. "Large Gas Engines," by G. D. L. Horsburgh.

Institution of Electrical Engineers: Glasgow Section.
8 p.m. At 207 Bath Street.

WEDNESDAY, JANUARY 11TH.

Institution of Electrical Engineers: Yorkshire Section.
7 p.m. At University, Leeds. "Radio-Telegraphy," by Dr. H. Stroud.

Institution of Electrical Engineers: Birmingham Section.
7.30 p.m. At University. "Merz-Price and other discriminative protective apparatus for A.C. circuits," by K. Faye-Hansen and G. Harlow.

Association of Engineers in Charge.
7.30 p.m. At St. Bride's Institute. "Engineering Plant in Institutions," by W. T. Hatch.

THURSDAY, JANUARY 12TH.

Institution of Electrical Engineers.
8 p.m. At Victoria Embankment. "Submarine Cables for Long Distance Telephone Circuits," by Major W. A. J. O'Meara. Adjourned discussion.

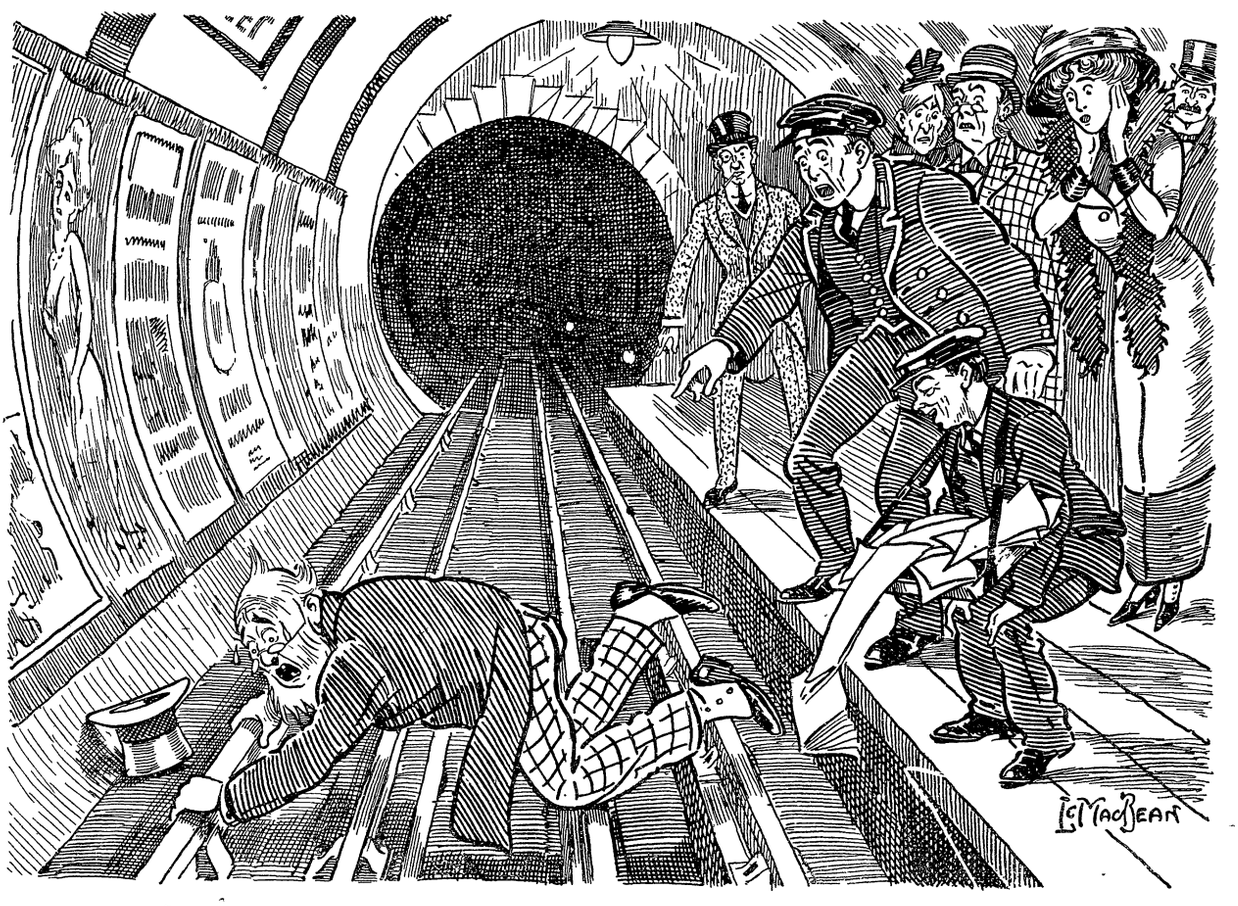
Institution of Electrical Engineers: Dublin Section.
8 p.m. At Royal College of Science.

Junior Institution of Engineers.
7.30 p.m. At Royal United Service Institution, Whitehall. "Depreciation of Buildings and Machinery," by H. F. Donaldson, C.B.

FRIDAY, JANUARY 13TH.

Electro Harmonic Society.
8 p.m. Smoking Concert, at Holborn Restaurant.

The Institution Dinner.—The annual dinner of the Institution of Electrical Engineers, which was postponed from December owing to the general election, will be held on Thursday, February 2nd, in the Grand Hall of the Hotel Cecil. There will be a reception at 7 p.m.



Station Official to old gentleman who has fallen on track: "If yez cannot take yer hands off the live rail, sorr, just thry an' lift yer knees off the other one an' ye'll break the circuit."

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PRIMARY CELLS FOR TELEPHONE PURPOSES

IN spite of the continual extension of the common battery system, and the introduction of secondary batteries wherever practicable, a large number of primary cells are still employed for telephone purposes, and there is no doubt that their use in large quantities is likely to continue. There are at present no less than 105,000 No. 1 Leclanché cells of the porous pot type in use in connection with minor and small exchanges for signalling and miscellaneous purposes. 43,000 six-block agglomerate cells are being employed chiefly for exchange operators' speaking batteries; and for subscribers' speaking batteries 29,000 two-block agglomerate cells and 18,600 (Y type) dry cells are in use, the latter taking the place of the agglomerate cells in situations in which wet cells cannot be conveniently maintained. In addition to these, 11,000 dry cells (Z type, square) of a larger size, and 26,500 bichromate cells of the porous pot type, are employed where heavier currents are required. These figures apply to cells in use by the British Post Office only; if those employed by the National Telephone Co. were added, the totals would be greatly augmented.

In view of these statistics, it is remarkable that so little has been done hitherto in the direction of investigating whether the patterns of batteries employed with but little modification for numbers of years are really the most suited for the purpose, and therefore great interest attaches to a Paper read by Mr. J. G. Lucas before the Institute of Post Office Electrical Engineers last month, in which a long and elaborate series of investigations (carried out by him in conjunction with Mr. Andrew Fraser) are described.

Stated briefly, the main conclusion arrived at is that by the substitution of powdered manganese dioxide for the comparatively large granules of manganese dioxide usually employed, the ordinary porous pot Leclanché cell is enormously improved, so much so, in fact, that there is little doubt that cells so constructed will largely displace all other patterns, both wet and dry, and will frequently enable No. 3 size cell to replace larger cells of the ordinary type. Fig. 1 (Chart 42 of the Paper) gives the results of discharging two No. 1 Leclanché porous pot cells, exactly similar in every respect, except that in one the manganese dioxide is powdered, and in the other merely granulated. The weights of material were identical, and in both cases the cells were discharged for five hours a day and six days a week.

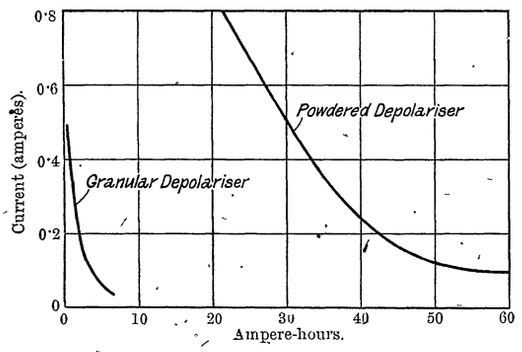


FIG. 1.—EFFECTIVE AMPERE-HOURS (ALLOWING A MAXIMUM FALL OF 33 PER CENT. IN THE VOLTAGE) OBTAINED FROM No. 1 LECLANCHÉ CELLS WITH THE SAME WEIGHTS OF MATERIALS. CELLS DISCHARGED FOR 5 HOURS PER DAY, 6 DAYS PER WEEK.

Fig. 2 (from tests plotted in Chart No. 3 of the Paper) is equally convincing. The tests were taken under conditions corresponding to working conditions. The cells were connected to the circuit from 10.30 a.m. to 4 p.m. for five days of the week and for 2½ hours on Saturdays. On Sundays they were allowed to rest, and this day is not included in the curve, which only represents the actual running days. The cells were considered discharged when the voltage had fallen to 0·925 volts, or if the resistance had risen to 3 ohms per cell. The voltage measurements recorded were taken on Mondays, Wednesdays, and Fridays at 10.30 a.m. and 4 p.m., and the ampere-hours were measured accurately by a copper voltameter. Curves 1, 2, and 3 relate to a two-cell No. 1 Leclanché battery of the ordinary porous pot type, discharging at an average current of 41·6 milliamperes; to simply comparisons, we have divided the reading by two, so as to give the mean volts and resistances per cell. Curve 1 gives the open-circuit voltage taken in the morning immediately after each period of rest; Curve 2 shows the open circuit voltage in the evening immediately after each period of discharge; and Curve 3 is the resistance of the cell. After the test was complete, the depolariser in the porous pot of one of the cells was removed, ground to powder and replaced, and another test was taken without renewing the salammoniac. Curves.

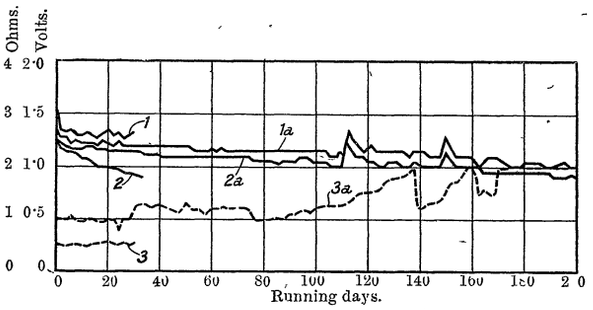


FIG. 2.—VOLTAGE AND RESISTANCE CURVE OF No. 1 LECLANCHÉ CELL, WITH THE DEPOLARISER SUBSEQUENTLY POWDERED.

Curves 1 and 1a = Open-Circuit Voltage (Morning).
" 2 and 2a = " " (Evening).
" 3 and 3a = Resistance of Cell.

1a, 2a, and 3a give the results of this test, and show conclusively the longer life and the smaller drop of voltage at the end of each discharge period. Mr. Lucas estimates a decrease of the cost of maintenance and renewals to one-seventh in the case of discharge rates of 40 milliamperes, and even greater economy with cells for larger discharge rates.

Fig. 3 (Chart No. 38 of the Paper) shows the effective ampere hours obtained from a number of different classes of cells, including dry cells and bichromate cells. Mr. Lucas attributes the larger number of ampere-hours obtainable in the case of the Siemens than in the Fuller dry cell to the fact that the Siemens depolariser is more finely powdered, and thus forms a more compact mass, so that the gases escape slower and carry off less moisture; the cell, therefore, does not dry up so quickly. The occasional bursting of the Siemens cells, he says, may be partly due to this cause, and partly to the formation of crystalline bodies within the zinc canister. Up to a certain point, it is seen that the effective ampere-hours of the dry cells actually rise with increased current; this is due to the rise in resistance (due to drying up) making it necessary to discard the cell after it has been in use for a certain period, and at the low discharge rates the ampere-hours developed in that period are of course less. The superiority of the Siemens cell is also seen; it has a far longer life than the Fuller on the lower discharge rates, and this is also clearly brought out in one of the other series of curves in the Paper. The bichromate cell shows a similar effect to the dry cells, due to the gradual diffusion of the liquids through the porous pot; in these cells, the lower limit of voltage is taken to be 1·8, and as the initial voltage is about 2·1, the permissible drop is, therefore, 15 per cent., instead of 33 per cent., as in the case of the Leclanché cell, which is allowed to fall from 1·4 to 0·925 volts. These values are the ones which are followed in practical working.

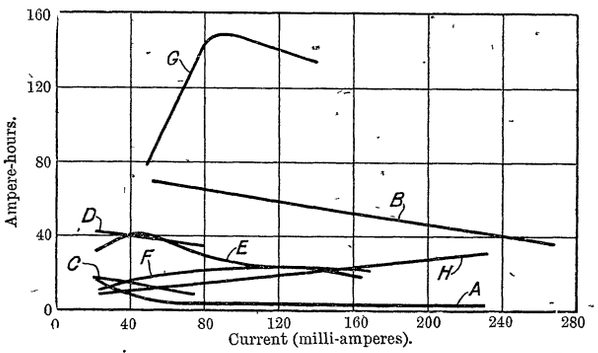


FIG. 3.—EFFECTIVE AMPERE-HOURS FROM DIFFERENT TYPES OF CELLS AT VARIOUS DISCHARGE RATES FOR 5 HOURS PER DAY, 6 DAYS PER WEEK.

A = No. 1 Leclanché Granular Depolariser.
B = " " Powdered "
C = 2-Block Agglomerate.
D = 6-Block "
E = Siemens Dry (Y size).
F = Fuller " "
G = Z Size Dry.
H = 3-Pint Bichromate.

The Paper also gives some interesting particulars with regard to the substitution of manganese chloride for ammonium chloride as the electrolyte in the wet Leclanché cell. The author has done this to prevent the evolution of ammonia

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gas. The absence of this gas renders it unnecessary to ventilate the boxes of subscribers' batteries, and therefore diminishes evaporation and "creeping," so that a considerable saving in maintenance costs is expected.

In comparing the costs and efficiencies of the various batteries for subscribers' speaking purposes, Mr. Lucas stated that experts in determining telephone transmission efficiencies were unable to perceive any loss due to the resistance of the usual two-cell speaking battery rising from 0·5 ohm to 4 ohms, and that even at 6 ohms internal resistance the loss was only just appreciable. This, he pointed out, has an extremely important bearing upon the question of the most economical type of battery to be used for subscribers' speaking sets, and he estimates that the total working costs may be reduced to half by employing cells with powdered depolarisers in place of the existing two-block agglomerate battery, and to nearly one-third as compared with dry cells. The cell he proposes has already been subjected to experimental trials with satisfactory results. It is a No. 3 porous pot Leclanché, with rod zincs, manganese chloride solution, and powdered manganese dioxide and carbon. The resistance is 1·5 ohms per cell, and Mr. Lucas sees no reason why a pair of such cells should not be maintained for five years (as compared with four years for the agglomerate type) without the resistance of the two cells rising above the 6-ohm limit, and without special maintenance costs.

ELECTRICAL BILLS IN PARLIAMENT

THE outstanding feature of the Electrical Bills of interest which have been deposited in Parliament for the 1911 Session is the large number of proposals relating to the use of trolley omnibuses. In all there are some fourteen Bills of this nature. The incorporation of new companies is proposed for Malvern (capital £24,000), Matlock (£15,000), Rotherham, Maltby and district (£60,000), the Western Valley of Monmouth (£60,000), Oldham and Saddleworth (£50,000), Croydon and district (£60,000), and Macclesfield and district (£100,000). In the last case the supply of electricity for lighting and power purposes will also be undertaken. The Rotherham Corporation also take powers in their omnibus Bill to use trolley omnibuses over several of the same routes that are scheduled by the Rotherham company mentioned above, and borrowing powers to the extent of £81,000, repayable in 30 years, are asked for, so that they are virtually competing Bills. The following Councils and companies also propose to construct trolley omnibus routes :—Aberdare, Newcastle, Northampton, Chiswick (in conjunction with the London United Tramways Co.), Lanarkshire Tramways Co., Brighton, Preston and Hove Omnibus Co. The last-mentioned proposes to run trolley omnibuses from Brighton to Worthing, and another company has scheduled the same route for tramways with some portions on the "trackless" system. The promoters of the latter undertaking include the Hon. Arthur Stanley, Mr. J. M. Henderson, and Mr. R. W. Watson, the capital being £210,000. In all the Bills relating to trolley omnibuses the Board of Trade is to be given similar powers to those which they possess in connection with tramways. The standard clause giving the Postmaster-General the right to use the posts carrying the overhead wires which is now common to tramway undertakings is also included in all the Bills.

The periods proposed for the repayment of loans by the Local Authorities shows considerable variation : *e.g.*, Rotherham wish to borrow £81,000 for 30 years, while Newcastle asks only 20 years for £14,100. Northampton divides its small loan into two portions, one for vehicles repayable in 15 years, and the other for electrical equipment repayable in 30 years.

Some interest attaches to the Bill of the Rhondda Urban District Council, which seeks powers to supply electrical fittings, apparatus, etc., on hire, and to wire premises, as there is no reference to the work being given to contractors.

There are only a few Bills of interest relating to London and the most important is a proposal to form a joint committee of the Metropolitan District Railway Co. and the London Electric Railways Company, to simplify the organisation of management of these undertakings, by practically completing their amalgamation. Proposals for a junction between the Bakerloo and Hampstead tubes at Charing Cross, and for the extension of the Bakerloo to Paddington are again brought forward; the former scheme, it will be remembered, was rejected last year owing to the possibility of danger to the foundations of the Hotel Metropole. Another interesting clause in this Bill is to empower the District, Metropolitan, Central London, Great Northern and City, City and South London Railway Co., and any other railway company, to enter into agreements for the supply of electrical energy. The Metropolitan Electric Supply Co. have deposited a Bill for acquiring the electricity undertaking of the Acton Urban District Council on the payment of £5,000 in cash under certain conditions, and paying also interest and sinking fund charges on outstanding loans.

The London, Tilbury and Southend Railway Co. seeks powers to acquire land for a generating station in Essex, and to raise £750,000 additional capital, and to sell their existing rolling stock with a view to purchasing rolling stock for the electrical operation of their lines. The Central London Railway Co. propose to extend their lines from the Wood Lane terminus to join the authorised Ealing and Shepherd's Bush Railway on the Great Western Railway Company's line. The London County Council Tramways Bill involves an expenditure of £829,030 upon tramways, and £352,010 on street improvements, and the Metropolitan Electric Tramways seek to construct a new bridge over the River Lea in order to link up with the Walthamstow tramway system, and also to construct lines in Enfield, Willesden, and Edgware.

There is also a large scheme for constructing an outer circle railway, starting at Feltham in Middlesex, and passing through the north-eastern outskirts of London, terminating at Tilbury with a total of 57¾ miles. No mention is made in the Bill of the method of traction which is to be adopted. The capital of the company is £5,500,000, and the promoters include the Hon. Arthur Stanley.

The following Corporations propose tramway extensions :—Belfast (£210,000), Hull (£92,000, which includes provision for enlarging their power station), Manchester (£7,850), Newcastle (£74,000), Southampton (£20,000), Rotherham (£51,700), Northampton (£111,000). The South Lancashire Tramways Co. propose to construct two small lengths of tramway in Farnworth and Worsley, to enter into running power agreements with the Wigan Corporation, to supply Atherton Council with electricity, and to supply electricity to premises on their tramway routes.

The Winchester Corporation will purchase the Winchester Electric Light and Power Co. at £91,000 plus the repayment of capital expenditure, although the company's Provisional Order has not yet expired. The Sidmouth Gas and Electricity Supply Co. is to be incorporated, with a capital of £30,000.

TRAIN LIGHTING

WE referred in our last issue, in connection with the recent railway accident at Hawes Junction, to the serious mistake made by some railway companies in not displacing gas lighting entirely by electric lighting in order to avoid the added danger of fire in cases of collisions and derailment. The matter has been taken up in various other quarters, and several articles have appeared in the daily Press drawing attention to the risk. Letters have called upon the Board of Trade to make regulations forbidding the use of gas on trains, but it has been pointed out by *The Times* that the actual imposition of such a regulation is outside their powers, although official recommendations can, of course, do much in that direction, and an Act of Parliament drafted by the Board of Trade for the purpose could certainly be passed. In the meantime, it is of interest to look around and see the extent to which electric lighting has already been and is being adopted on British railways. The first line to adopt electric train lighting exclusively was, we believe, the London, Chatham & Dover, many coaches on which were converted directly from oil to electric lighting on the Stone system. The South-Eastern Co.'s rolling stock was gas lighted, however, so that the trains on the amalgamated South-Eastern & Chatham Railway have still many coaches lighted with gas. The carbon filament electric lamps are gradually being replaced by metal filament lamps, and, needless to say, the electrically-lighted carriages are sought out in preference by the passengers. Among the railways whose trains are all electrically lighted are the North Staffordshire & Furness Railways. Almost the whole of the London & North-Western stock is now fitted with electric light, the change from gas having been commenced some ten years ago. The bulk of the stock of the Great Central has electric light, and the same applies to the London, Tilbury & Southend and the Great North of Scotland. The Great Northern are fitting most of their new stock, including dining cars, with electric light, and this is also being done, although at a slower rate, on the Great Western. Electric light is also being introduced gradually on the Caledonian and North British Railways. On the Midland Railway, only a small proportion of trains are electrically lighted, and the company appear to favour incandescent gas. This is also the case on the London & South-Western. The Great Eastern, the London, Brighton, & South Coast, the Lancashire & Yorkshire, and the Glasgow & South-Western Railways use gas in all except a few cases, such as dining cars and special expresses, and on the Highland Railway all the lighting is by gas or oil. As regards economy, it is difficult to get reliable figures, but there is no doubt that the adoption of the metal filament lamp has so lowered the cost of electric lighting in trains that there now can be little, if any, margin in favour of gas. The matter, however, is one of safety, and not of saving of fractions of a penny per train mile.

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

ELECTRICITY IN NEW SOUTH WALES COLLIERIES

A PAPER by Mr. E. Kilburn Scott with the above title has been discussed recently by several branches of the Association of Mining Electrical Engineers. Coal was first discovered in Australia in 1787, and the colliery industry has steadily grown. In 1908 (the year before the strike), over nine million tons were raised. The bulk of this comes from New South Wales, but coal is also mined in Queensland, Victoria, and West Australia. In the last-mentioned district electric coal-cutters are used a good deal.

The principal collieries in New South Wales are in the northern district. The Paper gives a table of particulars of those known to be electrically equipped. These are over 50 in number, and the installations range up to 475 kw. In only six cases is alternating current employed, the remainder being continuous current. In some cases the plant is for lighting only, but power is used in 18 mines for coal-cutters, in 11 mines for haulage, in 9 for fans, and very generally for pumping.

All these northern pits have adopted 250-volts continuous current, in order to employ standard American coal-cutters. Work under construction includes a generating station for the J. & A. Brown group equipped with two 1,000-kw. mixed pressure Willans turbines. Some of the D.C. stations are being changed over to A.C., such as those at Aberdare. In the Southern District, South Bulli has a 450-kw. 3-phase installation at 2,300 volts, cables at this pressure being taken through the main roads to the principal haulages. The Bellambi Colliery was the first to adopt 3-phase plant. The generating sets are 100-kw., 2,300 volts, 60 cycles, and there is a Tirrill regulator to keep the pressure steady. One of the haulages is 35 h.p. and the other 50 h.p., the pressure being stepped down at each of these from 2,200 to 220 volts. The cable is Siemens 3-core 19/16 insulated with paper, lead covered and armoured with steel tape. The water in the mine is slightly acid, so the steel tape is covered with bitumenised fibre.

Many of the older American engines for belt drive are being taken out in favour of British direct coupled sets. Mr. Scott remarks that there is no doubt whatever that British makers of coal-cutters would be preferred to the American for any extension plant if only they would produce machines suited for room and pillar work.

A favourite method of fixing cables in New South Wales mines is to tie them on to petticoat insulators which have right angle and coach screw stalks. The stalks are screwed into the supporting timbers of main roads and headings, or where convenient they screw into wooden plugs driven into the roof.

The type of coal-cutter most used is the chain breast pattern, of which the Jeffery, Goodman, Morgan-Gardner, and Sullivan machines are examples. Percussion pick machines are much used in New South Wales, but they are nearly all driven by compressed air. An electrically driven percussion machine called the Morgan-Gardner is, however, in use to a small extent. It has a reciprocating piston, actuated by a spring and cam, the spring striking the blow and the cam drawing the piston back. The cam is in turn driven by a motor, having a vertical spindle.

The bar coal-cutter as made by Mavor & Coulson has got a good foothold in Australia. These machines are in use at Mount Kembla Colliery, New South Wales; Stockton Borehole Colliery, New South Wales; Invincible Colliery, New South Wales; Zambunna Colliery, Victoria. At Mount Kembla one of these machines produced over 20,000 tons in its first year.

Briefly the reason for the appointment of the Committee of Inquiry into the use of electricity in mines was the unrest of the miners in some of the Maitland collieries. This was particularly the case at Hebburn Colliery in the South Maitland District, where the strike started. The first record of trouble was the burn out of a trail cable reported to the manager on October 24th, 1906. From then on there were various minor accidents, until August 23rd, 1907, when another trail cable burnt out in the safety lamp district. The miners of the whole Northern District then stopped, and one of the conditions they asked was that the electrical machines should be taken out. The committee appointed by the Government consisted of: His Honour C. E. R. Murray, District Court Judge; Professor T. W. E. David, Professor of Geology at the University of Sydney; O. W. Brain, M.I.E.E., Chief Electrical Engineer of Government Tramways and Railways; A. E. O. Sellers, Manager of the Bellambi Colliery; and Jas. Curley, a practical miner, to represent the men.

After examining various witnesses, the Committee issued an interim report on November 29th, and two of the clauses were: (*a*) A considerable number of electrical burn outs have taken place in the Hebburn Colliery. (*b*) The matter of the use of electricity in this mine will not be on a satisfactory basis until a complete set of regulations governing the installation, operation, and testing of every portion of the equipment has been adopted and is enforced. This will involve the obtaining of some additional testing apparatus by the management.

The Committee then proceeded to examine further witnesses and make inquiries regarding the drafting of special rules and starting of examinations.

The Paper reproduces some of the evidence given by the author himself before the inquiry, and some of the questions set in the examination for the mine electrician certificate in New South Wales. The number of certified mine electricians in New South Wales is given as 40.

It should be noted that the New South Wales rule *re* examinations provides that, not only must the mine electrician have a certificate, but that the assistant electrician must have one as well. The rule reads: "No person shall, after the expiration of twelve months from the coming into force of these rules, be allowed to act as mine electrician or as an assistant electrician, unless he shall be the holder of a certificate of competency issued by the Department of Mines, authorising him to act, in the first case as a mine electrician, or in the second case, as an assistant electrician." Engine drivers are also examined by the Government. At the University of Sydney, all the students in the Mining School have to take one year's course in Electrical Engineering.

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ELECTRIC WINDERS

THE discussion on electric winders by the Newcastle Local Section of the Institution of Electrical Engineers, reported in "ELECTRICAL ENGINEERING IN MINES," December 1st, 1910, p. cxxv, was continued on Monday, December 12th. Mr. T. CAMPBELL FUTERS said that he had no doubt that electric winding could be made as safe as steam, but he objected to many electric winders on account of the complications. In steam winders, the parts were visible and easily adjusted or repaired. They could run for years without repair, and accidents were few and chiefly due to fatigue of the metal. Could the same be said of electric winders? The initial cost of an electric winder was greater, and it was questionable if it could be run so economically that the greater prime cost was justified. Most German collieries had adopted the Koepe pulley, as it was recognised that the inertia of the heavy drum was disadvantageous to electric winding. The objections to the Koepe pulley were (1) the danger of both cages falling on breakage of rope; (2) the tendency of the rope to slip; (3) the difficulty of lowering or raising greater weights than the pulley was designed for; (4) the large size of pulley necessary to deal with heavy loads; and (5) the low limit of speed, and therefore inflexibility of colliery output. In Germany the life of ropes was limited by law, and usually they could not be greased or oiled. Provided the difficulty of the inertia of the cylindrical drum could be got over, he thought the Koepe system was not worth considering. In modifications of the system, the rope was balanced by the spiral drum (a cure worse than the disease), or flat hemp ropes were wound on a light bobbin. The difficulty was not so much the balancing of the ropes, but the inertia of the moving mass. The weight of the drum depended on its diameter, and this was determined by the depth of the pit and the angling of the pulleys, as it was not considered good practice to let the rope coil on itself. The minimum diameter of the drum was usually 100 to 120 times the diameter of the rope, but with a flexible rope might be much less than this. Both diameter and width of drum could probably be considerably reduced with safety. If the net load were made a maximum and the speed a minimum, the acceleration peak would be largely reduced, and the rope would be less strained. An objection to the Ilgner system was the heavy first cost, especially when the winding motor was direct connected. There was now no objection to gearing, even in the largest winders, and the size of the motor could thus be reduced. Considering the cost of the gearing, however, it was doubtful if the initial cost could be reduced. It was, he thought, questionable whether the Ilgner arrangement was justified, and he suggested a method utilising the stored energy of clutched and unclutched weights. As regards control, the Ward Leonard system was the best. On the whole, however, he thought it better to retain steam winders and utilise the exhaust in a low-pressure turbine. As to whether a colliery should generate or buy from a supply company, if the colliery company could find the capital and the load factor was favourable (the Eight Hours Act tended to aid this) it was undoubtedly cheaper to generate at the colliery.

In a written communication, Mr. F. ANSLOW (Glasgow) said that he was not prepared to agree altogether with Mr. Wilson that supply from a company would render electric winding commercially efficient. The margin in cost between the two systems of winding was very small. Centralised supply rendered the problem one of overall efficiency rather than efficiency of the winder only. With regard to the turbine plant with one generator for the winder and another for general colliery purposes referred to by Mr. Hooghwinkel in the previous discussion, his own firm had devised a similar arrangement with the addition of a flywheel for peak loads, which was better than relying on the boilers. Another plant installed by his firm in South Wales consisted of an Ilgner winder at a new pit two miles from the generating plant. All steam-raising plant and engines were dispensed with at the new pit.

Mr. MATTHEW KIRBY submitted two sets of figures for steam winding engines at Bowburn Colliery and Park pit respectively. The former was a cross-compound engine (put down in July, 1907), non-condensing, working without superheat at 150 lbs. per sq. in., cylinders 13¾ in. and 23 in. by 32 in. stroke. The drum was 8 feet diameter, and the depth of shaft 636·6 feet. Two tubs containing about 10 cwts. each were wound in each cage. There was a balance rope. The engine made the lift in 25 to 27 seconds, the tubs being changed in about 5 seconds. One hundred tons could be raised per hour. During the period over which figures were taken, the coal raised per hour was 20·28 tons. Summarised, the cost in pence per hour of boilers (depreciation and interest at 10 per cent.) was 1·97d.; labour, 2·124d.; coal, 9·67d.; stores and repairs, 0·205d. This gave a total of 13·989d. per hour, or 1·084d. per ton per 1,000 feet. The cost in pence per hour for the engine was, for interest and depreciation (10 per cent. of capital), 5·78d.; labour, 10·76d.; stores and repairs, 0·87d., giving a total of 17·41d. per hour, or 1·35d. per ton per 1,000 feet. The gross cost was therefore 2·434d. per ton per 1,000 feet. The Park pit engine (put down in December, 1907) was a similar one. The cylinders, 19⅜ in. and 32 in. by 60 in.; drum, 9 feet in diameter; steam at 150 lbs. per sq. in.; non-condensing. There was no balance rope. The shaft was 400 feet deep, and two tubs, each of 30 to 35 cwts., were wound at a time. The engine could raise about 300 tons per hour. During the period over which the figures were taken 35·2 tons were wound per hour. The figures gave a cost in pence per hour for the boilers (10 per cent. of capital), 3·878d.; labour, 6·5d.; coal, 16·8d.; stores and repairs, 0·172d. This gave a total of 27·350d. per hour, or 1·66d. per ton per 1,000 feet. Similarly for the engine the cost in pence per hour for capital charges was 10·2d., for labour 7·0d., and for stores and repairs 0·59d., a total of 17·79d., or 1·08d. per ton per 1,000 feet. This gave a gross total of 2·74d. per ton per 1,000 feet in this case. Neither gave low costs, but they were actual examples of steam practice.

Mr. H. A. COUVES (Newcastle-on-Tyne Electric Supply Co.) said that there was a large demand for electric winders of small output; many collieries in the North were working 700 to 800 tons per day, winding from 600 to 700 feet. Colliery companies were well advised not to put in electric winders if current had to be generated privately, but the case was different where a public supply was available. Many old steam winders still working ought to have been scrapped long since; the installation of electric winders in their place would not be expensive, as most of them could be three-phase geared machines. He knew of one small Ilgner set drawing coal from 140 feet, and taking a little over 50 units per 100 tons; in another case of a three-phase geared machine winding from 180 feet, the current consumption per 100 tons was about 80 units. Where a company had spent considerable capital on economical steam winders for large outputs, a case existed for installing exhaust turbines, but not otherwise.

Mr. SCHUIL drew attention to the omission by Mr. Wilson of buffer storage-batteries for equalising the load. It was not everywhere that supply companies could be found having plant of such capacity that a 1,500 h.p. load could be thrown on and off without causing voltage troubles. At Clausthal, a battery capable of giving 200 amps. for one hour kept the 'bus-bar volts within 2½ per cent., notwithstanding peaks of nearly four times the current mentioned. The battery need only be small, provided that heavy rates of charge and discharge could be carried. Many speakers mentioned the low power-factor of a three-phase induction motor at starting. Such rotors had non-inductive resistances in series, and therefore, unless the resistance was cut out too quickly, the power factor should not be low. Dr. Rosenberg had confirmed this view by giving figures from some large three-phase Westinghouse induction motors. In a 1,600 h.p. winding motor, 98 r.p.m., 50 cycles, the power factor was 74 per cent., 80 per cent., and 79 per cent., when the starting torque was normal and 160 per cent., and 200 per cent. respectively of normal torque. In a 1,000 h.p. motor, 300 r.p.m., 50 cycles, the power factor was 91 per cent. and 90 per cent., with starting torque equal to and double the normal torque respectively. In a 700 h.p. winding motor, 58 r.p.m., 25 cycles, the power factor was 84 per cent. and 85 per cent. for starting torques equal to and double the normal torque. Hence the power factor in starting was in general quite as good as, if not better than, during running at normal full load.

Mr. W. C. MOUNTAIN (Ernest Scott & Mountain, Ltd.) mentioned some figures just given by Mr. Hudspeth before the Institute of Mining Engineers for electric winders at the Deutschland, Castellengo, and Heinitz mines, Upper Silesia. To compare results he had obtained estimates from one of the first makers of steam winders in the country. Briefly, the cost of the electric winder at Deutschland, including generating plant, was £9,750. That of the equivalent steam plant, including boilers for the same duty, was £3,500. The cost of winding per 100 tons with electric drive was 24s. 9d., while with steam it was 9s. 3d. Taking the Castellengo plant, the cost of electric plant as above, was £9,750. The cost of the equivalent steam plant was £4,000. The cost of winding per 100 tons with electric drive was 16s. 2d., while with steam it was 7s. 7d. In the case of the Heinitz winder, the cost of electric plant was £9,050. The cost of steam plant for the same duty was £6,330; hence the cost of winding per 100 tons with electric drive was 15s. 10d., while with steam it was 11s. 9½d. The first two were Siemens-Ilgner winders, and the third was on the Ward Leonard system fed direct from a D.C. generator on a turbine which also drove a three-phase machine for the ordinary colliery supply. At another colliery winding 4,200 tons of coal per 15-hour day with one pair of steam engines from a depth of 1,626 feet, the cost per 100 tons, including 5 per cent. interest, 10 per cent. depreciation, labour, stores, coal, &c., was 5s. 2d. Thus in many cases electric winding could not compete with steam winding. There were cases, however, where electric winding, especially for small duties, could effect considerable saving. He would like to ask Mr. Schuil what was the life of the batteries he mentioned. In one case a battery had been installed at a German colliery for this purpose, but after nine months it was put out of commission as the plates were damaged, and an equaliser set used instead.

Mr. SCHUIL said that the batteries at Clausen had been in operation, he believed, for 2½ years, and a similar plant at the Carnegie Steel Works for 2 years.

Mr. WILSON replied briefly, and the discussion was closed.

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CONTROL OF ELECTRIC WINDERS

IN a Paper read before the Manchester Section of the Institution of Electrical Engineers on December 6th, Dr. E. Rosenberg (British Westinghouse Electric & Manufacturing Co.) dealt with the control of electrically driven main winders. The author pointed out that, besides starting and stopping ordinary loads, it is often necessary to lower unbalanced loads, in which case the motor, if it be used at all, must work as a generator. If no tail rope is used, and the load on the up-going cage is just balanced by the load on the down-going cage, then the rope weight will, in the first half-trip, exercise a positive, and in the second half a negative torque, and the winding machine has at first to act as a motor and then as a brake.

In the case of Ward-Leonard control, as long as the speed of the motor-generator is kept constant, the shunt regulator of the generator determines its E.M.F., and the speed of the constantly excited winding motor will attain a value which gives an E.M.F. of the winding motor only slightly higher, because a slight difference will give rise to a circulating current of sufficient magnitude to balance the torque impressed by the load. Assuming that the exciting voltage is kept constant, that there is no flywheel and no artificial slip in the motor-generator, that the slip of the induction motor at full load is 2 per cent., that the controlling machine has a drop in voltage from no load to full load of 5 per cent., and that the winding motor has a drop in speed of 5 per cent. from no load to full load, then the difference of the motor speed between no-load torque and full-load torque will be approximately 12 per cent. If the winding motor has to exercise a negative torque of half the value of the normal working torque, the difference in speed will grow to 18 per cent. This difference of 18 per cent. grows in proportion if the controller lever is put into a position for a low speed. For half excitation the lifting speed for normal load will be about 39 per cent. of the full (no-load) speed and the lowering speed for a load which would require half-braking torque will be about 56 per cent. of the full speed. If an Ilgner set with increased slip is used, or if the excitation is not constant, the differences will be greater. It is therefore necessary to use a speed indicator, and not to depend upon a positive relation between the position of the control lever and the speed of the winding engine. With Ward-Leonard control, the movements of the lever in order to come to rest are nearly the same whether the motor is driving or driven, and a very great braking torque can be obtained.

With a D.C. shunt motor fed direct from the 'bus-bars, and provided with combined series and shunt regulation, braking is done most effectively within the range of shunt regulation without any additional apparatus, as the motor will work as a generator if driven from outside and return power to the line. For a given position of the shunt regulator (with the series resistances cut out) the motor when exercising half full-load brake torque will develop a speed approximately 7 per cent. higher than the motoring speed for the same position. When resistance is inserted in the armature circuit, the E.M.F. of the motor working as a generator will have to be considerably greater than the 'bus-bar voltage in order to return power through the resistance to the line. Thus 80 per cent. motor speed at full load would correspond to 110 per cent. generator speed for 50 per cent. brake torque, and a position for creeping speed of the motor, say 5 per cent., would allow a generator speed for 50 per cent. brake torque of 148 per cent. Consequently, such controller positions are not suitable for lowering loads, and regenerative control should only be used with the controller in "full-on" position. Regenerative control cannot be used to slow down the motor at the end of the trip. The controller has to be moved into the "off" position and the mechanical brake applied, or it may be moved beyond the "off" position and the first steps for the lifting movement used. In case the speed throughout the lowering trip has to be kept lower than the speed which the motor develops with all the armature resistance cut out, for instance, for lowering of men, counter-current must be used during the whole trip. Regular braking with counter-current is a very safe, but naturally wasteful, method.

With a polyphase induction motor, the conditions are analogous to those of a D.C. shunt motor (without shunt regulator) fed direct from the 'bus-bars. If the rotor is short-circuited, the machine will, for a slight increase in speed, act as a generator and return power to the line. The generating speed on half-load would be only 3 per cent. above the full-load motor speed. Liquid controllers, however, are seldom completely short-circuited, and, therefore, the speed difference might be nearer to 6 or 8 per cent. To brake the motor down to lower speeds, counter-current is required. Driving the motor at over-synchronous speeds with resistance inserted (controller in lowering position) would here also cause too high a speed to be reached.

Dr. Rosenberg then described the use of a D.C. motor as a dynamic brake by disconnecting the armature from the line, and connecting it to a resistance. If the machine is constantly excited, the braking torque will be in direct proportion to the speed of the motor, and in inverse proportion to the resistance. It would be necessary at first to increase, then to reduce the resistance, or a constant resistance could be used which would only limit the speed of the lowering load, and other means could be used to bring the load to rest at the end of the trip. To use an induction motor as a dynamic brake, the stator is connected to a low-voltage D.C. supply and the three slip-rings to a three-phase resistance. The machine then represents an A.C. generator with stationary field, the exciting winding of which is distributed in the slots, and with a rotating polyphase armature connected to resistances. As the air-gap is small, the armature reaction is exceedingly high, and this has a very important influence, because it is only for small armature reaction that (at constant speed) the torque will be in inverse proportion to the resistance. As soon as the armature current exceeds a certain limit a reduction of the resistance will even reduce the braking torque.

The author then dealt with the different ways of connecting a three-phase winding to a D.C. supply, and necessary value of current to produce the same magnetic conditions as at full-load with A.C. supply. A method of determining the relations between torque, speed, and resistance under these conditions was given, and tests on a 30-h.p. motor were described. It was shown that the torque always increases with increased D.C. excitation, whereas for a decrease of resistance the torque might be increased or decreased, dependent upon the momentary speed. Consequently, it is not safe to use the variable resistance of the controller for braking, as the driver may easily overshoot the mark in trying to make the brake more effective, and then he would not be able to stop the load. It would, however, be possible to change the resistance automatically in proportion to the frequency of the rotor currents. For a constant excitation and a constant resistance in the armature there exists a critical speed up to which the torque increases and after which the torque goes down with increased speed. If the exciting current and the resistance are high enough, however, it is possible to ensure that the brake torque wanted is well below the obtainable maximum torque, and that the speed wanted is well below the critical speed. For stopping mechanical brakes would be supplied.

Turning to eddy-current brakes, the author pointed out that there is an essential difference between those with copper discs and those with cast-iron armatures. The latter had the important advantage that there was a steady increase in torque with increasing speed, and no critical speed after which the torque diminished as with copper disc brakes. His explanation was that the virtual resistance of the cast-iron armature cannot be considered as a constant value, but that it increases with increased periodicity. He considers that for low speeds the flux penetrates the whole depth of the cast-iron armature, and that with increased speed, and therefore increased voltage, the current density near the surface increases, and shields the deeper parts, so that the currents crowd on the skin of the armature. Therefore, with increasing periodicity, the resistance of the eddy-current path increases, and this also has the effect that the resultant flux does not tend to fall off, since in order to maintain the current with the increased resistance, a higher E.M.F. is required. The eddy-current brakes as used in connection with large hoisting engines are able to deal with continucus trips of unbalanced loads, and it is possible to regulate the speed without use of the mechanical brake down to a very low value. The field is excited from D.C. 'bus-bars which are fed by a motor-generator and on which a storage battery is floating; therefore the brake is also available in case of failure of the main supply current, and in such cases the excitation is switched in automatically.

Concluding, the author states that it is impossible to say which is the best system of control. For lowest power con-

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sumption, if the starting and braking periods and the periods of trips with reduced speed are of long duration, the Ward-Leonard system might prove the most efficient. With different starting and running conditions the simple A.C. motor system might be the most efficient, and in other cases might be preferred on account of its lower initial cost. If current is charged on a flat-rate basis, an equaliser would be out of place, because it not only increases the initial costs, but also the total current consumption. A charge on the maximum demand system, on the other hand, will turn the balance in favour of equaliser systems. The question also whether any inducement is offered to the power consumer for a good power factor might turn the balance in a given case from the direct-coupled slow-speed A.C. winding motor to the Ward-Leonard system with high-speed motor-generator.

Discussion.

Mr. J. S. Peck (Westinghouse Co.), referring to the use of an A.C. motor excited by direct-current, said that an objection to the system was that it was not possible to brake with counter-current while the motor was generating. With the eddy-current or with any other type of external brake, such as a water brake, it was possible to use the mechanical brake, counter-current, and the external brake simultaneously. The external brake also gave a highly satisfactory method of lowering at reduced speed.

Mr. W. Cramp asked if an induction motor with a variable number of poles could be used. It might be employed as a brake down to the speed corresponding to the largest possible number of poles. With regard to D.C. motors, why could not the compound motor be used, cutting out the shunt and using the motor as a series generator for braking purposes?

Mr. Frith said that he had used an eddy-current brake with an external iron wheel and an alternator field for ordinary test work to absorb the load of motors, and had also found that the torque increased with the speed. He thought the path of the eddy-currents was so undefined that their armature reaction on the field magnets was only very slight. To direct the eddy-currents he had tried slotting the iron and putting in a copper squirrel cage winding in good electrical contact throughout with the iron, but had had better results by employing the copper end rings only without the axial bars; these seemed to offer an inducement to the eddies to travel right across the face of the brake.

Mr. S. J. Watson said that he had been thinking what the effect would be on a generating station supposing there were about a dozen collieries connected up without any equalising load arrangements, and that their peaks all came on at once. Each would have a maximum load of about 1,500 kw., so that there would be a peak of 18,000 kw., and the complete cycle of no load to 18,000 kw. would occupy about 1½ minutes.

Mr. T. Ferguson (British Westinghouse Co.) said that the ideal arrangement would be to have a separate winding plant for lowering and raising men, but as a rule it would not be practicable. He had recently come across a proposition for installing a hoist for men in the up-cast or ventilation shaft. Of course, the cage had to be made so as to prevent obstruction to the ventilation. The eddy-current brake offered considerable safety and ease of manipulation. For example, if you had a tail or balance rope between the cages, and the torque thus became uniform throughout the wind, it was an easy matter to switch on the exciting current to the eddy-current brake and leave it on, and then simply operate the main control lever in a natural manner, starting the load downwards, if necessary, by a short application of current; then bringing the control lever back to the off position, when the load would descend at a uniform rate under the action of the eddy-current brake; then, finally, pulling the control lever backwards so as to apply counter-current, and thus bring the load to rest.

Mr. A. B. Mallinson (Mather & Platt, Ltd.) thought that colliery people would be apt to condemn large eddy-current brakes, as, for winding deep shafts, one of the first requirements was that you must return power to the line whenever possible. With large electric winders the losses between winds (due to the running flywheel set) would, he thought, be so reduced that D.C. winders with a flywheel converter would show an overall efficiency better than that of A.C. winder equipments.

Mr. A. F. Stevenson said that he had known of a case in which power was being returned to a power company's mains, and as they looked upon it as bad business they put a ratchet on the meter to prevent its going backward. The rheostatic method of control applied to a three-phase motor on the power supply mains appealed to him as the most suitable for colliery conditions; the checking and adjusting of the cage position being done by counter-current in exactly the same manner as steam is used at present.

Mr. W. Bolton Shaw asked what happened when the main switch of a three-phase motor running at normal speed was rapidly switched over to the reverse position. He had found in the case of a small haulage motor that the current rose to a high value even if full resistance were switched into the rotor circuit in the interval between opening the main switch and closing it on the reverse position. It seemed to him that unless energy were returned to the line, the only argument in favour of electric braking was that it would lend itself to lighter and more easily regulated control apparatus than the mechanical friction brake.

Dr. Rosenberg, in reply to Mr. Cramp's question as to the use of multiple pole induction motors, said that it would hardly be possible to get a smooth gradual braking over any big range in this way, but that the pole changing device could be used to get an economical running at half speed to lower men. An objection against this with direct-coupled motors was the great number of poles which would be required, and the deterioration in performance which such an arrangement gave, even at full speed. As to the suggestion to make a D.C. winding motor heavily compounded, and to use it for braking purposes as a series generator, the speed of the compound motor was dependent upon the load, and this would always be undesirable, but specially objectionable in cases when the torque changed during the trip itself, when, for instance, there was no balance rope, and the weight of the rope worked at first against and afterwards with the torque of the motor; in this case, violent speed variations would occur. Mr. Mallinson mentioned that the eddy-current brake did not allow of the power being returned to the line. For English coal mines, the eddy-current brake would hardly ever be required. In mines where coal- and men-winding is done at the same speed, and trips with unbalanced load are of rare occurrence, the expense of an eddy-current brake would not often be justified. The last speaker asked whether the rushes of current were not too great if the motor was reversed while running at full speed. This would not happen if the controller was properly designed for the service. For braking with counter-current, a larger resistance is required than for starting, and therefore liquid starters, if to be used for counter-current, have a special sluice gate which allows a lower water level for braking. A controller of an ordinary haulage motor with only a few steps, and which would allow on the first step for starting, say, twice normal current, would, if reversed with the motor running at full speed, give a rush equal to nearly four times the normal current.

THE PRETORIA PIT EXPLOSION

THE cause of the disastrous explosion which occurred on December 21st last in the Yard seam at the Pretoria Pit of the Hulton Collieries is as yet unknown, but various suggestions have been made, including one that the fire-damp and coal-dust was ignited by the sparking of an electric coal-cutter employed in the mine. Mr. J. Gerrard, H.M. Inspector of Mines, who has been leading the exploring party, has stated, however, that his investigations in that section of the Yard seam in which the coal-cutter was in use have convinced him that the explosion was not due to sparking of the motor, as he found the cable disconnected and wound on a reel some yards away from the machine. He points out also that the coal-cutter was worked at night only, whereas the explosion took place about 8 o'clock in the morning. There was also an electrically-driven jig conveyer at the coal face, which was being loaded, and was about three-quarters full at the time of the explosion, so that it would not have been running; Mr. Gerrard is, therefore, convinced that this did not cause the explosion either. Notwithstanding these facts, the miners are very distrustful of the electrical plant, and at a meeting on December 29th of some 600 men employed at the various pits of the Hulton Colliery Co., the miners agreed to start work on the following morning only on the understanding that the electric coal-cutters should not be worked. It was pointed out to them that the electric lighting at the bottom of the shaft and the electric haulage were absolutely necessary if the coal was to be got out, and the continuation of these was agreed upon. This arrangement only holds, of course, until the result of the investigations into the cause of the accident have been made known. Further details will, no doubt, be given at the inquiry, which it is expected will be held at Westhoughton on January 24th. Many statements were made at the inquest as to the presence of gas in the mine previous to the accident, and one miner mentioned that a man in charge of the conveyer had referred to the sparking of the motor.



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THE CARE OF UNDERGROUND PLANT

A PAPER by Mr. R. R. Smith entitled "Inspection and Repair of Electrical Plant Underground" has been read and discussed at several of the recent branch meetings of the Association of Mining Electrical Engineers. In view of the rough usage to which colliery plant is subjected, the author emphasised the necessity for systematic inspection by a competent person, and outlined the system of inspection in use at his own colliery as follows:—

An assistant electrician goes down the pit at 6.30 a.m. and takes charge of a district covering roughly 180 statute acres, there being in this section some 30 motors, four sub-stations, six switch-rooms, cables, lights, telephones, and signals. It is his duty to visit each motor and sub-station, and to take the leakage indicator readings while the plant is running. He also tries the telephones and signals, and examines all cables, earth-wires, and lighting, any defects being noted. Should a fault occur which requires immediate attention, he sends to the surface for a man, stating the nature of the trouble, so that the correct tools may be brought down. If the defect is serious, the Inspector stands by until the second man has arrived, and then proceeds upon his rounds, it being his business to inspect, and not to repair. He notes the maximum load on each motor, and if this is excessive endeavours to ascertain the cause, and reports thereon. When the winding finishes, at 2.30 p.m., it is his duty to examine the interral parts of the switches of two of the motors, and to make any necessary adjustments. Two sets of switches are thus taken each day, which means that each switch is examined once every 14 days, and from experience this proves ample. Should the oil show signs of carbonisation, a sample is taken and tested, new oil being sent down if necessary. Every week a motor is opened out by men from the surface, cleaned, and the clearances taken. The Inspector works his way round to examine it, and if the motor is in good order it is put together again. Further, when any work is done below ground, the Inspector has to satisfy himself that it has been done in an efficient manner, he being held responsible to the engineer for passing it. Insulation tests are taken monthly as far as possible. A whole section is taken at once, and if this comes below a certain minimum resistance, then each individual part is tested until the fault is located. The tests are recorded in a book, it being stated which cables, switches, &c., are taken together, and if the insulation of any part is found to be low, a note to that effect is made. At the end of each shift the Inspector fills up a Report on the condition of the plant, under suitable classified headings.

The author then briefly scheduled out the various defects which should be looked for, making a few remarks and suggestions, and in conclusion gave the text of the standard sheet of "Instructions to Electricians" which is hung up in various parts of the mine. These provide for due information being given in the power house when work on H. T. circuits is to be done, and all men about to take charge of high-tension work must show written instructions signed by the chief electrician. Danger labels are also required to be attached to switch handles controlling circuits upon which work is being done.

In the discussion at the Newcastle Branch on December 3rd, several members, in reference to one of Mr. Smith's headings, emphasised the necessity for lock nuts or similar devices on switchgear, and Mr. Clothier remarked that even the magnetic hammering on alternating circuits was sometimes sufficient to loosen nuts on connections. Mr. Barker and some other speakers mentioned cases where the tripping of switches was caused by the presence of rats and mice. Dr. Thornton spoke of the instantaneous action of the Merz-Price protective gear, and had seen a cable short-circuited by being cut in two by a steel wedge with the slightest flash. Mr. Burrows questioned the value of insulation tests as indications that a cable was not likely to break down, and preferred a pressure test. He also suggested that the Association should prepare a pocket-book on the maintenance of plant. Some discussion as to the correct level of the oil in oil switches ensued, and several members testified to the value of the butterfly attachment on Messrs. Reyrolle's switch in preventing an arc forming above the oil. Mr. Simpson referred to transformer troubles due to loose cores, and Mr. Clothier advocated, instead of danger cards, the locking out of switches controlling circuits worked on, and the carrying of the key by the man at work. The phases of feeders should be short-circuited, and earthed before work was commenced.

The discussion before a meeting of the Scottish Branch at Glasgow, on December 17th, was opened by Mr. Thomson, who thought that it was out of the question to keep a man only for inspection purposes at a moderate-sized colliery. He thought that the oversmen were quite capable of reporting anything wrong. Mr. Scott (Edinburgh Collieries, Ltd.) thought that the Paper applied chiefly to larger collieries than those in Scotland, a point as to which several other speakers agreed, and Mr. Anslow thought that to carry out the procedure outlined in the Paper, a very large electrical and clerical staff would be required. Both the last speakers emphasised the necessity for proper cable slings. Mr. Anslow also mentioned the unsuitability of lead-covered cables in mines on account of corrosion by the acid water found. Mr. Atchley (Harland Engineering Co.) agreed in this, and raised the question of fuses of too large size, which he called one of the bugbears of an electrician's life. Mr. Anderson (Messrs. Anderson & Boyes) failed to see how an inspector working under Mr. Smith's conditions would be able to make a satisfactory examination of each motor. It was important that earth plates, as well as earth wires, should be examined.

Mr. Smith's Paper was also discussed at Cardiff last Saturday.

ELECTRICAL MINING PATENTS OF DECEMBER

Among the Patent Specifications published during the past month of interest to electrical mining engineers was one by J. G. Barclay and A. N. Barclay, of Kilmarnock (No. 20,183 of 1909), for an automatic device for preventing the overwinding of pit cages. The supply of power is shut off first, and the brake and reversing levers are then actuated in succession.

Specification No. 26,051 of 1909, by R. Rohde, of Berlin, relates to feeding and reversing gear for electrically driven rotary and percussion rock drills, and covers the combination of an automatic feed and return motion with an arrangement whereby the machine is stopped at the end of the return stroke only after the parts have been reset for another feed. A device is provided for reversing the feed into the return motion and the return into the feed motion by the use of springs put in compression alternately and acting on a reversing bar controlling the feed and return mechanism and the switch.

A combined oil and electric miners' lamp is described by J. R. Allott, E. A. Hailwood, and E. Dean in Specification No. 29,818 of 1909. The electric lamp is provided with a reflector for the examination of roofs, and should the oil lamp fail, the electric light will be available to enable the miner to reach a re-lighting station. The lamp accumulator is annular in form, and is provided with a central receptacle for the oil.

In Specification No. 3,013 of 1910, W. Winsborough, of Wigan, describes a system of protection for three-phase systems particularly adapted to mines. The neutral point of the generator is connected to earth through the coils of a very sensitive relay which closes the circuits of one or more relays which in turn close the circuits of tripping coils for opening the main circuit-breakers. If the generator neutral point is not available, an artificial neutral can be obtained by means of resistances connected across the lines. The slightest earth leakage will thus break the main circuit. The specification also describes an arrangement in which a leakage indicator is used for detecting the amount of leakage, and showing on which feeder it occurs.

J. Shaw, of Kirby Moorside, in Specification No. 14,927 of 1910, describes a gear for the prevention of overwinding of pit cages, which can be adapted to electrically driven engines, and a gear for the same purpose, but more particularly for steam winders, is described by J. W. Melling, of Wigan, in Specification No. 13,152 of 1910.

Home Office Prosecution.—At Linlithgow Sheriff Court on November 29th, Mr. Scott Lees, manager of the Dalmeny mine, South Queensferry, of the Dalmeny Oil Co., was fined £2 as the result of a prosecution by the Home Office under the Special Rules for having failed to maintain an electric motor and switchgear in a safe condition in June last. For the defence it was stated that the defects were caused by a sudden creep of the strata.

Cumberland Branch, Association of Mining Electrical Engineers.—This Branch held its first annual dinner at the Grand Hotel, Whitehaven, on Saturday, December 17th, 1910. There was a very good attendance of mining, mechanical, and electrical engineers, and the Institutions of Mining, Mechanical, and Electrical Engineers, and other societies were represented. The dinner was followed by a musical programme, in which Messrs. Rayles, Humphreys, and J. Glynn Williams took part, and several humorous recitations by Mr. W. Leck, H.M. Inspector of Mines for the district, were greatly appreciated. The local president, Mr. T. P. Martin, in a few remarks, expressed the regret that Mr. W. Maurice (the president) was unable to attend, and Mr. B. Sankey, A.M.I.E.E., Borough Electrical Engineer of Whitehaven, in responding to the toast of "Kindred Associations," expressed his interest in the Association. Mr. Cecil Walton, president of the Cumberland Scientific Association, very generously offered to allow the branch to make the Scientific Institute their headquarters, with use of the library, the lecture hall, and lantern. The offer was accepted with enthusiasm.

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Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during December.

Dec. 1st.—Monthly supplement on ELECTRICAL ENGINEERING IN MINES, opening with an illustrated description of the electrical equipment of the Leven Colliery, Fife, which includes mixed-pressure turbine plant. An official report on electricity in mines in 1909 is reproduced, and accounts are given of various meetings where electrical mining matters have been discussed. At one of these Mr. Clothier read a Paper on "Switchgear for Mines." Mr. S. Mavor also chose the power equipment of collieries as the subject of his address to the Glasgow Section of the Institution of Electrical Engineers; while Mr. J. G. Wilson opened a discussion on "Electric Winders," at the Newcastle Section. Some new motor controllers and a fire-damp safety cut-out are also described.

Dec. 8th.—Illustrated description of a Diesel engine plant. A note on a new boiler cleaning tool.

Dec. 15th.—Special literary supplement containing reviews of books on electrical engineering, &c., and a list of books recommended in all branches of the subject. An article on motor controllers. An account of an emergency installation of an electric motor.

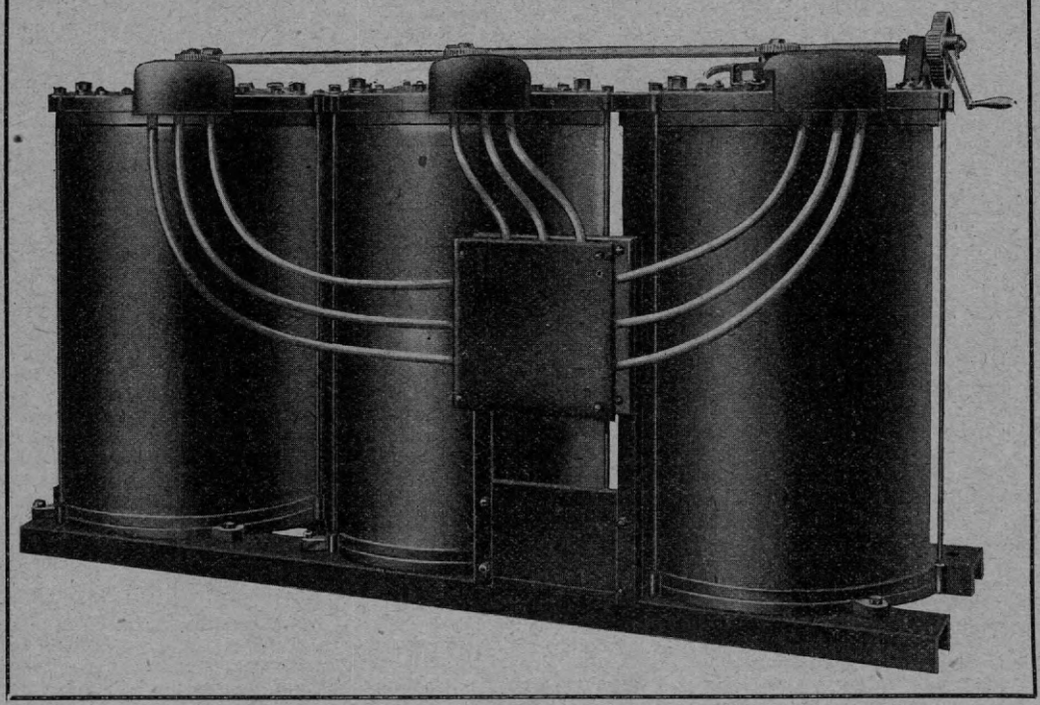
Dec. 22nd.—Special articles on arc and incandescent exterior lighting by up-to-date methods.

Dec. 29th.—Illustrated description of the electrical equipment of a large manufacturing works. Report of a Paper describing the Merz-Price protective system, and the discussion thereon.

Whitehaven Disaster.—At the Home Office inquiry into the Whitehaven Pit disaster, which was concluded on December 2nd, the jury returned a verdict to the effect that the 134 men and boys were killed in an explosion of fire-damp, but that there was not sufficient evidence to show the source of ignition. Mr. J. H. Blackett, mining engineer, of Durham, called in as an expert witness by the Whitehaven Colliery Co., suggested that electric hand lamps would be safer than ordinary lamps under conditions such as existed in the part of the mine where the explosion took place. Mr. Richards suggested that some electric lamps should be tried for a period of six months, and Mr. Helder stated that the Colliery Co. were quite willing to make the trial. The jury added a recommendation that a strict observance of the rules should be required, but made no reference to the use of electric lamps.

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CORRESPONDENCE

LAMP DIMMERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—At the present time there is a big scheme of advertising on foot relating to a regulating switch for incandescent electric lamps. According to the circulars, the said regulating switch is something phenomenal, but on examination I find it is simply a neat design embodying the old and wasteful method of putting resistances in circuit with the lamps. The circular says: "You turn up your electric light and you turn it down just like gas," and a summary of advantages is set out. The advertisement includes a Faraday House certificate of a test on one of the switches, but this certificate carefully avoids all reference to the very heavy current consumption per candle-power due to the energy taken by the resistance. In the whole of the circular there is no reference to watts per candle-power, and I think, therefore, that the figures appearing hereunder, which are the result of tests made on one of these switches obtained out of stock from a contractor, will be interesting:—

Position of switch.	Total watts.	Lamp watts.	Resistance watts.	C.P.	Watts per c.p.	Total watts per c.p.
Full on	64	64	0	42	1·52	1·52
1st stop	52	34	18	9	3·77	5·77
2nd stop	44	21	23	2	10·5	22
3rd stop	38	15	23	·7*	21·4*	54*
4th stop	30	8	22	·2*	40 *	150*

*Approximate.

These figures were obtained with a metallic filament lamp, and if a carbon lamp had been used, the watts per candle-power would be much heavier.

I should not think of recommending a device which entails such a heavy and wasteful expenditure of energy per candle-power obtained. It would be far better and more economical to use two lamps, one of the candle-power required for ordinary illumination, and the other of small candle-power to be used as a night-light. In this way a consumer would get something like good value for his money. I believe lamp-makers can produce lamps with the two filaments in one bulb, and that such lamps are already in the market, this being a reasonably efficient and economical arrangement.

Borough of Harrogate, Yours faithfully,
Electrical Engineer's Offices, GEO. WILKINSON.
33 Swan Road, Harrogate.
December 30th, 1910.

[We quite agree with Mr. Wilkinson that resistance dimmers should not be used for the purposes of economy, but they are very convenient when the dimming of lamps is occasionally required without altering the wiring. Where, on the other hand, it is to be a regular practice, double filament lamps with 3-contact lamp-holders and 2-way switches should be employed; several lamp-makers supply such lamps, the holders are also obtainable, and 2-way switches with intermediate "off" position are a regular stock article. Double filament lamps with the switching arrangement on the lamps, although simpler, are more troublesome to use and are not so popular.—ED. E.E.]

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to the Editor, ELECTRICAL ENGINEERING, *203–6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.*

J. A. HOPKINS.—We should recommend you to use 7/16 cable from the switchboard to a distributing board placed in one of the shops near the "covered yard," and from there to wire in circuits of five lamps, using 3/20 cable. The lamps in the shop containing the generating plant could be wired in three circuits (say with 3/22 cable) from the main switchboard. It will be best to have a charging board for the small accumulators, fitted with a regulating resistance, and wired as a separate circuit with 7/20 cable. You would find it more convenient to use 50 volts (using a 50 volt dynamo) as the pressure, instead of 75 volts, as 50 volt lamps are a regular stock size.

W. R. CASTLE.—A tape-cutting machine is practically no more than a lathe, and almost any machine tool maker could supply this. Johnson and Phillips make a speciality of cable-making machinery, and would also be able to supply tape-cutting machines.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

HOLOPHANE REFLECTORS.—A new leaflet from the Sun Electrical Co., Ltd. (118-120 Charing Cross Road, W.C.), lists the latest forms of Holophane Stiletto reflectors of the distributing, concentrating, and focussing types. The company have also placed on the market a new form of adjustable gallery, ensuring the correct relative positions of the lamp and the reflector.

INSTRUMENTS.—A new supplementary list from Siemens Brothers & Co., Ltd. (Caxton House, Westminster), deals with portable frequency indicators on the Frahm vibrating reed principle, and a special series of demonstration instruments for lecture room and school use. These represent the electromagnetic, moving coil, and induction types. The movement is visible in a glass case, and two scales are provided, one with a large open dial to face the students, and the other with a smaller, more accurately graduated dial to face the lecturer.

ADVERTISING SIGNS.—The Sun Electrical Co., Ltd. (118 and 120 Charing Cross Road), have issued a new edition of their electric illuminated sign catalogue. The list includes various examples of new designs using luminous raised opal letters, and the latest pattern of the company's mercury-contact type of flasher is described. (See ELECTRICAL ENGINEERING, Oct. 20th, page 662.)

ALUMINIUM.—A card from the British Aluminium Co., Ltd. (109 Queen Victoria Street, E.C.) gives tabulated particulars of aluminium sheet. On the reverse side is a view of the company's works at Kinlochleven.

STORAGE BATTERIES.—A pamphlet from the Hart Accumulator Co., Ltd. (Stratford), gives particulars of special 8-, 10-, and 12-volt batteries for motor-car and carriage lighting.

TELEPHONES AND BELLS.—The Sterling Telephone and Electric Co., Ltd. (200 Upper Thames Street, E.C.), have issued a revised edition of their "abridged" catalogue of telephones and electric bells, which, although "abridged," is a 76-page book. The principal revised portion relates to the "Primax" system of common battery intercommunication telephones, designed particularly to reduce induced cross-talk to a minimum. The same company have sent us a book containing diagrams showing various methods of connecting up their telephones. The diagrams are clear and practically executed, and every user of "Sterling" telephones should apply to the company for a copy of this book.

WATTMETERS.—A leaflet issued by the Allgemeine Elektricitäts Gesellschaft (Berlin) contains a brief illustrated description of the construction and use of the A.E.G. wattmeters on the dynamometer principle for A.C. and D.C. circuits.

CALENDARS, &c.—The Hart Accumulator Co., Ltd. (Marshgate Lane, Stratford, London), have taken the opportunity of the season in sending to their friends a neat and convenient desk blotter.

Messrs. Haslam & Schontheil, Ltd. (Western Mail Chambers, Cardiff), send us a scribbling block made up of squared paper with a few sheets interleaved, to call attention to some of the electrical material handled by them.

The combined calendar and blotter from Messrs. Alfred Graham & Co. (St. Andrews Works, Crofton Park, S.E.), who specialise in loud speaking telephones, is one of the most convenient that we have seen.

The British Thomson-Houston Co., Ltd., have prepared an attractive wall calendar with a large sheet for every month. This is illustrated with various B.T.-H. electrical installations in collieries, and should therefore be of particular interest to colliery owners, managers, and others in any official capacity connected with the mining industry, and a copy will be sent post free to any colliery upon application being made to the Publication Department, B.T.-H. Co., Ltd., Rugby. A particularly useful feature is the inclusion on each sheet of the next and last months in smaller figures.

The calendar of the Brush Electrical Engineering Co. is, as usual, an artistic production. It bears an effective coloured reproduction of an oil painting, and has a tear-off sheet for each day, containing particulars of historic anniversaries, &c.

Messrs. Charles H. Blume (Insulating Varnish Department, The White Building, Fitzalan Square, Sheffield) accompany their compliments with a neat monthly tear-off calendar.

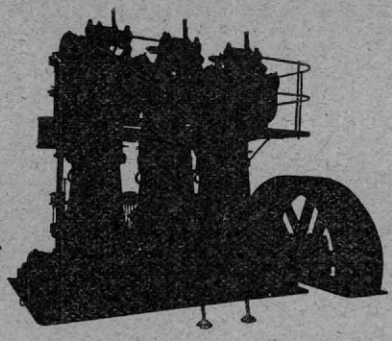
The monthly tear-off calendar of the Western Electric Co., Ltd., distinguishes itself by its quiet and harmonious design and colouring, and the clear printing of the calendar itself.

Messrs. Venner & Co., anticipating a flourishing year for the electrical industry, are presenting a neat leather sovereign purse to their friends. They ask us to say that should any of their customers not have received one, they would be pleased to forward one on receipt of name and address. They are unable to distribute these to any who are not customers, as their stock is nearly exhausted.

A pocket diary of convenient size and shape, handsomely bound in morocco leather, is being sent to their friends by the Dussek Bitumen Co., Canal Bank, Deptford, S.E.

The pocket diary and engagement book which accompanies the good wishes of Messrs. Johnson and Phillips, Ltd., will appeal to those who appreciate a small and compact book.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published December 29th, 1910

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

3,013/10. **Protection of Three-phase Distribution Systems.** W. WINSBOROUGH (Wigan). This specification describes a method of protection for three-phase systems, in which the slightest leakage to earth causes the supply to be cut off. Further particulars are given under "Electrical Mining Patents of December," in the supplement to this issue.

7,463/10. **Prevention of Induced Currents in Shafts and Bearings.** FELTEN & GUILLEAUME LAHMEYERWERKE A.-G. In order to neutralise the E.M.F.'s induced in shafts and bearings by the fluxes which pass through these parts, a winding is arranged on the stator in such a way that an E.M.F. is induced in it by the influence of the same field fluctuations which produce the shaft voltage. The winding is short-circuited, and counteracts the field fluctuations which induce currents in the shaft. Five figures.

10,943/10 and 10,955/09. **Arc Lamps.** H. W. LAKE (*W. E. Clark, U.S.A.*). The first of these two specifications describes an enclosed vertical carbon lamp with very sensitive regulating mechanism to provide a steady light. The plunger controlling the position of the lower carbon is immersed in mercury in a cylinder, on which is wound a solenoid of a special construction to give an even pull over a long range. (Three figures.) The second specification describes an enclosed lamp, in which the upper carbon is suspended from a plunger working in a vertical solenoid. The latter is provided with a closed magnetic circuit formed by the casing of the lamp. Three figures.

15,014/10. **Repulsion Motor.** A. BIBER (Pforzheim, Germany). This specification describes a single-phase commutator repulsion motor in which two pairs of brushes are provided per pair of poles; one pair is used for running in one direction, and the other in the other. A starter with a starting resistance for each pair of brushes is provided. One figure.

17,415/10. **Prepayment Meter.** W. S. SPRAGUE and CHAMBERLAIN & HOOKHAM, LTD. In specification No. 3,250/10, was described a prepayment mechanism combined with an electricity meter in which a wheel is rotated in one direction on the insertion of a coin, and is permitted to rotate in the opposite direction by the working of an escapement worked by the meter. This specification describes a mechanism in which the necessity of a movable pawl is dispensed with, and the escapement is instead carried through part of its oscillation at a high speed. Two figures.

21,326/10. **Metal Filament Lamps.** BERGMANN ELEKTRICITÄTSWERKE A.-G. This specification describes a method of effecting simultaneously the sealing in of the leading-in wires and the fusion of the central glass pillar of the filament carrier to the foot of the lamp bulb. A special appliance for the purpose is also described. Nine figures.

23,044/10. **Guiding Ships.** C. ARNOLD (Mechlenburg, Germany). Ships are guided along the channels of river mouths and harbour entrances by means of instruments on deck which are actuated by magnetic induction from a cable laid along the proper course. Rapid current impulses are sent through the cable, and these affect two coils on the ship, placed at right-angles to each other, and connected to telephones. Morse signals can be transmitted to the ship by the same means. Three figures.

25,008/10. **Ignition Apparatus.** R. BOSCH. This specification relates to the construction of high-tension ignition coils, and describes a method of insulating the several sections of the secondary winding one from another.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables & Wires, Insulating Materials, &c.: CODD [Electric supply system] 29,329/09; ROGERS [Distribution system for mines, spirit stores, &c.] 4,066/10.

Dynamos, Motors, & Transformers: MILCH [Control of A.-C. motors] 20,743/09; STEVENS [Petrol-electric transmission system] 2,700/10; SCHLICK [Bicycle lamp dynamo] 12,524/10; SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens Schuckertwerke Ges.*) [Ward-Leonard control system] 22,110/10.

Electric Ignition: RUPPERT [Ignition of gas burners] 29,606/09; LONGFORD [Sparking plugs] 339/10; MIDGLEY and VANDERVELL [Ignition dynamo] 2,525/10; CHRISTMAS [Sparking plugs] 10,842/10; RAWSON [Ignition mechanism] 14,754/10; BOULT (*Ruzicka*) [Ignition mechanism] 18,946/10; CURTISS & HARVEY, LTD. and SMITH [Electric detonators for submarine blasting] 22,594/10; R. BOSCH [Current indicator] 23,049/10 and [Ignition apparatus] 24,687/10.

Electrometallurgy and Electrochemistry: JOHNSON (*Chemische Fabrik Griesheim Electron*) [Manufacture of alkali metals] 29,795/09; KOOPMAN [Electric welding of joints in metal structures] 30,097/09; PETERSSON [Charging resistance furnaces] 6,035/10; SMITH and DEAKIN [Apparatus for electrodeposition of metals] 7,225/10; PETERSSON [Resistance furnaces] 8,711/10; HENRI, HEILBRONNER and VON RECKLINGHAUSEN [Sterilising liquids] 14,128/10; THOMSON [Furnaces] 15,169/10.

Incandescent Lamps: RENNERT [Miners' lamps] 4,451/10; MADDEN and HOUSKEEPER [Manufacture of filaments] 7,331/10; WEBER [Mercury-carbon filament lamp] 9,250/10; KNIGHT [Manufacture of incandescent lamps] 24,810/10.

Instruments and Meters: MURRAY [Meters] 28,947/09; THOMAS WALKER & SON, LTD. and WALKER [Electrical ship's log apparatus] 29,448/09.

Storage Batteries: DOBBIE [Prevention of over-charge or over-discharge] 29,496/09; GATINAUD, 6,746/10.

Switchgear, Fuses, and Fittings: REASON MANUFACTURING CO. and REASON [Time switches] 30,051/09; ROGERS [Wiring system for mines, spirit stores, etc.] 4,066/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co., U.S.A.*) [Multiple switch motor-starters] 5,270/10.

Telephony and Telegraphy: BELCOURT and LEBRET [Bell signalling apparatus] 29,637/09; SIEMENS BROS. & CO. and IRELAND [Telephone installations] 29,677/09; SIEMENS BROS. & CO. and HIRD [Telephone switchboards] 8,551/10.

Traction: DE PROSZYNSKI [Operating tramway points from vehicles] 8,602/10; SIEMENS BROS. & CO. (*Siemens & Halske A. G.*) [Power operated signals and points] 10,037/10; GRESLEY [Tramway vehicles] 17,147/10; ENGEL [Trolleys or collectors] 17,380/10.

Miscellaneous: MACFARLANE [Ship's winches] 29,259/09, and [Centrifugal drying machines] 29,549/09; COCKAYNE [Smoke consumption] 29,627/09; SCOTT and MILLER [Disc coal-cutter] 4,357/10; WILLIAMS [Electrically-protected plates for safes] 11,550/10; THOMAS [Portable drills] 14,453/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Incandescent Lamps: SKAUPY [Manufacture of metal filament lamps] 15,621/10.

Storage Batteries: KAMPERDYK [Plates] 28,419/10.

Telephony: SIEMENS & HALSKE A.-G. [Telephone exchanges for automatic call distributors] 27,860/10.

Miscellaneous: CABOT [Electric conversion] 27,696/10; JULIUS PINTSCH A.-G. [Recording sound] 27,889/10; GILES [Electrical condensers] 28,179/10; VON PAUSINGER [Apparatus for indicating presence of inflammable gases] 28,697/10.

The following amended Specification can now be obtained.

BROOKS and ALSTON [Combined ignition coil and distributer] 15,802/09.

Opposition to Grant of Patents

16,300/09. **Prevention of Corrosion of Steel.** W. E. BULLOCK and J. CALCOTT (Coventry). Opposition has been entered to the grant of this patent, which covers a process for protecting iron and steel from rusting. It consists in subjecting the surface to be protected to the action of a boiling mixture containing phosphoric acid, while the surface acts as cathode to a current passed through the mixture.

23,014/09. **Arc Lamp.** J. NEU. Opposition has been entered to the grant of this patent. The specification, abstracted in ELECTRICAL ENGINEERING, November 10th, 1910, describes a lamp of the supported carbon type, with a pivoted stop, which tips up and cuts the lamp out of circuit when the carbons are fully consumed.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: B. G. LAMME [Carbon-brush holder] 19,125/04; ALLMÄNNA SVENSKA ELEKTRISKA AKTIEBOLAGET [Control of single-phase compensated shunt motors] 10,304/05.

Switchgear, &c.: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Motor controller] 19,885/04; A. ROMAIN and J. AYGUESVIVES [Combined lampholder and cut-out] 20,007/04; G. HELPS [Lamp pendants] 18,535/05.

Traction: R. H. SIMPSON and W. PARK [Motor trucks] 19,714/04; SIEMENS BROS. & CO. (*Siemens & Halske A.-G.*) [Electro-pneumatic operation of signals and points] 18,402-2A/05.

Miscellaneous: D. M. NESBIT [Feedwater-heater] 21,020/97.

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LOCAL NOTES

Airdrie: *The "Fair Fare" System.*—The Airdrie & Coatbridge Tramways Company announce their intention of abandoning the "fair fare" system of charging by means of farthing stages on their tramways.

Finchley: *Supply Outside Area.*—The Friern Barnet Council have agreed to the Finchley Council applying to the Board of Trade for an Order to supply electricity in their district.

Leicester: *Management of Electrical Undertaking.*—The Electricity Committee have decided to recommend the Council to adopt Mr. James Swinburne's suggestion that the two power stations should be worked as one undertaking, instead of two separate ones as at present. Mr. Swinburne estimates a saving of about £2,000 per annum if this course is adopted.

London: *Hammersmith: Tramways.*—A difference has arisen between the Council and the London United Tramways, Ltd., as to the condition of the tramway tracks, and the Council have applied to the Board of Trade for the appointment of an arbitrator. The Council state that the track rails are in a defective and dangerous condition, and that the only effective and satisfactory way of dealing with the matter is to reconstruct the whole of the tracks in respect of which the complaints are made.

Malton: *Street Lighting.*—The directors of the Northern Counties Electricity Supply Co. have offered to accept £275 for the street lighting posts and fittings, provided the agreement for the supply of energy for street lighting is renewed for a further term of three years. Although willing to pay this sum, the Council have decided not to renew the agreement, but to invite tenders for street lighting from the Gas Co. and the Electricity Co.

Russia: *Electric Railways.*—According to an American Consular report the Moscow-Windau-Rybinsk Railway has purchased an accumulator railway car for experimental purposes. The car has cost about £7,700, and is designed for speeds up to 67 miles per hour. It is intended to run the car on the line between St. Petersburg and Tsarskoye-Selo.

South Africa: *Tramcars.*—The Durban Corporation have instructed the Tramways Manager to proceed with the construction, in the Corporation's car-sheds, of five new tramcars.

Stafford: *Wiring Regulations.*—The Electrical Engineer has been instructed to prepare regulations which all wiring contractors in the town will be required to comply with. The Engineer has also been instructed to report upon the charges for power supply, the supply of electricity at cost price, and the supply of electricity for power purposes with time switches. The whole question of charges is to be considered at a special meeting of the Electricity Committee shortly.

Tottenham: *Overhead Telegraph Wires.*—Another difference has arisen between the Council and the Postmaster-General with regard to the erection of overhead telegraph wires, and proceedings are to be taken in the County Court in order to test the matter. In a similar dispute a short time ago the Council were successful in forcing the Postmaster-General to put the wires underground.

Uruguay: *Electric Traction.*—A scheme is under consideration for the construction of an electric railway from Monte Video to Colonia. The distance is 110 miles, and at Colonia it is anticipated that the trains will be carried on ferry boats thirty-four miles to the port of Buenos Aires, and thence travel underground to the centre of that city. It is proposed to erect a power station and utilise the waters of the river Santa Lucia. The project has been approved by the Lower Chamber, and no serious difficulties are anticipated from an engineering point of view.

Worcester: *Municipal Wiring Powers.*—In consequence of the recent decision of the Council not to allow the Electricity Committee to develop their undertaking by making arrangements for the wiring of premises and the hiring of apparatus, Mr. A. H. Parker, Chairman of the Electricity Committee, has resigned. The Committee have informed the Council that they find a difficulty in obtaining the services of a Chairman, as the decision referred to has given the impression that the Council are not prepared to give such assistance to the Committee as they must have if they are to manage successfully such an important undertaking.

Ystradgynlais: *Electric Lighting.*—The Glantawe Electric Light Co. have completed their installation, and public lighting was switched on for the first time on Christmas Eve.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Burnley.—The Electricity Committee have under consideration the question of extending their generating plant.

Canada.—The incorporation is announced of the Central Canada Power Co. with a capital of about £2,050,000. The headquarters are in Toronto.

East Ham.—An inquiry was held last week concerning a loan of £17,420 for electrical extensions. There was no opposition.

London: *Hammersmith.*—The Electricity Committee recommend the installation of two new boilers with economisers, air-heaters, mechanical stokers, feed-pumps, steam pipes, &c., and a new steel chimney, at an estimated cost of £8,000; a 3,000-kw. turbo-alternator, with condenser, air-pumps, and accessories, £10,000; mains extensions, £3,553; services, meters, &c., £2,700; static transformers, £1,000; making a total of £25,253. In order to avoid sub-contracting as far as possible, the work is to be divided into nine specifications.

Plymouth.—Mains extensions are to be carried out in Exeter Street, St. John's Road, and Alma Street at an estimated cost of £68.

South Africa.—The Durban Corporation have sanctioned the expenditure of a further £30,000 for extensions to the power station. Mr. Roberts, the Borough Electrical Engineer, in his annual report, states that applications have been received for some 2,000 h.p., which at present he is unable to meet.

Turkey.—According to the *Board of Trade Journal*, H.M. Consul-General at Constantinople reports that the Turkish Ministry of Public Works invite tenders for the construction and working of electric tramways, and the supply of electricity in Adana. Tenders to Monsieur le Ministre du Commerce et des Travaux Publics, by March 14th.

Warrington.—Tenders for extra high-tension cable are invited by January 10th. Particulars from the Electrical Engineer.

Eleven Corporations have applied to the Board of Trade for extensions of their electric lighting areas or new Orders, and fifteen Companies have made similar applications in respect of Orders in different parts of the country. A complete list, with names of the promoters, can be obtained from Messrs. Wyman & Sons, Fetter Lane, London, E.C., at a nominal price.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Proposed extensions at University College, Gower Street.

Estimates are to be prepared for lighting the St. George's (Mile End) Guardians' premises by electricity.

New Drill Hall in Willesden. Middlesex Territorial Association.

New branch Post Office at Poplar. H.M. Office of Works.

PROVINCES.

Cardiff.—Block of office buildings in James Street, Bute Docks. Architect, H. Budgen, 95 St. Mary Street.

Carlisle.—The School Management Committee of the Education Committee recommend that the Lowther Street School be fitted for electric lighting at an estimated cost of £75 12s.

Darlington.—Reconstruction of premises for the Darlington and Stockton Times Newspaper Co. Architects, Messrs. Hoskins & Brown, Court Chambers, Darlington.

Doncaster.—New Institute for the Trades and Friendly Society Institute, Ltd. Architect, F. Masters, Bank Chambers, Scot Lane, Doncaster.

Dublin.—Tenders are invited for the electric lighting of the Richmond District Asylum. Current is to be supplied by the Dublin Corporation. Consulting Engineer, Mr. T. Tomlinson, 16, Beresford Place, Dublin. Tenders are invited for the electric wiring of St. Peter's Church. Architects, Ashlin & Coleman, 7 Dawson Street, Dublin.

Dunfermline.—Institute in Nethertown Broad Street.—Also Women's Institute in Bath Street.

Glasgow.—Reconstruction and enlargement of Royal Institute of Fine Arts, Sauchiehall Street.

Gorleston.—New buildings for East Anglian Institution for Blind and Deaf Children. Architect, J. E. Burton, 57 London Street, Norwich.

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Llandudno.—New church. Ecclesiastical Commissioners.
Swansea.—Additions to baths and laundry, St. Helens Road. —Eight houses, Jersey Terrace. Mr. J. Thomas.—Eight houses, Carmarthen Road. Mr. J. Pye.—Eight houses, Neath Road. Mr. H. Smith.—Six houses, Beechwood Road. Mr. R. Lacy.—Seven houses, Glanmor Road. Point Bros.—Seven houses, Barclay Terrace. Mr. J. Lewis.
Wishaw.—Proposed Town Hall.
Wolverhampton.—Extensions to premises of Patent Hydro Bread Co., Ltd., St. Mark's Street.

MISCELLANEOUS

Birmingham.—Tenders are invited by January 30th for the supply of stores during the year ending March 31st, 1912, including electrical sundries.
Blackpool.—The Corporation have decided to proceed with the scheme for providing 100 electrically controlled public clocks.
Bootle.—The Corporation invite tenders by January 18th for the supply and erection of two electrically-driven turbine pumps for the Raleigh Street pumping station. Tenders by January 18th. Particulars from the Borough Electrical Engineer.
Manchester.—The Corporation invite tenders for the supply of tramway rail bonds. Particulars from the Manager, and tenders by January 17th.
Plymouth.—The Electricity Committee will shortly be inviting tenders for the supply of meters for the ensuing 12 months.
Spain.—The Sociedad Anónima El Tibidabo have, says the *Board of Trade Journal*, applied for a concession to construct and work electric railways in Barcelona.

TENDERS RECEIVED AND ACCEPTED

Aberdeen.—The tender of Messrs. Stewarts & Lloyds, Ltd., of Glasgow, has been accepted for the annual supply of wrought-iron tubes and fittings to the Electricity Department.
London.—Messrs. Thomas Tilling, Ltd., have placed an order with Messrs. W. A. Stevens, Ltd., of Maidstone, for several additional petrol electric omnibuses for use in London. The chassis, with the exception of the electrical equipments, have been designed by, and will be manufactured by, Messrs. Thomas Tilling, Ltd., to whom Messrs. W. A. Stevens are supplying the electrical equipments. The first instalment of seven buses is expected to be running in May.

The Imperial Lamp Works.—An interesting "break-up" for the Christmas holidays took place at the Imperial Lamp Works, Brimsdown, on Friday, December 23rd. To every female employee, to the number of about 500, was presented a gold and enamel brooch and a fancy box of Christmas cakes, and to every male employee, cigars, tobacco, or cigarettes. The presentations were made in the girls' dining hall, which was tastefully decorated and ornamented with Christmas trees, &c. At the end of the proceedings mutual good wishes were exchanged and hearty cheers for the management given. We are glad to see that, at the Imperial Lamp Works (the output of which we understand has been increasing by rapid strides since the works were opened), the relations existing between the employers and employees are of so cordial a description.

The Association of Mining Electrical Engineers.—The first volume of Proceedings will be issued in January. It contains 300 pages, and includes Papers (with the discussions) on:—Accidents from Electric Shock; Electric Breakdowns in Collieries; Cables for Colliery Work; Relative Merits of D.C. and A.C. for Colliery Work; Discussion on Home Office Rules; Earthing as applied to Mining; Earthing Neutral Point of a Three-phase System; Mining Switch Gear; Flame Proof Apparatus; Storage Batteries in Colliery Work; The Cascade Three-phase Motor. Included in the Appendices are the Articles of Association, and a full list of names and addresses of the 700 odd members. The volume will be issued free to all those who had joined the Association by December 31st, 1910. To non-members the price will be 6s., but only a limited number of copies are available.

Telegraph Traffic.—The Direct Spanish Telegraph Co.'s Falmouth-Bilbao cable failed on the 21st ult., but was again working on the 31st.—The Bagdad-Bassorah line was down from the 23rd to 27th Dec.—The Compagnie Française des Cables Télégraphiques has had considerable trouble in the West Indies.—The Cape Hayti-Puerto Plata cable gave out first, and was followed by the section between Paramaribo and Cayenne, and on Christmas Eve the Fort-de-France (Martinique) Paramaribo cable also broke down. Telegrams for the latter place are being routed *viâ* Hayti.—On 30th Dec. the Djedda-Souakim cable broke down.—The Commercial Cable Co. has also had trouble with one of their sections.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 15s. to £59 per ton (last week, £59 to £59 5s.).

"Pixielite" Strip.—We understand from the General Electric Co. that their well-known "Pixielite" strip system of decorative lighting has been officially approved by the London County Council as being in accordance with their suggestions for Coronation illumination. Large quantities are being manufactured in view of the enormous demand that is likely to arise. For a description of the system, which uses ordinary B.C. lamps, see ELECTRICAL ENGINEERING, September 10th, 1908, page 401.

Bankruptcies.—An application for the discharge of J. F. Davie, electrician, late of 10 Great Castle Street, Oxford Street, London, will be heard on January 18th, at 11 a.m., at Bankruptcy Buildings, Carey Street, London, W.C.
A. Yearsley, of 27 Brazenose Street, Manchester, has been appointed trustee for C. H. Pearson (Pearson & Co., electrical and sanitary engineer, 51A Mosley Street, Manchester). The public examination will be held at the Court House, Quay Street, Manchester, on January 20th, at 10 a.m.
The discharge of H. Barham, Electrical Engineer, 60 Fratton Road, Portsmouth, has been suspended for two years from October 18th, 1910.

Dissolution of Partnership.—W. J. Charles and A. Watson, Electrical Engineers, Edward Street, The Parade, Birmingham, have dissolved partnership.

Liquidations.—A meeting of the Chichester & District Electric Supply Company, Ltd., will be held at Electrical Federation Offices, Kingsway, London, on Jan. 13th, at 10.30 a.m., to hear the liquidator's account of the winding-up. This is not the company at present supplying electricity in Chichester.
The North British Electric Power Syndicate is to be wound up voluntarily. Mr. A. Wood, of Messrs. Monkhouse, Stoneham & Co., Salisbury House, London, E.C., is liquidator.
Mr. J. H. Bailey, 2 Booth Street, Manchester, has been appointed receiver and manager of the Small Power Dynamo Motor Co.
The British Electrical Device Co., Ltd., is to be wound up voluntarily. Mr. P. J. Boucher (72 Victoria Street, Westminster), has been appointed liquidator.

Siemens Telephones.—Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, inform us that they are installing an additional telephone line to cope with the enormous number of calls which they are continually receiving. Arrangements are also in hand for a still further increase in the number of the Dalston lines. The present telephone numbers are Central 8388 and 8389, and Dalston 4. The firm apologise to the many customers who have been seriously inconvenienced during the past few weeks, as many complaints have been received concerning the difficulty in getting through.

Awards at the Argentine Centennial Exhibition.—In connection with the Railway & Land Transport Section of the Argentine Centennial Exhibition last year, 920 awards were made. Great Britain secured a total of 222, made up of 82 Grand Prix, 12 Diplomas de Honor, 75 Gold Medals, 39 Silver Medals, 12 Bronze Medals, and 2 Hon. Mention.

Change of Address.—The Indestructible Cable Co. have removed their office to 20 High Holborn, London, W.C.
Mr. H. Boot has removed his London office from 4 Great George Street, Westminster, to Westminster Chambers, 7 Victoria Street, London, S.W.

Johnson & Phillips' New Offices.—Messrs. Johnson & Phillips, Ltd., have opened the following branch offices, showrooms, and stores:—Birmingham: 187 Corporation Street; Cardiff: 12 Castle Arcade; Dublin: 27 Anne Street, South; Glasgow: 159 West George Street: Leeds: 21 Bridge End; Manchester: 251 Deansgate; Newcastle-on-Tyne, 44B Blackett Street.

OSRAM·LAMPS

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APPOINTMENTS AND PERSONAL NOTES

Mr. T. H. Roberts-Wray, who has been with Messrs. Crompton & Co., Ltd., as chief representative for eight or nine years, has started on his own account as consulting and inspecting engineer at 15 Leadenhall Street, London, E.C. Mr. Wray has had a large and varied experience in marine and general engineering work, and particularly in regard to the requirements of the British Admiralty and other foreign Governments.

The Chairman of the Union Cable Co., Ltd., thanks applicants for the post of cable engineer and works manager at the company's new works at Dagenham, and asks us to intimate that the position has now been filled.

We understand that Sir William Preece, K.C.B., is leaving England on January 14th for South Africa.

Mr. J. E. Mallinson, of Blackpool, has been appointed Chief Engineer to the Burmah Electric Lighting & Tramway Co.

Mr. Duncan Maclellan, of Messrs. Kelvin & James White, Ltd., has been appointed Borough Electrical Engineer at Oban. There were 171 applicants.

Mr. P. J. Pringle (late tramways manager, Burton-on-Trent) has arrived in Melbourne to take up his appointment as General Manager and Engineer of the Electric Supply Co. of Victoria, Ltd. His duties will include management of the electricity and tramway undertakings of Ballarat and Bendigo, and he will also act as Consulting Engineer to the electrical undertaking at Koolgardie, Western Australia. Mr. Pringle will reside at Ballarat, a city some 1,500 ft. above the sea-level.

A working mechanical engineer is wanted for small electrical power plant. (See an advertisement on another page.)

Mr. W. S. Wilson has resigned his position as Outside Manager of the Electrical Department of Messrs. Clarke, Chapman & Co., Ltd., to take up the position of Branch Manager with Messrs. Pinchin & Johnson, Ltd., at 44B Blackett Street, Newcastle-on-Tyne. Telephone No. Central 1691.

The Aston Electricity Committee recommend an increase in the salary of Mr. R. Foster, the Electrical Engineer, from £500 to £600 per annum.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

British Power Co.—The report for the year to January 30th states that the utmost endeavours have been made to place upon a more satisfactory footing for realisation the remaining undeveloped assets of the company. It is expected that shares will shortly be issued in the new Fife Tramway, Light and Power Company in exchange for the company's holding in the old Fife Electric Power Company. The company is also assisting in the finance of the Llanelly and District Electric Lighting Company, and hope to be able shortly to announce the completion of arrangements for considerably strengthening the financial position of the Nottinghamshire and Derbyshire Tramways, and the Derbyshire and Nottinghamshire Power Company. On the other hand, the Board have had to agree to accept ordinary shares at a greatly reduced value in place of their present holding of deferred shares in the Cleveland and Durham Electric Power Company. Of the remaining assets of the company there seems to be a slightly improved prospect for British electrical enterprises.

Rio de Janeiro Tramway, Light & Power Co.—A dividend of 1¼ per cent. on the ordinary stock.

Chloride Electrical Storage Co.—Interim dividend at the rate of 6 per cent. per annum upon the preference shares.

Aron Electricity Meter Co.—At an extraordinary general meeting on Friday, a resolution was passed, increasing the capital to £350,000 by the creation of 100,000 ordinary shares of £1 each.

Cleveland and Durham Electric Power.—An Order has been made confirming the reduction of the capital of this company from £1,000,000 to £700,000.

Tantalum Lamps for Railway Station Lighting.—Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston) have sent us an illustration showing a station of the Metropolitan Railway, which has now been lighted for some time by Tantalum lamps. The strength of the filament renders them particularly suitable for this class of work, where there is naturally a good deal of vibration. We understand that several other stations are to be similarly equipped.

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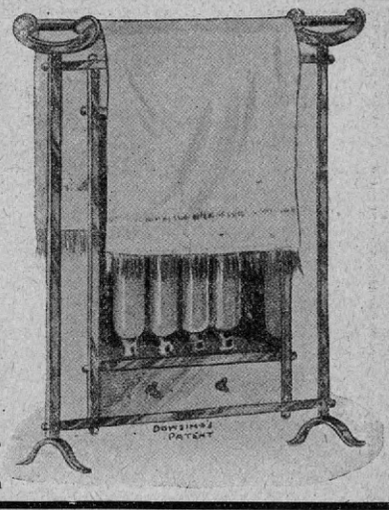
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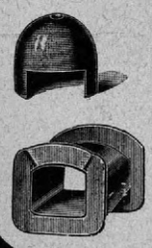
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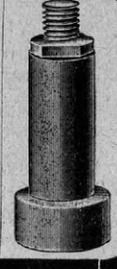
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WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

A communicated article deals with the subject of rotary converters. Their general features and uses are considered, and suitable transformer connections and switchgear are discussed. (Page 13.)

Particulars are given of the new submarine telegraph cable between England and Norway. This cable is the joint property of the British and Norwegian Governments, but is at present being worked by the Great Northern Telegraph Co. The new cable is single-core, with a conductor weighing 200 lb. per naut, and gutta percha, 200 lb. per naut. (Page 14.)

Our monthly article on new electrical supplies and accessories contains illustrated descriptions of some new switchgear, including a cheap line of small knife switches, a simple battery cut-out, a solenoid starter, a push-button switch, and a new quick make and break oil switch. Notes are also given on a convenient gallery for holophane shades, some new reflectors, an ingenious candle fitting, and a series of switchboard and portable instruments. In the section on heating and cooking apparatus a particularly cheap radiator and a new form of the well-known "Quartzlite" heater for use with a number of different utensils, are described and illustrated. (Page 15.)

A new zinc-carbon primary cell, with caustic soda excitant and a patented depolariser, has been introduced. The E.M.F. on open circuit is 2·7 volts, and the internal resistance 0·15 ohm. (Page 17.)

A 2,000-h.p. single-phase locomotive, constructed for the Loetschberg Tunnel Railway, has two commutator motors of the compensated series type, developing each 1,000 h.p. continuously at a speed of 26 m.p.hr. The trolley line pressure is 15,000 volts, and the frequency 15 cycles. (Page 18.)

Messrs. K. Faye-Hansen and G. Harlow dealt with the Merz-Price protective system in a Paper read recently before the Manchester Local Section of the Institution of Electrical Engineers. They considered that the Merz-Price system had great advantages in its power of instant isolation of faulty sections of a circuit, and favoured the balanced-current modification thereof. They further described another system of feeder protection specially immune from trouble due to capacity currents in the pilot wires. (Page 19.)

Under "Wiring Contractors' Point of View" we deal with the Australian Fire Underwriters' Association comments upon the quantity of cheap grades of wire and cable which is being imported into Australia. Attention is also called to an attempt in 1903 to settle the difference between the wiring contractors and municipalities. At Islington and Worcester there is friction between the Electricity Committees and the Corporations upon the question of municipal wiring powers. The majority of the Islington Lighting Committee are resigning. (Page 21.)

We give an illustration of an improved method of filament support for tungsten lamps. (Page 22.)

A letter from the Electrical Standardising, Testing and Training Institution refutes some aspersions cast upon a recent Faraday House Report. (Page 22.)

The Lepel patent for a wireless oscillation generator comprising metal discs separated by rings of paper, has been granted in Germany, in spite of the opposition of the Telefunken Company, whose patent for a similar device has been refused. This decision may have very far-reaching effects, in Germany and elsewhere. (Page 22.)

Among the specifications published by the Patent Office on Thursday was one by E. T. Ruthven-Murray describing various forms of limit-indicators, combined with a scale of charges on the fixed price per quarter principle. The consumer can increase (but not decrease) his limit, and in doing so causes the instrument to indicate a correspondingly higher charge.—W. A. Stevens describes a two-motor drive with chain-gear suitable for petrol-electric vehicles.—An improved method of Ward-Leonard control, in which the field

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of the main motor is strengthened automatically according to the load, is protected by Siemens Bros. Dynamo Works. (Page 23.)

THE Sydney Electrical Engineer has prepared a scheme for displacing gas by electricity for street lighting.—The Brighton and Worthing Corporations have decided to oppose both schemes for tramways and trolley omnibuses between Brighton and Worthing.—The Stone system of train electric lighting is being adopted by the Canadian Pacific Railway Co.—An attempt is being made to prevent competition between the Manchester Electricity and Gas Departments.—The Elective Auditors point out that insufficient provision is being made for tramways renewals by the Wigan Corporation.—The Leicester Corporation have adopted Mr. James Swinburne's recommendations to link up the two power stations by means of motor generators, and to use one as a spare. (Page 24.)

A 1,000 kw. generating set is to be installed at Burnley; steam turbine plant at Halifax; motor generator at Cheltenham; generating set at Kendal; and economisers, superheaters, and mains at Peterborough. The £100,000 extension scheme at Hull is to be proceeded with. The Australian Postmaster-General's Department requires quantities of telegraph material; the Klerksdorp (S.A.) Council propose to instal electric lighting; and stores are required at Bexley, Battersea, and Islington. (Page 24.)

Telegraph Traffic and Movements of Cable Ships.—The cables of the Compagnie Française des Cables Télégraphiques in the West Indies have been giving trouble. The Fort de France (Martinique)—Paramaribo (Dutch Guiana) section, which was repaired on the 4th inst., again broke down on the 7th inst. Probably the c.s. *Pouyer Quertier* may have left already to repair other breaks, which will mean some delay in putting this section into working order.—Communication between Rome and Constantinople was down for a short while on the 7th inst.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JANUARY 12TH.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. "Submarine Cables for Long Distance Telephone Circuits," by Major W. A. J. O'Meara. Adjourned discussion.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science.

Junior Institution of Engineers.

7.30 p.m. At Royal United Service Institution, Whitehall. "Depreciation of Buildings and Machinery," by H. F. Donaldson, C.B.

FRIDAY, JANUARY 13TH.

Electro Harmonic Society.

8 p.m. Smoking Concert, at Holborn Restaurant.

SATURDAY, JANUARY 14TH.

Birmingham and District Electric Club.

7 p.m. At Colonnade Hotel, New Street. Presidential Address by F. W. Foster.

MONDAY, JANUARY 16TH.

Junior Institution of Engineers.

7.30 p.m. At Caxton Hall, Westminster. Fifth lecture on "Law Relating to Engineering," by L. W. J. Costello.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. Discussion on Library Lighting.

TUESDAY, JANUARY 17TH.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At University. "Electric Heating as Applied to Cooking Apparatus," by Harold Gray.

Association of Mining Electrical Engineers.

8 p.m. At 39 Victoria Street, London. "Electricity in New South Wales Collieries," by E. Kilburn Scott.

WEDNESDAY, JANUARY 18TH.

Institution of Electrical Engineers: Birmingham Section.

7 for 7.30 p.m. Annual dinner, at Grand Hotel.

Institution of Electrical Engineers: Students' Section.

7.30 p.m. At Victoria Embankment. "Wireless Telegraphy, with Special Reference to Short Spark Methods," by P. R. Coursey.

THURSDAY, JANUARY 19TH.

Rugby Engineering Society.

8 p.m. At Benn Buildings, High Street. "Electric Power in Collieries," by J. Miller.



FOREMAN: What's this 'ere? I *arst* you to git "C.M.A. cable"; *he* won't 'ave no other. This ain't got no bloomin' buff All-British label!!

BRIGHT YOUTH: I does my best. I made quite sure by askin' Bill, and 'e ses them letters means Cable Made Abroad. They told me at the shop that this was best Anglo-Dutch.

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NOTES ON THE ROTARY CONVERTER

(Communicated)

THE rotary converter may be said to be essentially a continuous-current generator provided with a certain number of slip rings, in addition to the commutator, connected to suitable points in the armature winding. The machine, if driven by mechanical power, would deliver both alternating current and direct current; if supplied with alternating current it will run as a synchronous A.-C. motor, and if supplied with direct current will follow the laws which govern the operation of a D.-C. motor, the machine working under the latter conditions being known as an "inverted rotary." It is intended to deal here chiefly with the machine as used to convert alternating current to direct current, as this is the condition chiefly met with in present-day work. Large rotaries are more satisfactorily built to run on a supply frequency of 25 cycles, but smaller machines are satisfactorily built for frequencies up to 50 and 60 cycles.

The alternating current in the armature of a rotary converter flows at such a time as to be partially neutralised by the current generated, which is afterwards commuted into direct current. Thus for a given output a rotary converter has a smaller armature than either a direct-current generator or motor, since the heating which is occasioned by the current is diminished on account of this neutralisation of the two currents. By increasing the number of slip rings in the machine, *i.e.*, also the number of tappings off the armature, it is found that this heating becomes less.

The following figures show the relative outputs of a rotary converter armature as compared with an armature of the same size of a direct-current generator, considered from the heating aspect :—

Direct Current Generator	100
Two-phase Rotary Converter	162
Three-phase Rotary Converter	133
Six-phase Rotary Converter	193

VOLTAGE AND CURRENT RATIOS.

The voltage ratios of the rotary converter depend on and vary with the nature of the A.-C. supply, whether single, two, or three phase, &c.; the shape of E.M.F. wave supplied; the number of armature conductors embraced by the poles; and whether the machine is used to convert from A.-C. to D.-C., or *vice versa*.

The following table of voltages is given for a rotary converting A.-C. to D.-C., with a sine wave, and poles covering approximately 75 per cent. of the armature circumference. The figures given are values at no load, and the resistance drop of the machines has been neglected :—

Direct Current Generator	100
Two-phase Rotary Converter	71
Three-phase Rotary Converter	61
Six-phase Star or Delta connected Rotary Converter	35·5

On full load, the drop in the machine will increase the ratio of A.-C. to D.-C. voltage by about 1·5 per cent. Varying the excitation of a rotary converter does not sensibly vary the ratio of A.-C. voltage to D.-C. voltage. Over-excitation, however, causes the supply current to lead, and under-excitation to lag, with reference to the impressed E.M.F. It therefore becomes necessary, when a varying D.-C. voltage is required, to resort to either hand A.-C. voltage regulation by means of an induction regulator, or to an automatic method by the use of choking coils and a compound D.-C. winding on the machine field, the latter method being the one usually adopted in practice. An over-compounding effect of from 10 per cent. to 15 per cent. may be obtained by this method.

The ratios of continuous current to alternating current for various forms of converter, all for unity power factor, and a sine wave, are given in the following table, the losses in the machines being neglected :—

Direct Current Generator	100
Two-phase Rotary Converter	71
Three-phase Rotary Converter	94·5
Six-phase Rotary Converter Star or Delta Connected	47·2

From these figures the following useful practical rules may be deduced for obtaining the approximate full load currents of the machines :—Two-phase alternating line current should be equal to three-fourths of the direct-current output in amperes. Three-phase A.-C. should be the same as the D.-C. Six-phase A.-C. should be equal to one-half the D.-C.

Those desiring to pursue these parts of the subject further will find an extended treatment of such matters in Hay's "Alternating Currents," Chapter XV.

TRANSFORMER CONNECTIONS.

As the voltage ratio is fixed by the nature of the machine, it is practically always necessary to employ transformers in conjunction with rotary converters. The connections shown in Fig. 1 are those mostly in use. For large machines, that shown as No. 4 has the advantage that only one secondary transformer is necessary, which simplifies the switchgear. Delta connections are to be preferred to star, as in the event

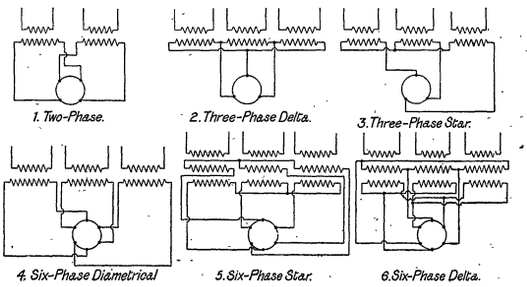


FIG. 1.—DIFFERENT METHODS OF CONNECTING TRANSFORMERS TO ROTARY CONVERTERS.

of one phase becoming faulty, two whole phases are still left in use for supplying the machine. Conditions, however, are sometimes met with in which a star-connected transformer is more suitable on account of the higher value of the secondary phase voltage.

STARTING ROTARY CONVERTERS.

The following methods are usually adopted for the starting of such machines :—A small induction motor mounted on the same shaft; starting from A.-C. side by means of tappings on the main transformer; or from D.-C. side as a D.-C. motor.

The first method is usually employed for large machines, where a heavy alternating line current would be drawn from the supply if the second method were employed. Starting is usually effected from the A.-C. side for machines of medium capacity where a direct-current source is not available, but direct-current starting, where possible, is preferable where it is desirable not to affect the A.-C. supply voltage in any way by A.-C. starting.

Fig. 2 shows the connections employed for starting by

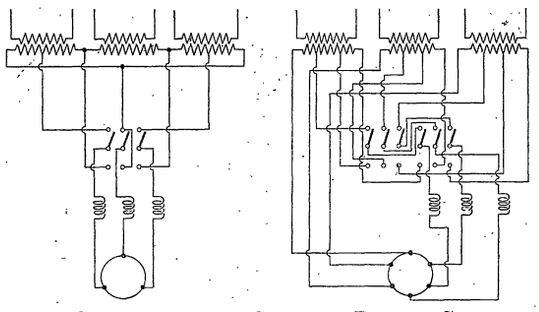


FIG. 2.—CONNECTIONS FOR STARTING ROTARY CONVERTERS BY VOLTAGE TAPPINGS ON TRANSFORMERS.

means of voltage tappings from the transformers. Since high voltages may be induced in the shunt D.-C. field winding of these machines when starting from the A.-C. side, it becomes necessary to provide a switch to break the field winding into five or six sections. Such a switch is usually fixed to the machine frame, and closed after starting. It is also necessary to provide a double-throw field switch for the same field winding in order to reverse the field polarity if necessary after starting in this way, since it is possible for the A.-C. field to run up in the wrong direction. On account of the high inductance effect of heavy capacity cables, it is advisable to fix the main low-tension transformer switch near to its transformer, so as to reduce this distance to a minimum; and since indicating apparatus is not usually connected in this circuit, a satisfactory arrangement is formed by fixing these switches on the machines themselves.

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When D.-C. starting is employed, the machine is started with strong field, and synchronised with the supply voltage before connecting to the A.-C. supply. When compound rotaries are supplying power to common D.-C. bus-bars, care is necessary so that the machines are started as shunt motors from the common equalising bar and one main bus-bar; this necessitates all overload control apparatus being connected in the negative side.

SWITCHGEAR.

Fig. 3 gives a diagram of connections of the switchgear

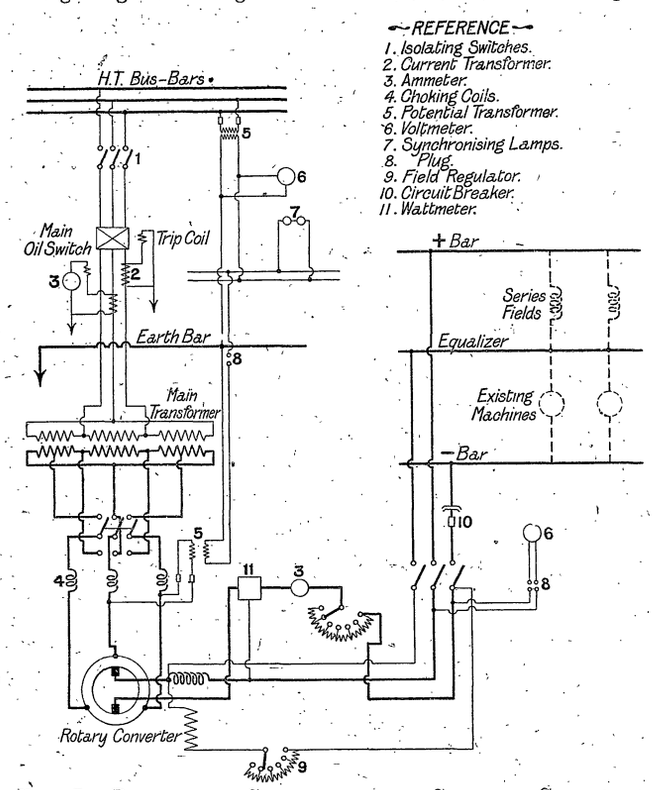


FIG. 3.—DIAGRAM OF CONNECTIONS FOR COMPLETE CONTROL OF A COMPOUND-WOUND THREE-PHASE ROTARY CONVERTER SUPPLIED BY A HIGH-TENSION INCOMING LINE.

necessary for the complete control of a compound wound three-phase rotary converter supplied by a high-tension incoming line, and running in parallel with direct-current generators, and providing for both A.-C. and D.-C. starting. The various items of switchgear necessary are clearly seen from the diagram.

When starting from the D.-C. side, it is necessary first to close the equalising switch, negative switch, and circuit-breaker. The machine then starts as a shunt-wound motor with strong field between the equaliser and negative bus-bars, and can be synchronised on the A.-C. side with the supply voltage by means of the synchronoscope. When in synchronism, the transformer switches are closed, the direction and strength of field adjusted if necessary, and D.-C. end put on to the D.-C. bars.

In conclusion, it may be remarked that the rotary converter, although having been subjected in the past to adverse criticism, has still maintained its place against its rivals as far as its practical capabilities are concerned, and is employed in present-day practice probably more than any of the later forms of machines. Its efficiency is high, its operating qualities are comparatively good, and the cost satisfactorily low.

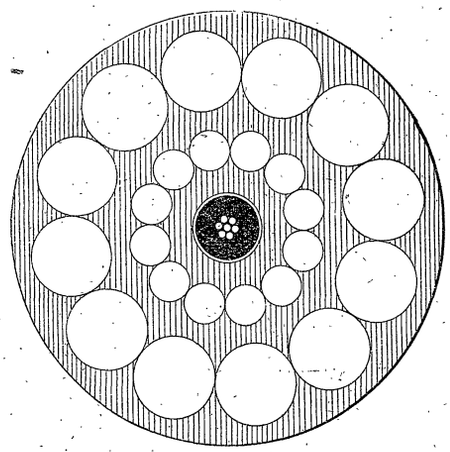
University College, London.—The second term of the session opened last Tuesday. A special course of lectures on "Advanced Electrical Measurement" commenced last Wednesday.

London Borough Councils and Testing Stations.—With reference to the recent threat of the London County Council to summons the Islington and Marylebone Borough Councils for failing to provide pressure testing stations, as required by the County Council, a Committee has been appointed to consider the best means for giving effect to the views of the Borough Councils in this matter. The conference, which was held in November last, also dealt with the question of street boxes and the necessity for removing them from the category of building structures within the meaning of Section 145 of the London Building Act of 1894.

NEW TELEGRAPH CABLE BETWEEN ENGLAND AND NORWAY

THE new submarine telegraph cable connecting England with Norway was opened to public service on January 1st.

It is the joint property of the British and Norwegian Governments, and was laid, on the expiry of the Great Northern Telegraph Co.'s concession for the Norwegian service, in accordance with the policy of the British Government of acquiring the means of international communication. Up to the present time the company has worked the Norwegian service over a single cable between Peterhead and Ekersund connecting stations at Aberdeen and Bergen respectively, and negotiations are now in progress for the purchase of this cable by the two Governments. The new cable has been laid between Newbiggin, in Northumberland, and Arendal, on the south coast of Norway, and is worked from Newcastle and Christiania respectively. The Great Northern Telegraph Co. have four cables landing at Newbiggin, including one which also goes to Arendal, but is continued on to Marstrand, and is used solely for the Swedish service. A tentative arrangement has been made whereby the Great Northern Telegraph Co. work both cables on behalf of the Governments. The new cable actually terminates at the company's cable-house at Newbiggin, but we understand that



SECTION OF DOUBLE-ARMOURED SHORE END. (FULL SIZE.)

both may ultimately be worked from a Government office in Newcastle. The rate has been reduced from 3d. to 2½d. per word.

Through the courtesy of Major W. A. J. O'Meara, Engineer-in-Chief to the Post Office, we are enabled to give the following description of the cable:—The total length is 411 nautical miles or nauts, and the total weight somewhat over 3,000 tons. The cable is divided into three portions: a 4-naut length of shore-end cable at the Arendal end, a 66-naut length of light deep-sea cable, and a 341-naut length of heavy deep-sea cable. The accompanying figure shows a section of the shore end. The conductor is a strand of seven copper wires weighing 200 lbs. per naut, and the gutta-percha insulation also weighs 200 lbs. per naut. Over this is a spiral layer of brass teredo-proof tape, 4 mils. thick, and the core is then served with a layer of tanned jute yarn to form a bedding for the twelve inner galvanised iron sheathing wires, each 203 mils. in diameter. The outer 12 iron sheathing wires of 378 mils. are stranded over a further serving of tanned yarn and compound. This double-armoured type cable is employed only at the Norwegian end, where the coast is rocky. The light deep-sea section is exactly similar, but without the outer armouring; while the remainder, extending right into Newbiggin, has the same core only, being armoured with a single sheath of ten iron wires of 280 mils. diameter each. The landing point on the English coast was cleared of rock, thus avoiding the necessity for a special armoured shore-end section at this end. The weight of the shore-end type is 402 cwt. per naut, that of the light deep-sea type 103·3 cwt. per naut, and that of the heavy type cable 152·5 cwt. per naut. The specified maximum resistance of the cable at 75° Fahr. was 5·999 ohms per naut, while the specified capacity was 0·348 m.f. per naut. It should perhaps be mentioned that the cable is for telegraphic service only, and that no provision has been made for adapting it to telephone work.

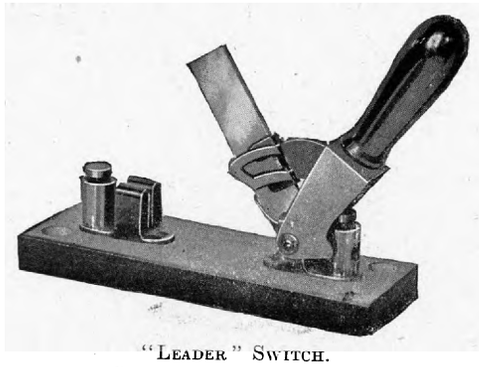
The South African Institute of Electrical Engineers.—The November issue of the Transactions of this Institute contains a Paper entitled "Notes on Three-phase Motors," by Mr. P. Herd, discussing in a general manner some of the characteristics of three-phase induction motors, and the bearing these characteristics should have in determining the capacity and speed of motors to be installed. Discussions on Papers previously published are also included.

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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

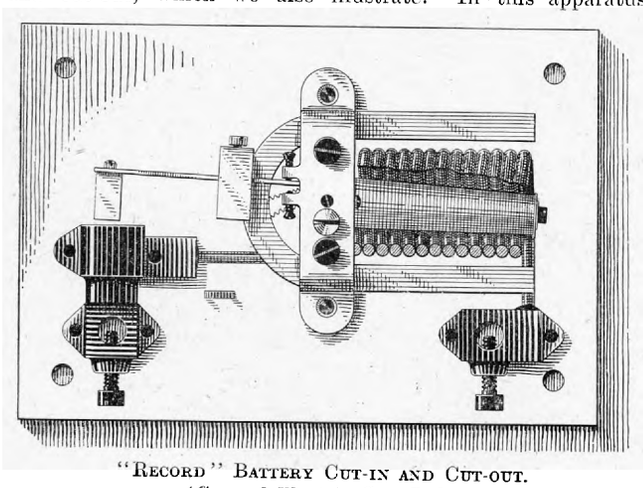
Switches and Switchgear.

A comprehensive new catalogue of low tension switchgear has just been brought out by the General Electric Co. In addition to various forms of the well-known "Peel" and "Witton" knife switches, including a new tandem back to back arrangement of the former, we have the familiar "Adelphi" switch with laminated contacts and an entirely new line of small quick break knife switches known as the "Leader" switch, and illustrated here. These are designed



"LEADER" SWITCH.
(*General Electric Co., Ltd.*)

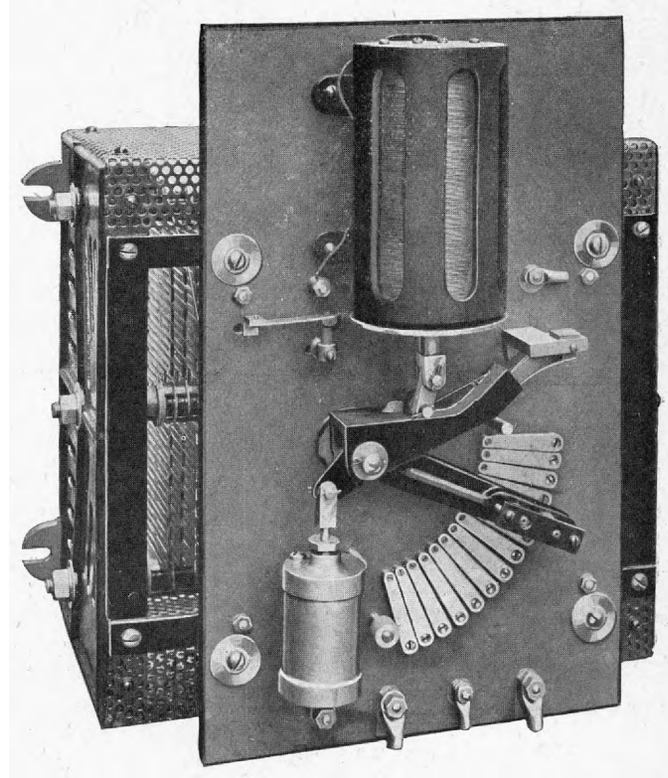
with remarkably few parts, and are therefore very moderate in price. We also notice improvements in the battery and resistance regulation switches, in which the brush contacts are more easily renewed than formerly. Some new patterns of voltmeter switches are also included, and among the smaller articles, attention may be drawn to a new range of angle sweating sockets. Perhaps the most important novelty is the "Record" patent automatic battery cut-in and cut-out, which we also illustrate. In this apparatus



"RECORD" BATTERY CUT-IN AND CUT-OUT.
(*General Electric Co., Ltd.*)

one end of the balanced arm carrying the main series contacts which dip in the mercury cups is provided with an iron core surrounded by a fine wire winding shunting the cups. This causes the arm to be polarised when the circuit is open in a direction depending upon the relative voltages of the dynamo and battery. If the dynamo voltage is more than 10 per cent. above that of the battery, the arm is attracted up and the switch is closed, if the dynamo voltage is lower, the arm is polarised the other way tending to hold the switch open. In either position the current in the fine wire coil tends to strengthen the permanent magnet. When current is flowing, the armature is polarised by the series coil, which surrounds it in such a direction as to be attracted by the upper pole of the magnet, and therefore to keep the switch closed. A reverse current reverses its polarity and immediately opens the switch, which, as we have already seen, is then held open by the fine wire coil. The counter-weight can also be set to make the switch open definitely at no current or at a predetermined minimum current. The list also contains particulars of a large number of patterns of circuit breakers, house service switches and fuses, and other ironclad gear.

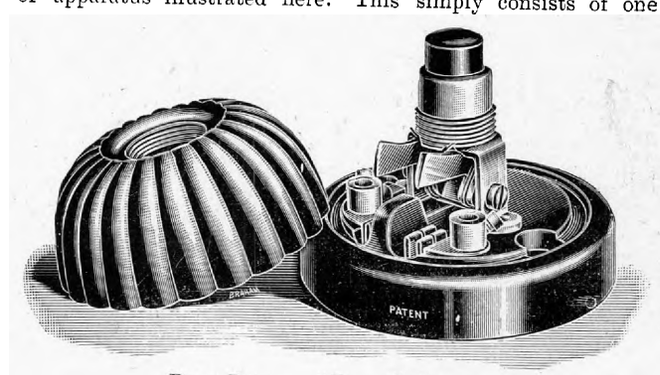
We have received from the Electrical Apparatus Co., Ltd. (Milford Works, Queen's Road, Battersea, S.W.), a leaflet describing an automatic starter of the solenoid pattern. This is provided with two levers, held together by a powerful hub-spring. The upper one is attached to the core of the solenoid and carries the main contact. The dashpot is attached to the lower arm which carries the carbon and copper contact



SOLENOID STARTER.
(*Electrical Apparatus Co.*)

plungers for cutting out the resistance. When the solenoid is energised the upper lever is pulled up with a snap, closing the main contact and starting the motor with all resistance in. The spring between the two levers is now in tension, and the lower lever is steadily pulled up, being retarded by the dashpot. The starting resistance is gradually cut out until the motor attains full speed. On failure of supply, the solenoid releases the main lever, and the circuit is broken, both levers flying back to the off-position.

To meet the demand for a push button to carry heavier currents, and of stronger construction than those designed for bells, Messrs. A. P. Lundberg & Sons (477 to 487 Liverpool Road, London, N.) have introduced the piece of apparatus illustrated here. This simply consists of one



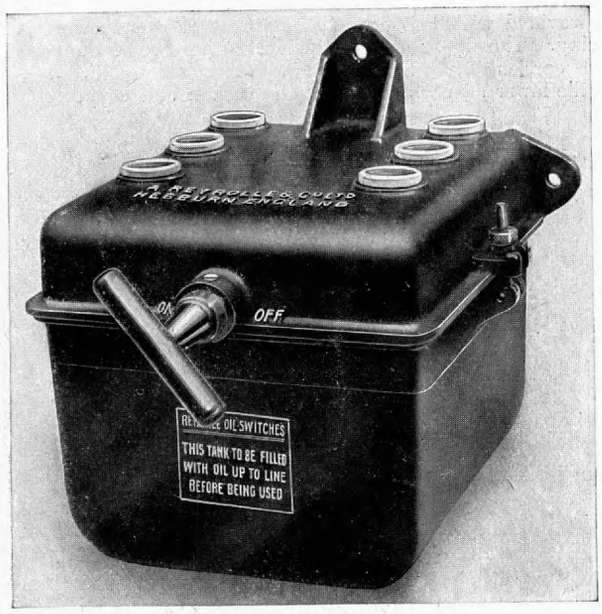
PUSH-BUTTON "PIVOT" SWITCH.
(*A. P. Lundberg & Sons.*)

of their well-know "Pivot" switch movements adapted to be worked by a plunger instead of the ordinary dolly-head. Two patterns are made, one in which the circuit is normally open, and is closed as long as the plunger is depressed, and the other in which pressing the button breaks the circuit.

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The accompanying illustration shows a new quick make and break three-phase non-automatic oil switch, which Messrs. A. Reyrolle and Co. (Hebburn-on-Tyne) have just put on the market, in the 50 ampere size. This has been designed to meet the difficulty experienced in shipyards and works, especially with squirrel cage motors, in preventing



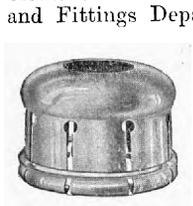
REYROLLE QUICK BREAK OIL SWITCH.

the men from trying to "inch" the motors round by means of the switch. The operating handle will remain in two positions only, full-on or full-off, and the operator is absolutely powerless either to make or to break slowly. The brushes are laminated, and ample sparking contacts are provided. The company have also issued a new leaflet describing their small totally enclosed starter with oil immersed resistances.

The Sun Electrical Co., Ltd. (118–120 Charing Cross Road, London, W.C.), have shown us three interesting switches of their Kalkos pattern, two of which have undergone very severe tests. One of these has been used to break three amperes 40,000 times, the second has broken five amperes 10,000 times, and the third has been switched on and off 40,000 times without carrying current. The contact surfaces of these three switches all appear practically as good as new, and it is almost impossible to distinguish which switches have undergone the test under current. In these switches the contact surfaces carried by the contact arm are plain circular discs which are joined by a short piece of flexible cable passing through the marmorite block which carries them. The result is that there is a certain amount of flexibility, and the contact discs adjust themselves and form an exceedingly good contact against the fixed contact springs.

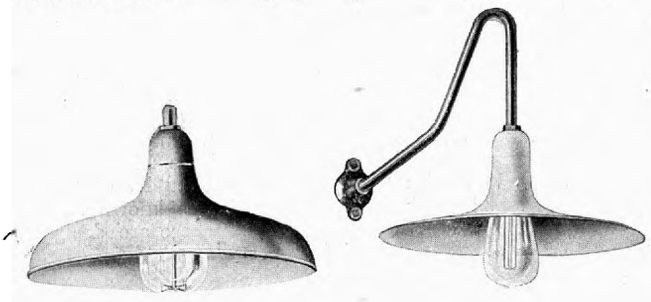
Fittings and Accessories.

We illustrate here a new screwless gallery which Messrs. Siemens Brothers Dynamo Works, Ltd. (Incandescent Lamp and Fittings Department, Tyssen Street, Dalston), have introduced for Holophane shades. It is of a specially deep nature, in order to bring the lamps into true focus with the glassware. By this means wonderful illumination effects are obtained with the new "Stiletto" Reflectors. This gallery entirely dispenses with the use of screws, the ring slides along the outside and is pulled up when the gallery is pushed over the lip of the reflector. The ring is then pushed down and the glass is securely held. To release, the ring is pushed up and the glass pulled out. The old type of gallery with the three screws is often a cause of breakage, for if the screws hold the glass too tightly the reflector may crack through expansion. The new screwless gallery is admirably ventilated, as will be seen, and thus the cap end of the lamp is kept cool.



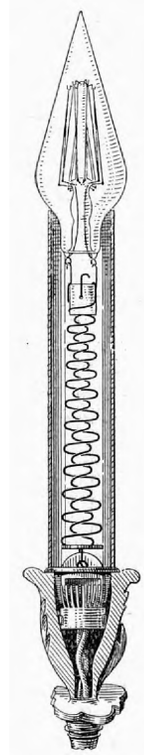
SCREWLESS GALLERY FOR HOLOPHANE SHADES.

Two new weather-proof reflector fittings, recently introduced to this country by The Benjamin Electric Co., Ltd. (1a Rosebery Avenue, E.C.). These are constructed of vitreous enamelled steel. The lamp-holders are made in two pieces of vitreous porcelain, all conducting parts and terminals having widest possible separation. Easy access to terminals for connecting up is provided by constructing the



DIFFUSING PATTERN DISTRIBUTING PATTERN
BENJAMIN REFLECTORS.

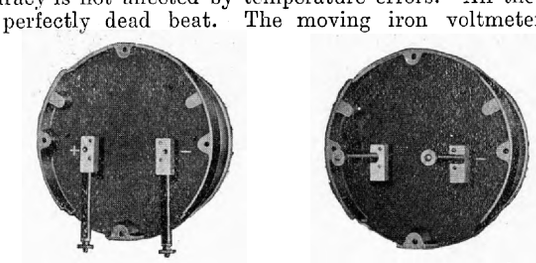
fitting in two parts. They are stocked with bushing screwed for ½-inch gas thread, and a simple but effective rubber washer arrangement is provided for preventing moisture entering the lamp-holder after inserting the lamp. Two patterns are made with diffusing and distributing reflectors, the former 12 in. in diameter, and the latter 14 or 16 in.



"FLEXALITE" CANDLE FITTING.

An entirely new candle fitting, known as the "Flexalite," has been brought out by the Sun Electrical Co., Ltd. (118–120 Charing Cross Road). The combination, which comprises several novel features, is shown in the accompanying illustration. The base consists of a piece of porcelain with a steel ribboned self-centreing collar, which may be placed in the socket of any candle-stick. Two taper screws fit into the base, and a tight grip can be obtained irrespective of irregularities in the hole in the fitting. To the porcelain base is attached an expanding spring connection, which hooks into the loops on the lamp. The opal tube is held purely by the action of this spring, and this gives a flexibility which guards the candle from damage by allowing it to deflect when knocked, and then to return to its original position. The absence of a lamp cap much improves the effect of the transparency of the tube without any of the filament requiring to be inside. The whole device is simple, durable, and affective, and can be adapted without alteration to a wide range as regards the size of the socket and the length of the tube. Only the lamp itself, which is of the metal filament type, requires to be renewed.

Simplex Conduits, Ltd. (Garrison Lane, Birmingham) have issued a new catalogue of measuring instruments, including both switchboard and portable pattern types of instruments on the moving iron, moving coil, hot wire, and dynamometric systems. The accuracy of the moving iron instrument, which is the cheapest form, is given as within 1 per cent., owing to the lightness of the moving element and the use of jewelled bearings. The moving coil, hot wire, and dynamometric types are guaranteed within 1 per cent., and this accuracy is not affected by temperature errors. All the types are perfectly dead beat. The moving iron voltmeters are



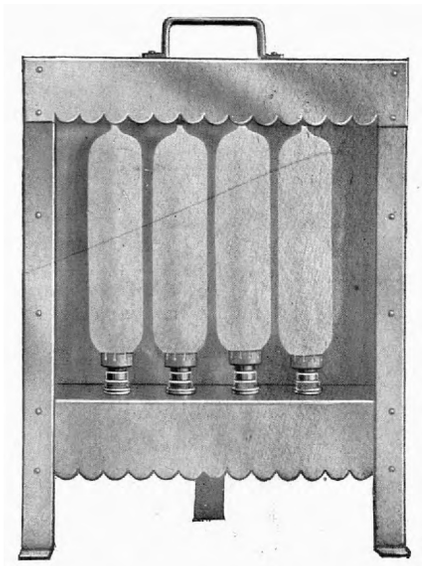
ARRANGEMENT OF FRONT AND BACK CONNECTIONS TO SIMPLEX INSTRUMENTS.

fitted with an additional resistance seven times the ohmic resistance of the copper bobbin, whilst the moving coil voltmeters have a resistance of 10,000 ohms per 100 volts. The switchboard patterns are of a flange type, open dial, or cast-iron type, and have special terminals which are interchangeable, so as to allow of their being used for either back or front connections in the manner shown in the illustration.

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Heating and Cooking Apparatus.

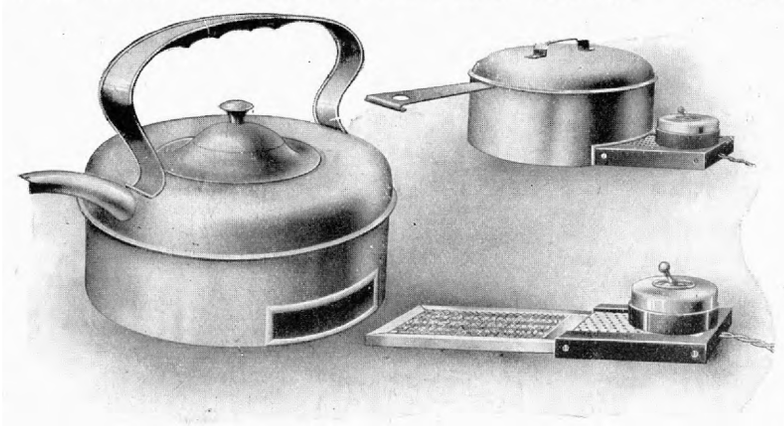
The British Prometheus Co., Ltd. (Salop Street Works, Highgate, Birmingham) have recently introduced some new designs of electric radiators and convectors at remarkably low prices. One of these is the radiator illustrated, which is



CHEAP PATTERN OF PROMETHEUS RADIATOR.

listed as low as 12s. 6d. subject without lamps. This is constructed in wrought iron with black finish. No switches are provided, and the wiring is brought direct to the lamp-holders. Switches can, however, be provided at a slight extra price. A convector is also sold in the 1,000 watt size complete with Prometheus strip elements, for 37s. 6d.

From time to time descriptions have appeared in these columns of heating apparatus on the "Quartzalite" principle supplied by the Bastian Electric Heating Syndicate, Ltd. (91 Palmerston House, London, E.C.). The heating element in these devices consists of a number of quartz tubes containing helices of a non-oxidising wire, which cause the tubes to glow at a red heat. The latest production is a device known as an "insertion heater," and consists of eight short tubes mounted in a metal framework and protected by wire network at top and bottom, as shown in the illustration. One such heater can be used in conjunction with several special but inexpensive utensils. These are provided with a chamber at or near the bottom, into which the heater is inserted. Kettles, water-boilers, tea-urns, etc., have the chamber some-



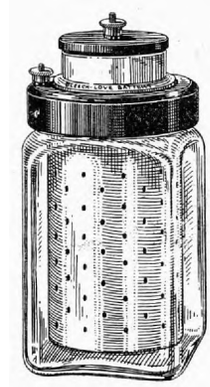
"QUARTZLITE" INSERTION HEATER.

what above the bottom, so that there is liquid all round it. The heater takes 500 watts, and will boil two pints of water in the kettle in from 12 to 15 minutes. A one-gallon boiler will boil in about 50 minutes, and, by means of a very efficient lagging, some 75 per cent. of the heat is said to be retained after 12 hours. This boiler should therefore be found of great convenience in offices, shops, etc. It should be noted that by means of the insertion heater, it is possible to convert gas-heated urns to electric heating. A 250 watt size can also be obtained.

Another recent Quartzlite production is a radiator similar in all respects to the now well-known rat-trap pattern (see ELECTRICAL ENGINEERING, July 8th, 1909, p. 631), except that the quartz tubes are vertical. The tubes are spaced in a circle round a central vertical cylinder, which acts as an efficient reflector, and the whole is fitted in an attractive looking frame with spun-metal ends and a protecting wire cage. This radiator takes 750 watts, and gives a comfortable heat with an attractive glow. It is suitable for heating small bedrooms, sitting-rooms, drawing-rooms, offices, etc., and is known as the Lighthouse radiator, on account of its appearance.

THE BLEECK-LOVE PRIMARY CELL

A NEW primary cell has been introduced by the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., of Silvertown, London, E., under the name of the Silvertown Bleeck-Love Battery. It is a two-fluid cell of the bichromate type with zinc and carbon elements. The excitant is caustic soda, and the zinc, which is not amalgamated, may be left in this solution without deterioration when the cell is not in use. The depolariser is a patented solution. As shown in the illustration, the zinc is enclosed in a porous pot containing the caustic soda, while the negative element is in the form of a perforated carbon cylinder surrounding it and immersed in the depolariser. An outer vessel of glass, ebonite, or other suitable material is employed. The cell has an open-circuit E.M.F. of 2·7 volts, and the initial P.D. on closed circuit with a small current is 2·5 volts. The internal resistance is only about 0·15 ohm, and no fumes are given off. The cell is claimed to have a large current capacity, and to have a very constant E.M.F. on varying loads. The initial and recharging costs are comparatively low, and this renders the cell suitable for telegraph and telephone batteries where heavy currents are required. Among the other uses for which the cell is suitable are small wireless sets, X-ray work, lighting small lamps, charging accumulators, etc. It is claimed that two cells on one charge will run a 7 in. fan for 36 hours, or will run a 4-volt 4 c.p. lamp for 18 hours, or will charge a 20 ampere-hour 4 volt accumulator in 16 hours. A three-cell battery with tray measures 17 in. by 6¼ in. by 11¼ in. high; a ten-cell battery 28 in. by 12 in. by 11¼ in.



BLEECK-LOVE CELL.

The Turin Exhibition.—We have received from the exhibitions branch of the Board of Trade some further particulars regarding the forthcoming International Exhibition in Turin. The exhibition is to be opened on April 29th, 1911, by the King of Italy, and the site is at the end of the Corso Vittorio Emanuele II. The British section is to be a special fire-resisting building, and, with the international machinery hall, will stand on the side nearest the city. The space available in the British section amounts to five acres. Among some particulars of the industries of the province of Piedmont, in which Turin is situated, it is mentioned that the hydraulic power in use for industrial purposes in Piedmont in 1903 was 132,948 h.p., the other power in use for industrial purposes being 126,162 h.p. The yearly rate of increase in the use of hydraulic power since 1903 has been about 11,000 h.p. The concessions for new hydraulic power granted in 1909 were 13, totalling 21,784 h.p., as against 24 concessions, totalling 13,582 h.p. in 1908, and 59 concessions, totalling 104,957 h.p. in 1907. It is stated that the British Consuls in Italy report good prospects as regards the extension of British markets in Italy for electrical apparatus. Very complete precautions against fire are being adopted. The town has a fire brigade with 20 stations and over 200 men, and a force of no less than 1,200 watchmen will be employed at night in the exhibition. Hydrants fed from a special service quite apart from the town supply, will be placed about 38 yards apart, and a pressure of 90 lbs. per sq. in. will be available. Sappers and engineers will also be in readiness to blow up buildings if it becomes necessary to isolate a fire area. The British section will be separated from the only other building with which it is in contact by a fireproof wall 35 in. thick, and a passage 16 ft. wide surrounds all other parts. Thirty extra hydrants drawing water from the river will be provided, in addition to those of the Italian authorities, and these will be fed by special pumps capable of throwing 1,000 gallons per minute. Every part of the buildings will be rendered non-inflammable.

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2,000-H.P. SINGLE-PHASE LOCOMOTIVE FOR THE LOETSCHBERG RAILWAY

SOME further particulars are to hand of the large single-phase locomotive built by the Maschinenfabrik Oerlikon for service on the Loetschberg tunnel route now being constructed between Berne, in Switzerland, and the Simplon

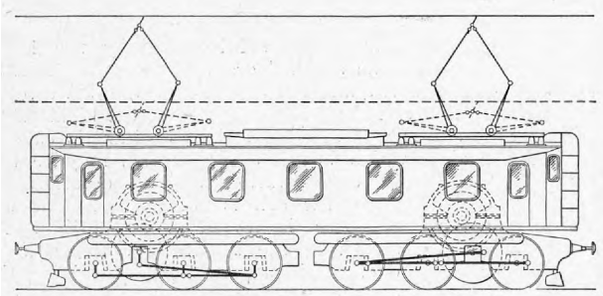


FIG. 1.—2,000-H.P. OERLIKON LOCOMOTIVE FOR THE LÖTCHBERG TUNNEL RAILWAY.
(Scale 1 in. = 15 ft.)

Tunnel connection with Italy. The equipment of this line will be on the single-phase system, with a trolley-wire pressure of 15,000 volts and a frequency of 15 cycles. The Oerlikon locomotive develops 2,000 h.p. continuously at 26 miles per hour, giving a tractive effort of 28,700 lbs. at the wheel periphery. If the connections were altered so that this normal torque were exerted at a speed of 37 miles per hour, an output of 3,000 h.p. on the one-hour rating would be obtained without any increase in weight. At starting the tractive effort can be increased to 33,000 lbs. Speed regulation can be effected from standstill to 44 miles per hour. As shown in Fig. 1, the body of the locomotive is supported on two three-axle trucks, the six wheels of each of which are coupled together. On each truck is a 1,000-h.p. motor driving, through spur-gearing, an intermediate shaft coupled to the driving axles as shown. The gear ratio is 1 to $3\frac{1}{4}$. A general view of one of these trucks, showing the commutator side of the motor, is given in Fig. 2. The motors are of the Oerlikon compensated series type, and are 12-pole machines with commutating fields produced by a special phase-displaced current. Each weighs somewhat under 9·5 tons, including gearing. They are so designed that even when developing the maximum torque at starting, the maximum voltage per segment of the commutator is 4 volts. The greatest number of segments touched by one brush simultaneously is three, and consequently there can be no serious sparking. There are no resistance leads between the segments and the armature coils, but these connections are, on the contrary, particularly heavy. By experiment, the efficiency has been found to be 90 per cent. between half-load and full-load. At the speed corresponding to a locomotive speed of 19 miles per hour, the power factor was over 95 per cent. The air-gap of these motors is 3 mm. Of the total locomotive weight of 88 tons, the electrical equipment is responsible for 42 tons. The weight per axle is under 15 tons.

The electrical equipment is divided into two portions, which can be worked independently if necessary, and the presence of two transformers renders it possible to drive the locomotive from a three-phase supply. In this case the transformers are placed in the Scott three-phase-to-two-phase connection, and each motor is supplied from one phase of the two-phase supply. A special arrangement of the two current collectors would be required, however. The motors will also run off a 400-volt direct-current supply, but for this purpose heavy series resistances for starting up would have to be provided. The transformers, each of which will deliver 2,000 K.V.A. continuously, are air-cooled by forced draught, and supply the motors with current at sixteen different voltages up to 840 volts. The low-tension windings are earthed at the middle-points, so that the maximum pressure between motor winding and earth is 420 volts. Special tappings off the transformers supply current at 300 volts for train heating. Some 100 kw. is required for this purpose for one train.

For lighting the train and supplying current for the contactor switches, a motor-generator set and battery are provided. An 8-h.p. air compressor with automatic starting and stopping gear for the collector-bow raising gear and the air brakes, and a 10-h.p. blower for the forced ventilation of the motors and transformers are also installed on the locomotive. We are indebted to the Maschinenfabrik Oerlikon for the above particulars and the illustration of the motor truck.

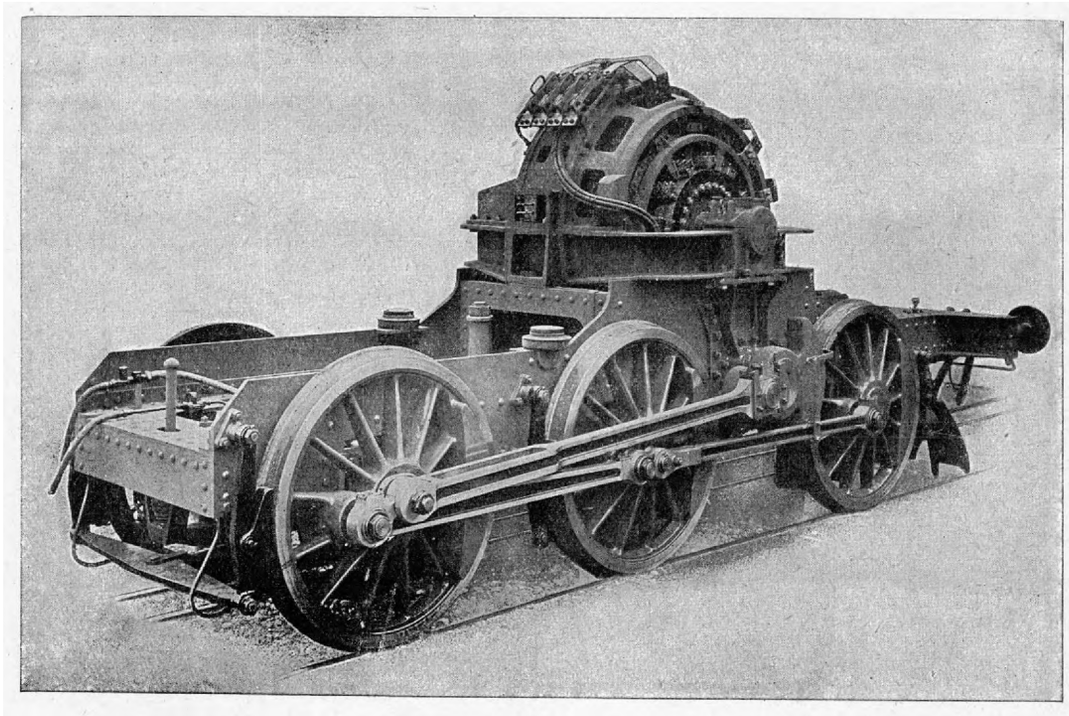


FIG. 2.—MOTOR TRUCK OF OERLIKON 2,000-H.P. LOCOMOTIVE, WITH 1,000-H.P. SINGLE-PHASE COMMUTATOR MOTOR.

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THE MERZ-PRICE SYSTEM

THE Merz-Price protective system, which had been described in a Paper by Mr. H. W. Clothier on December 19th before the Newcastle Section of the Institution of Electrical Engineers, was further dealt with on the following day in a Paper read before the Manchester Section by Messrs. K. Faye-Hansen and G. Harlow, entitled "Merz-Price Protective Gear and other Discriminative Apparatus for Alternating Current Circuits." After dealing briefly with the limitations of and objections to overload time-limit protection and reverse energy apparatus, the authors proceeded to set forth the essentials of the Merz-Price protective gear, and explained the simpler forms of the system, of which particulars were given in ELECTRICAL ENGINEERING of Dec. 29th (page 822), in connection with Mr. H. W. Clothier's Paper; the difference between the current and magnetic balance arrangement was pointed out, and several methods of connection were shown. The balanced voltage system for feeders was seen to require less pilot wires. In this system, however, it is not so easy to predetermine the fault current at which the relay will operate, as the fault current in one series transformer must induce an electromotive force large enough to overcome the impedance of the comparatively long pilot wires, the relays, and also of the other transformer, so that the magnetising current of the transformers will be a large part of the primary fault current; if, therefore, the relays are not designed for a comparatively low volt-ampere operating capacity, the series transformers must be very large. For this reason relays are used in many cases. It is possible, however, to use trip coils direct in the circuit for short feeders without too large series transformers being required. The balanced voltage system is similar to the balanced current system in that the series transformers have to be made larger if it is desired that the gear shall operate at a fault current small compared with the normal full-load current.

Fig. 1 shows the balanced current method adapted to the

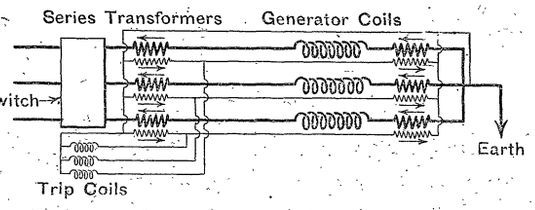


FIG. 1.—BALANCED CURRENT SYSTEM AS APPLIED TO STAR-WOUND THREE-PHASE ALTERNATOR.

protection of a star-wound 3-phase alternator. The case of a delta wound machine requires the mounting of all six transformers adjacent to the machine or the carrying of six leads from it. The authors remark that Merz-Price gear can only protect against fault to earth or between phases, and does not take care of breakdown between different parts of one phase or loss of field or loss of power, so they do not recommend its use alone for generators.

The connections for transformer protection, and the use of time-limit fuses in conjunction with the relays, was then explained. It was pointed out that a breakage in the pilot wire circuit prevents the operation of the balanced voltage system in case of fault, and is difficult to locate without frequent testing of the pilot wires. Such a breakage with the balanced current system or balanced magnetic system results in the immediate isolation of the section in which the fault occurs. A break in trip coil or trip coil circuit, however, renders all the systems inoperative. With the balanced voltage system, the balancing of the transformers must be most carefully carried out, whilst in the balanced current system this is not necessary, as the ratio of the series transformers decides this point, provided the transformers are chosen of a size suitable for the work. The balanced voltage system can be used for protection only, whereas the balanced current or magnetic systems may be used in many cases for measuring purposes in connection with instruments. The balanced current and magnetic systems require less power than the balanced voltage system, due to the fact that the operating series transformers on the latter system have to overcome the impedance of the opposing series transformers, in addition to the relays or trip coils, whereas in the former system the impedance of the relay or trip coil only has to be overcome. The authors consider that the balanced current system, wherever applicable, has an advantage compared with the balanced voltage system, if it is possible to adopt it without an increase in cost. They also advocate the use of the fault current itself for tripping without relays wherever possible.

In the design of balanced voltage gear, the following special points have to be kept in mind: The fault current at which the gear is to operate must be well within that expected in case of breakdown when the minimum plant is running in the generating station. Thus the maximum short-circuit current to be expected through a healthy feeder when the maximum available plant on the system is in operation, should not be large enough to raise the voltage between the pilot wires to a value endangering the safety of the pilot-wire insulation, or to cause a capacity current in the pilot-wire circuit sufficient to operate the relays. Considerable margin must be allowed for any extraordinary high-frequency phenomena which may be expected on the system. The series transformer secondary voltages have to be balanced with extreme accuracy against each other. These points were elaborated at some length in the Paper, and quantitative data for various cases were gone into. The authors hold that the reliability of the balanced voltage system can be increased and the maintenance reduced if in place of direct-current tripping alternating-current tripping be adopted where the tripping is directly dependent on the current flowing under fault conditions. This can be carried out by using special series transformers in each phase for tripping, the relays closing the circuit of these transformers through the trip coils.

An improved arrangement for feeders is then described which does away with both relays and batteries. The method is shown diagrammatically in Fig. 2 as applied to a three-

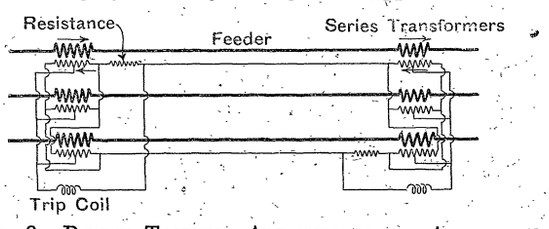


FIG. 2.—DIRECT TRIPPING ARRANGEMENT AS APPLIED TO FEEDERS.

phase circuit using two pilot wires and one trip coil at each end. The principle of the method which can equally well be applied to feeders is that of the balanced current system whereby equipotential points (under healthy conditions) are obtained by means of tappings from the transformers secondaries and additional resistances. The centre point of each transformer is connected to the end of a small resistance, approximately equal to the resistance of one of the pilot wires. Under normal conditions of operation, the middle point of the secondary of the series transformers is at the same potential as the end of the resistance, and consequently the trip coil may be connected across these two points without any danger of tripping under all conditions of load. Immediately a fault occurs in the section of the feeder protected by the two series transformers, the middle point of the series transformer and the end of the resistance are no longer equipotential points, and current flows through the trip coil thus tripping the switch. In this system there is no necessity for the accurate balancing of the transformers, and a break in a pilot wire cuts off the feeder at once.

A detailed comparative table is given showing the currents, voltages, &c., in the different circuits, and other quantitative data for four modifications of the system for four different fault conditions, and it is finally concluded that the balanced voltage system with three pilot wires for D.C. or A.C. trip with relay, or the balanced current system with two pilot wires and A.C. trip without relays can be all used satisfactorily, provided the necessary attention is paid to the design of the apparatus and the characteristics of the system to which they are applied carefully studied, but that the balanced voltage system with A.C. trip without relay with three pilot wires is not so suitable.

The balanced current system with resistances is well suited to the protection of branched feeders, and with this arrangement two pilot wires can be used, as shown in Fig. 3, due to the fact that three trip coils instead of two have to be operated; the fault current required for tripping is increased

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approximately 50 per cent. For all the above systems the sensitiveness can be improved by increasing the size of series transformer and the secondary voltages.

In the authors' opinion, the most effective method of protecting parallel feeders is by the use of the Merz-Price

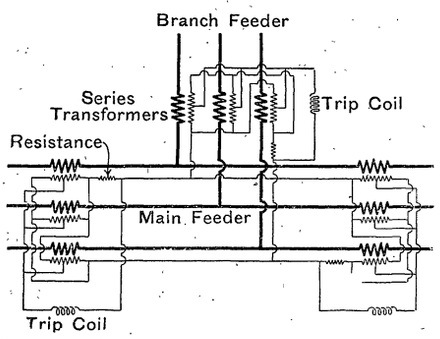


FIG. 3.—BALANCE CURRENT WITH RESISTANCES AS APPLIED TO BRANCH FEEDER.

gear, and most of the data given above are applicable to this case. Other methods of protection have been proposed, one of which is shown in Fig. 4. This was introduced by the British Thomson-Houston Company. With the series transformers interconnected as shown at the sub-station end, no potential will exist between *a* and *b*, provided the secondaries are carrying the same currents. If, however,

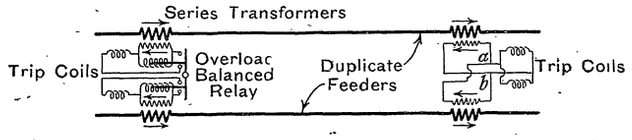


FIG. 4.—B.T.-H. SYSTEM FOR PROTECTION OF PARALLEL FEEDERS.

a fault occurs in one of the feeders, then the currents in the primaries of the two series transformers flow in opposite directions. This method, however, does not discriminate as does the Merz-Price, in that both the healthy and the faulty feeders are cut off at the same time.

This method of protection can be made discriminating by using such an arrangement as shown in Fig. 5, where A and B represent two incoming 3-phase feeders. The currents on these feeders are balanced against each other on separate transformers. The extra windings on the balancing transformers *c* and *d* are led to a discriminating reverse-current

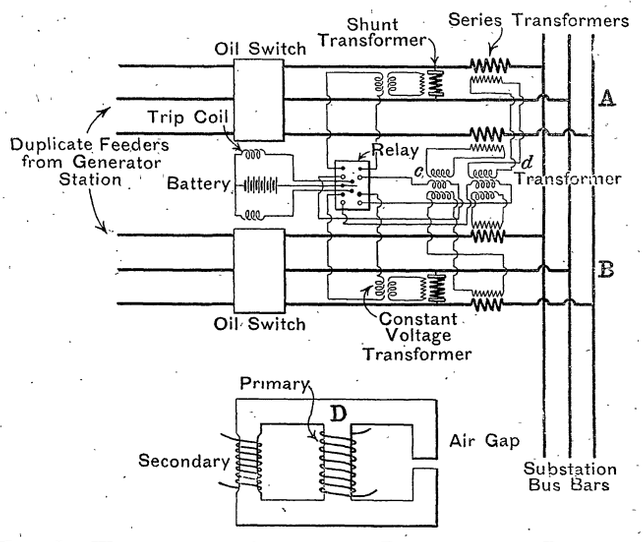


FIG. 5.—WESTINGHOUSE SYSTEM FOR PROTECTION OF PARALLEL FEEDERS.

relay. As normally no voltage is induced in the extra windings, no current flows through the relay coils. On reversal of current in one feeder due to a fault in the feeder, current flows through the relay, which is deflected to one side or the other depending upon which feeder is faulty. This method was introduced by the Westinghouse Company in 1905. In order to guard against the voltage failure in some measure, the special shunt transformer shown in Fig. 5 is adopted. It is designed with three legs, on the centre one of which the primary winding is placed. The secondary winding is wound round the left-hand leg, which at the normal voltage is highly saturated. The right-hand leg is built with an air-gap. Assuming that at full voltage the flux produced by the primary coil divides equally between the two outer legs, then with a lower primary voltage the flux will divide so that a greater proportion than half passes through the leg on the left, since the permeability is greatly increased as the flux is reduced. Thus the voltage induced in the secondary winding will not fall so quickly as the primary voltage.

The relays are usually constructed in a very simple manner. The British Thomson-Houston Company's and the Westinghouse Company's relays are very similar in construction. In the latter (Fig. 6) the weight of the armature A is counter-

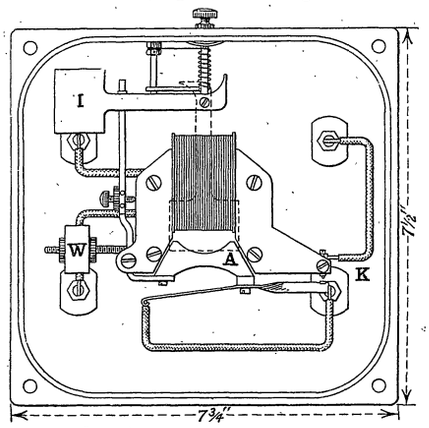


FIG. 6.—WESTINGHOUSE RELAY.

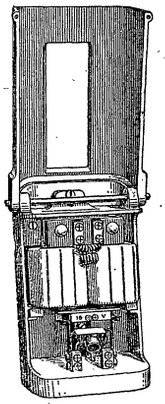


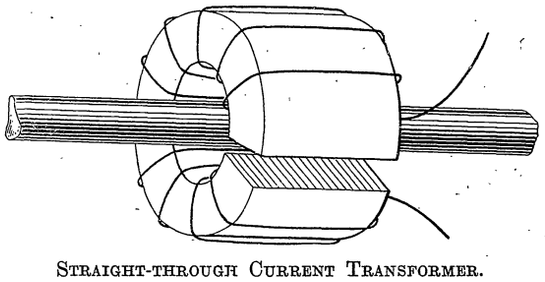
FIG. 7.—REYROLLE RELAY.

balanced by an adjustable weight W, and the trip-coil circuit is closed at the contact K. On the relay tripping, the indicator I falls and denotes on which phase or between which pair of phases the fault has occurred. In the British Thomson-Houston Company's relay the trip-coil circuit is closed at two points, one at each end of the armature. The Reyrolle relay (Fig. 7) differs somewhat in form from the two previously described, and is not arranged for automatically re-setting itself when a fault is cut off. This latter feature serves as an indicating device and renders a special indicator unnecessary, but in the form shown necessitates opening the case and re-setting the relay before the opened switch is closed again.

DISCUSSION.

Mr. P. V. HUNTER (Messrs. Merz & McLellan) called attention to the necessity for bearing in mind the great rise of voltage that might occur in the secondaries of the current transformers under fault conditions. Sometimes it would be as high as 700 volts. He also particularly emphasised that the apparatus must always be designed in reference to the maximum fault current possible, and not to the full load current. The author had described a large number of methods of connection; only about three, however, were actually in use. He rather questioned whether in the author's arrangement shown in Fig. 2, that in the event of a pilot wire breaking, there would always be enough current in the feeder to work the relays. An objection to the author's system of direct tripping was the number of parts that had to be balanced. In the figures given in the Paper the author had taken transformers of very much larger size than those used on the North-East Coast system.

Mr. H. W. CLOTHIER (Messrs. A. Reyrolle & Co.) showed a piece of cable which had developed a fault between phases on



STRAIGHT-THROUGH CURRENT TRANSFORMER.

the Glasgow system, where Merz-Price protection was in use. The small damage done to it showed how promptly it had been cut out. He then proceeded to describe the actual form of transformer used on the Newcastle system; this is shown diagrammatically in the accompanying figure. The primary is a

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straight bar, and the core is made with an air gap, which afforded a ready means of adjustment for balancing. The input in less than 5 volt-amperes as compared with the 41 and 125 volt-amperes of the author's transformers. They have a straight line characteristic up to about thirty times full-load current. The relay shown in Fig. 7 could be arranged to be self-resetting. In the North, the current balancing system of feeder protection known as neutral wire balancing, had been used, but was abandoned in favour of electrical balancing. The author's direct trip system was interesting, but evidently required large and expensive transformers. Auxiliary tripping had the advantage of permitting the switches to be tripped periodically to see that all was in order.

Mr. E. B. WEDMORE (British Thomson-Houston Co.) paid tribute to the excellence of the Merz-Price system. The circulating current system shown in a number of the author's figures has also been worked out by his company. He preferred single-turn transformers, and sensitive relays to direct tripping. His own system, which had been described in the Paper, could be made discriminating by the addition of reverse current relays normally short-circuiting the respective trip coils. He also put in a plea in defence of the modern reverse current relay, which was a very different piece of apparatus from that condemned by Messrs. Merz and Price. Finally, he pointed out that there were many cases where parallel feeders were preferable to inter-connectors, where very simple and inexpensive protective arrangements could be employed.

Mr. A. E. MCKENZIE (Manchester Corporation Electricity Department) mentioned that 10 sets of feeder protection gear were on order for the Manchester system. They had used the Merz-Price system with success on their 4,000 kw. generators, and were about to apply it to the 6,000 kw. generators at Stuart Street. All the feeders recently laid in Manchester had pilot wires. He quite agreed that indirect was preferable to direct tripping.

The authors, in their reply, defended their large transformers as being more reliable for systems smaller than that of Newcastle, where the fault current had a lower ratio to the load current. They thought that the advantages of single turn transformers were overrated. They did not agree with Mr. Wedmore's use of reverse current relays to make his system discriminative.

THE WIRING CONTRACTOR'S POINT OF VIEW

THE "Electrical Record" of the *Australian Mining Standard* has called attention to the fact that there has been trouble owing to the importation of poor-grade and faulty wire and cables into Australia. The matter, our contemporary says, has come under the notice of the Minister of Customs, and importers have been officially notified that they should safeguard their business interests by having adequate tests applied to consignments before taking delivery. "The insulation in the cheaper grades of wire and cable," the article continues, "is apt to be of the poorest quality, and sometimes there is remarkably little of it. In order to make up for a 5 per cent. duty imposed, the insulating material is impoverished with respect to its rubber contents, and the quantity also is reduced. The thickness of the rubber under the braid and tape is often only 22 to 24 mils. thick, instead of 35, as specified by the rules for an 18 gauge wire. Other sizes will be found to vary similarly." The rules referred to are those of the Australian Fire Underwriters' Association, and the dielectric thickness quoted above agrees with that specified by the Engineering Standard Committee in this country. Our contemporary does not state whether the wires and cables to which exception is taken are of British or foreign manufacture, but we trust that the warning will result, not only in ensuring greater care being exercised by the Australian buyers, but also in an improvement in the insulated wire exported. We have reason to believe that it is not only Continental firms who are the sinners in this respect, but that British firms—even those of C.M.A. standard—have at times been tempted to export cables of a quality that would certainly not be accepted for wiring work of a good class in this country. The secret of what are the requisites of "Association" cable other than a label with a particular colour and inscription, has never been divulged, so perhaps it would be futile to ask whether the class of cable which members of the Cable Makers' Association export is of equal quality. The buyer of British cable, both at home and abroad, is becoming impatient of the methods of the Association, and he has a right to demand some more definite assurance than is afforded by a buff-coloured label, that the function of the Cable Makers' Association is to keep up quality as well as to keep up prices.

While the conference between representatives of the Municipal Electrical Association and the Electrical Contractors' Association is proceeding leisurely, with occasional adjournments and postponements, it may be opportune to remind those who are interested in the subject that an abortive attempt to hold a similar conference on exactly the same subject was made nearly eight years ago. On April 29th, 1903 (a better date would have been 28 days earlier), a discussion on this very same subject of municipal wiring took place at Anderton's Hotel, London. It was organised by the London Electrical Contractors' Association (the predecessors of the present E.C.A.), and representatives of the electricity supply undertakings attended by invitation. At the conclusion of the discussion, a Committee of representatives of supply undertakings were appointed to confer with representatives of the Contractors' Association, with a view to an amicable settlement of their differences being arrived at. We believe we are right in saying that no meeting of this Committee was ever convened. Mr. Rashleigh Phipps was President of the London Electrical Contractors' Association at that time, and perhaps he can tell us why the proposal fell through.

An amusing incident occurred at a special meeting of the Islington Borough Council on Friday. A few weeks back the Lighting Committee of the Council recommended that they should be authorised to put into force the powers which they possess under the London County Council (General Powers) Act, 1906, to wire premises and hire out apparatus, etc. At the Council meeting on December 16th these recommendations were rejected, and as a result the Chairman of the Lighting Committee reported to the Council that that body had resigned. This report was on the agenda for the meeting on Friday last, but when it was reached the Mayor refused to allow it to be put to the meeting or to be discussed, as he had been advised that this method of resignation was *ultra vires*. The facts are that 12 out of 17 members resigned, and signed a letter to that effect, but according to the Standing Orders of the Council, any member resigning from a Committee must intimate, independently, his intention to the Town Clerk, who reports to the Council in due course. If the 12 members of the Lighting Committee send in their resignations in the proper manner, the matter will be reported to the Council meeting on January 20th.

At Worcester there is also some internal friction on the same question. Like many others, the Worcester undertaking has been hit very hard by metal filament lamps, and anxiety has naturally been manifested to obtain fresh business as a set-off against the loss of revenue. Not having trading powers, it had been thought possible to get round the law by the Department acting as agents for apparatus. The local contractors opposed this arrangement, although it was explained that all the work of fixing any such apparatus sold in this manner by the Corporation would be passed on to them. The Corporation threw out the Committee's suggestion, and the Chairman resigned. A new Chairman has been appointed, but he has made it clear to the Corporation that if he finds it necessary, in the interests of the electricity undertaking, that the powers which have been refused are essential to its well-being, the Council must give way, or he will not continue in office.

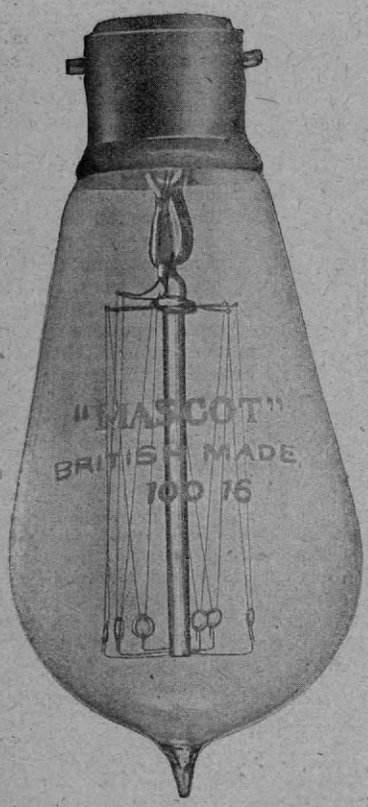
Ozone Treatment of St. Petersburg Water.—The Russian Siemens & Halske Company have installed, in conjunction with the Lahmeyer Company, a large plant for the electrical sterilisation of water for the public water supply of part of the city of St. Petersburg. By means of an electrical discharge, air with a high percentage of ozone is prepared, and this is brought into intimate contact with the water. The plant is the largest of its kind, and treats some 50,000 cubic metres of water daily. The system employed is a combination of the Siemens ozonising apparatus and the sterilising towers of the Compagnie de l'Ozone, Paris. It is probable that the system will be extended later to the whole of the water supply of the city.

Durability of Arc Lamps.—The Union Electric Co. send us the following report from one of their engineers: "You will probably be amused to hear my little experience previous to the order being secured for the lamps for the above. We were in competition with the 'Y' and 'X' lamps. When I went to start up the lamps I found several were not fixed, and were about being slung up. The wireman was on a crane, electrically equipped, but hand-worked from the floor. He was pulling up the lamps by a light rope, and had one half-way up when the man on the ground worked the crab of crane sideways instead of travelling forwards. The rope was cut in two, and the Excello dropped 16 to 18 feet on the wood block floor. The floor was cut a bit. I thoroughly examined the Excello, and with the exception of the slightly bent striking rod and broken economiser ring, no damage was done, and the lamp was running in half an hour. I insisted to the general manager that before a fair comparison could be made a similar combined bending and reliability test should be applied to the competitive lamps. The general manager was very surprised that the lamp was not ruined, as he saw it fall."

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A NEW METHOD OF SUPPORTING LAMP FILAMENTS

MR. R. S. HORVATH (47–51 Standen Road, Southfields, London, S.W.) has brought us samples of an improved form of his "Mascot" lamp. The improvement is in the support of the filament at the pip end of the lamp. One of the difficulties in manufacturing metal filament lamps is to make sure that this support is sufficiently flexible, and yet sufficiently strong. If it is too rigid the filaments are apt to break in transport, or on contracting after use; on the other hand, if the arms supporting the filament are made of wire which is too thin, although this allows for the contraction, the hook is liable to bend out and release the filament when hot. In Mr. Horvath's new lamp, which we illustrate, it will be seen that thin flat circular links are inserted between the wire hooks and the filament. A great increase in flexibility is thus attained, and at the same time the wire hooks can be thin and springy, as they do not become so hot as they would do if in direct contact with the filament. Mr. Horvath, who informs us he himself was the maker of the first metal filament lamp made in this country, has provisionally protected the device (Patent No. 27,401 of 1910).



The sale of these new lamps is in the hands of Messrs. Galsworthy, Ltd., 15–16 Newman Street, London, W.

CORRESPONDENCE

LAMP DIMMERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—In your last issue you publish a letter from Mr. George Wilkinson, in which the following sentence occurs: "The advertisement includes a Faraday House certificate of a test on one of the switches, but this certificate *carefully avoids* all reference to the very heavy current consumption taken by the resistance."

We do not for a moment wish to suggest that Mr. Wilkinson questions the impartiality of the Report issued by Faraday House, but we regard the above sentence as being unfortunately worded. We were not instructed to report on the switch as a current-saving device, but were specifically asked to make tests of its regulating power and insulation. To have included "candles per watt" in our certificate would have been to volunteer to give our clients experimental data for which they had not asked, a course which is obviously inconsistent with professional etiquette.

In case any misapprehension may have arisen in the minds of those who are not familiar with the character of the Reports issued by this Institution for the last twenty years, we should be obliged if you would publish this letter.

Yours faithfully,

ERNEST A. NASH,
Secretary and Business Manager.

The Electrical Standardising
Testing and Training Institution,
Faraday House,
Southampton Row, W.C.
January 9th, 1911.

Wireless Telephony.—Experiments are being carried out by the French cruisers *Justice* and *Vérité* with the Jeance-Colin system of wireless telephony. It is stated that satisfactory results have been obtained up to a distance of 72 nautical miles. The apparatus employed was constructed by the Compagnie Générale Radiotélégraphie.

THE LEPEL PATENT

AFTER litigation extending over a period of nearly three years, Baron E. von Lepel has been granted a patent in Germany for his wireless telegraph oscillation generator comprising a series of metal discs separated by rings of paper. The grant was opposed by the Gesellschaft für Drahtlose Telegraphie (the owners of the Telefunken system), but the final result after appeal is that the Lepel patent has been granted, while a subsequent application by the Gesellschaft für Drahtlose Telegraphie, describing a similar device, has been refused. This is said to be the fundamental patent of the Telefunken system, which is almost universally employed in Germany. We understand that the Anglo-German Wireless Syndicate, Ltd. (the owners of the Lepel patents) will take proceedings to enforce their rights in Germany, in view of the fact that most of the apparatus used by the German Government and principal shipping companies now comes under the Lepel patent. This is all the more interesting in view of the efforts of the German Government to bring about the exclusive adoption of the Telefunken system as the standard in Germany.

It will be remembered that the British Patent Office granted both the British patents equivalent to the above German patents, but that the Gesellschaft für Drahtlose Telegraphie only obtained their patent on condition that a reference was inserted in the specification to the Lepel patent which is of earlier date. This decision of the Comptroller-General was accepted by the Telefunken company, but an appeal against the grant of the Lepel patent by Mr. Valdemar Poulsen, whose original opposition was unsuccessful, has yet to be heard. (*See* ELECTRICAL ENGINEERING, September 8th, 1910, p. 578.) We understand that the success of the Lepel company, both in Germany and England, is chiefly due to the efforts of Mr. Albert Holt, the chairman of the company.

An agreement between the Anglo-German Wireless Syndicate, Ltd., and the Compagnie Générale Radiotelegraphie, who originally exploited the Rochefort system, will be completed next week. The latter company has a large factory in Paris, and will take over all the Lepel patents except those of England, Germany, and the United States, which will be controlled by the Anglo-German Wireless Syndicate. The French company supplies the French and Belgian Governments, and has already installed Lepel stations in post offices at Brussels and Paris. The latter station (in the Rue des Plantes) is in communication for experimental purposes with the English station at Slough, described in ELECTRICAL ENGINEERING, September 15th, 1910, p. 591.

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to the Editor, ELECTRICAL ENGINEERING, *203–6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.*

J. PERREN.—We cannot refer you to any municipal undertaking which, after being found unsuccessful, has been leased to a company. A proposal of this character was made in 1908 in connection with the Bath Corporation works, but the Board of Trade refused to sanction it, on the grounds that it was contrary to their practice to allow the transfer of an undertaking for which the full capital expenditure was being paid *plus* a further sum as consideration, or to permit a company to lease the works in perpetuity. We think it may be taken that the Board of Trade would not object to the transfer of an undertaking upon suitable terms, but the Board does not countenance the bartering of undertakings by municipalities. At Willesden, in 1904, the Council's generating station was purchased by the North Metropolitan Electric Supply Co. for the purposes of their larger undertaking, and a "bulk" supply agreement entered into, the Council still supplying the electricity to consumers.

J. A. HOPKINS.—Your forty 16 c.p., 50-volt metal filament lamps will take about 16 amperes. We should advise a 1½ kw. 55-volt dynamo, so as to allow for future additions. This would give 27 amperes at 55-volts when fully loaded. We think you will find the other information you require in the following books:—"Theory and Practice of Electric Wiring," by W. S. Ibbetson (5s. net); "Practical Electrician's Pocket Book and Diary, 1911," (1s., or by post 1s. 2d.); "Institution of Electrical Engineers' Wiring Rules" (6d. net, by post 7d.) Shall we send you these?

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published January 5th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

20,743/09. **Motor Control.** M. MILCH (Hungary). The speed of an induction motor is regulated by supplying current at a variable frequency to the rotor from a frequency transformer. Current of the frequency of the slip of the motor is supplied to an auxiliary motor driving the frequency transformer or to driving windings arranged on the stator of the frequency transformer itself. One figure.

28,947/09. **Meter.** E. T. RUTHVEN MURRAY (London). Various forms of an instrument termed an assessmeter are described. The object of the device is to indicate the maximum demand which a consumer may make. Should the demand exceed the limit indicated, a dimming switch comes into operation, and the consumer may either decrease his demand or increase his limit by moving an indicator on the assessmeter. He cannot, however, decrease the limit indicated. A scale of fixed charges per quarter is fixed on the meter, and on increasing the limit of current, the indicator points to a higher charge or assessment. The instruments described work on the hot-wire or other principles in which the heating effect of the current is employed. Eleven figures.

2,525/10. **Motor Ignition and Lighting.** A. H. MIDGLEY and C. A. VANDERVELL (Acton Vale). A variable-speed, constant-output dynamo (Spec. 16,447/09) is mounted on the same shaft with the distributor, and is used both for ignition and for charging the lighting battery. A special contact device for retarding or advancing the spark is described. Three figures.

2,700/10. **Petrol-Electric Vehicles.** W. A. STEVENS (Maidstone). Two motors are employed, each one being suspended from a tube at right angles to the chassis frame and driving one of the rear wheels through a chain on the inner side of the frame. The motors are suspended one behind the other, and the driving chains are of unequal length. This enables a chassis of normal width to be used while giving accessibility to the motors. Two figures.

7,331/10. **Manufacture of Metal Filaments.** H. MADDEN and W. G. HOUSKEEPER (Philadelphia, U.S.A.) A heating process specially adapted to filaments prepared by squirting a tungsten paste through a die, consists in subjecting every portion of the continuous filament to different degrees of heat successively by passing it through a series of contacts which cause currents of different values to flow through the portions between different contacts. Three figures.

17,380/10. **Trolley Head.** K. ENGEL (Berlin). The trolley wheel is mounted on a forked holder which has a stem sliding against the action of a spring in a tube or sleeve attached to the end of the trolley pole. The holder is attached to the sleeve by a toggle lever or lazy-tongs device. When the pole is shaken by passing over a switch the spring presses the wheel upwards and compensates for any downward movement of the pole. Three figures.

22,110/10. **Ward-Leonard Control.** SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens-Schuckertwerke-Ges.*). In a rolling-mill or other plant controlled on the Ward-Leonard system, the main motor is given a series characteristic (*i.e.*, large turning moment with moderate armature current) and yet can be reversed without reversing heavy currents. This is effected by connecting the motor field in series with the generator field to a D.C. supply at constant voltage. Both fields are also influenced by an auxiliary dynamo, the voltage of which depends upon the armature current of the main motor and can also be regulated by hand. When the load increases, the main motor field is strengthened automatically and the generator field weakened by the influence of the auxiliary machine. Two figures.

24,810/10. **Manufacture of Metal Filament Lamps.** A. S. KNIGHT (Newark, New Jersey, U.S.A.). This specification describes an apparatus for winding filaments on their zigzag carriers, in which the filament is kept taut during the mounting by means of a friction device. On breakage of the filament, the rotating part of the apparatus stops automatically. One figure.

Opposition to Grant of Patents

19,872/09. **Electrical Propulsion of Ships.** BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*). The grant of this patent has been allowed in spite of opposition by Mr. W. P. Durtnall. The specification was abstracted in ELECTRICAL ENGINEERING, June 23rd, 1910, and describes a system with an induction motor and a low-pressure turbine on each shaft. At high speeds both are used, while at low speeds only the motors are used. Mr. Durtnall desired the insertion of a reference to his patent covering an electrical reduction drive with polyphase machinery, but the Comptroller has not considered this necessary.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Insulators for H.-T. transmission line] 7,212/10.

Dynamos, Motors, and Transformers: BRUCE, PEEBLES & CO. and DE LA COUR [Machines] 24,137/09; WALKER [Machines] 30,482/09; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke Ges.*) [Polyphase commutator machines] 23,633/10.

Electric Ignition: KUHN [Sparking-plugs] 12,133/10; SOC. INDUSTRIELLE DE DELLE [Connections to sparking-plugs] 12,593/10 BRITISH INSULATED & HELSBY CABLES, LTD., and AITKEN [Portable shot-firing generator] 19,659/10.

Electrometallurgy and Electrochemistry: SOC. ANON. ELECTROMETALLURGIQUE (*Procédés Paul Girod*) [Steel refining] 26,588/09 and 27,003/09; JOEL [Electrode separators for batteries] 29,511/09; HENRI, HELBRONNER, and VON RECKLINGHAUSEN [Sterilisation of liquids] 30,397/09; SMITH and DEAKIN [Electroplating barrel apparatus] 7,226/10.

Heating and Cooking: PRICE [Heating apparatus] 29,411/09.

Incandescent Lamps: ELECTRIC EXPORT WERKE GES. and GOTTSCHALK [Portable lamps] 28,079/10.

Storage Batteries: JOEL [Plate separators] 29,511/09.

Switchgear, Fuses and Fittings: BROADBENT [Switches] 29,339/09; KEY ENGINEERING CO. and NAGEL [Wiring conduit] 29,350/09; SUNDERLAND and PILLINGER [Automatic electrical control of engines, dynamos and batteries] 29,944/09; ADAMS MANUFACTURING CO. (*Cutler Hammer Mfg. Co.*) [Motor controllers] 4,794/10; BROOKER and HOOPER [Lampholder locking device] 6,132/10; VIETTE [Bell call indicator] 18,778/10.

Telephony and Telegraphy: AMERICAN AUTOMATIC TELEPHONE CO. and GOODRUM [Automatic telephone systems] 29,963/09; WOOD [Telegraphy] 1,287/10; GOLDSTEIN [Central battery signalling system] 16,332/10; EISENSTEIN [Oscillation generator for wireless telegraphy] 16,364/10.

Traction: HEILMANN [Spring-suspension for vehicles] 5,276/10; W. R. SYKES INTERLOCKING SIGNAL CO., BOOT, and TARRANT [Electrically operated signalling system] 6,743/10.

Miscellaneous: COWPER-COLES [Lamps] 29,849/09; STEWART [Ventilating apparatus] 29,937/09; SWIFT and BAXTER [Electric clocks] 4,936/10; AFFLECK and PILLING [Electric driving of roundabouts] 9,538/10; BLOXAM (*Siemens & Halske A.-G.*) [Manufacture of glass] 16,441/10; SIEMENS BROS. & CO. (*Siemens & Halske A.-G.*) [Electromagnets with removable cores] 19,971/10; BOULT (*Normal Zeit. Ges.*) [Electric winding of clocks] 23,773/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: SIEMENS-SCHUCKERTWERKE GES. [Reversing of polyphase motors] 28,661/10; ALLGEMEINE ELEKTRICITÄTS-GES. [Motor control] 29,309/10.

Electrochemistry: LE NITROGENE SOC. ANON. [Separation of oxides of nitrogen] 28,933/10; WALLACH [Artistic copper articles] 17,262/10.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: BRITISH THOMSON-HOUSTON CO. and E. B. WEDMORE [System of protection] 19,210/05.

Dynamos, &c.: B. G. LAMME [Rotor field system with distributed embedded winding] 20,616/02.

Switchgear, &c.: T. VON ZWEIGBERGK [Motor controllers] 18,947/01; A. P. and G. C. LUNDBERG [Wall plugs] 20,461/02; O. L. PEARD and F. DEW [Fuses for high voltage and heavy currents] 20,483/02; BRITISH THOMSON-HOUSTON CO. and E. B. WEDMORE [Reverse-power cut-outs for alternators in parallel] 19,210/05.

Telephony, &c.: W. L. WISE (*C. L. Buckingham, U.S.A.*) [Printing telegraphic apparatus, perforators, &c.] 20,682-3-4/02; J. GRAY [Telegraph pole brackets] 20,102/03; W. M. STILL [Coin-freed telephone apparatus] 18,924/05.

Traction: A. BOULT (*N. A. Christensen*) [Motor-driven compressor for air-brakes] 19,833/98; A. N. CONNETT [Collector ploughs for conduit tramways] 18,879/01; T. VON ZWEIGBERGK [Controller with electric braking positions] 18,947/01; A. N. CONNETT [Conduit construction] 19,062/01; A. M. CAREY [Permanent way] 20,508/04.

Miscellaneous: H. MCPHAIL [Superheaters] 20,853/02; J. MACLEAN [Hair-brush with electric current attachment] 20,100/03.

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LOCAL NOTES

Australia: *Sydney: Street Lighting.*—Mr. H. R. Forbes Mackay has prepared a report upon the electric lighting of those streets in the city at present lighted by gas. The estimated cost is put at £26,100, whilst the revenue will amount to £10,718 on the basis of £23 per annum for each arc and £3 7s. 6d. for each incandescent lamp. Mr. Forbes Mackay has also calculated that whereas the cost per candle power per annum for gas lighting is 2s. 4d., the cost of electric lighting for those lamps at present in use is only 4·8d. The *Australian Mining Standard*, in giving these figures, suggests a demonstration of street lighting, before the Electricity Committee finally decides.

Melbourne: Tramways.—According to the *Australian Mining Standard*, the Government have appointed a Royal Commission to inquire into the whole question of suburban traffic in Melbourne. This foreshadows considerable extensions of tramways.

Ballymoney: *Overhead Wires.*—The promoters of the electric lighting scheme have asked for the Council's permission to erect overhead wires.

Bavaria: *Electricity Supply Statistics.*—The preliminary results of the Government inquiry relative to electrical generating stations in Bavaria show that 1,620 are owned by private individuals, 374 belong to companies, while about 500 are controlled by the Government, by municipalities, and by co-operative societies. The output of all these stations, including also the installations used only for private purposes, amounts to 275,472 kilowatts. About 47 per cent. of the plant is driven by steam, 30 per cent. is worked by water power and steam, and 8 per cent. is operated by water power only.

Brighton: *The Brighton-Worthing Tramways.*—The Corporation, at a special meeting on Friday, decided to oppose the proposal for the construction of tramways from Brighton to Worthing, so far as the consents of the Corporation are required.

British Columbia: *Reported Amalgamation.*—It is officially announced that the statement to the effect that the British Columbia Electric Railway Co. has entered into negotiations with the Western Canada Power Co. for the purchase of that undertaking has not the slightest foundation, and that no agreement has been made or considered either to purchase the property or take power from this undertaking.

Canada: *Train Lighting.*—The Canadian Pacific Railway Co. are adopting the Stone system of electric lighting on their new sleeping, dining and parlour carriages now being constructed at their Montreal works.

Chicago: *Municipal Exhibition.*—H.M. Consul-General at Chicago, says the *Board of Trade Journal*, reports that an International Municipal Congress and Exhibition will be held in Chicago from September 18th to 30th. The exhibits will be limited to manufactures, &c., required in connection with municipal government, including lighting, traction, telephones, &c. Some further particulars may be obtained at 73 Basinghall Street, London, E.C.

Chichester: *Street Lighting.*—Street electric lighting was inaugurated last week with very satisfactory results.

Dorchester: *Electric Lighting.*—The proposal of an Exeter firm to promote an electric lighting undertaking in Dorchester has been abandoned, as the preliminary enquiries have satisfied them that at present there is no prospect of making such a scheme successful.

Elland: *Tramways.*—The Council are still negotiating with Halifax for a tramway service, but their offer of £100 a year for five years as an inducement to the Corporation is considered inadequate in Halifax. A suggestion by the latter Corporation to accept a 1d. rate for 10 years, which would be equivalent to about £2,000, has been rejected. The matter rests here for the present.

Frome: *Electricity Transfer.*—Two of the largest consumers upon the electricity mains have petitioned the Board of Trade to withhold their sanction to the proposed transfer of the Electricity Works to Messrs. Edmundsons Electricity Corporation until a full inquiry has been held.

Johannesburg: *Tramway Service.*—The City Electrical Engineer has reported upon the increased and accelerated tramcar service, together with a general reorganisation of the management, which it is anticipated will bring about a saving of £7,000.

Leicester: *Working of Electricity Undertaking.*—Mr. James Swinburne's recommendations to amalgamate the two undertakings of the Electricity Department have been adopted by the Corporation. The proposal involves running the Aylestone alternating current power station virtually as a spare, and to give the bulk of the supply from the direct current station. An exhaust steam turbine set has recently been added to the latter. Mr. Swinburne puts on one side the possibility of scrapping one station absolutely, and recommends putting down motor generators at the direct current station coupled by trunk mains with the A.C. station.

Lewes: *Public Lighting.*—The Lewes and District Electric Supply Co., Ltd., are to be allowed to erect some street lighting standards, and to give an experimental demonstration of public electric lighting.

Malvern: *Trolley Omnibuses.*—The Council have decided to oppose the bill of the company, which proposes to run trolley omnibuses in Malvern.

Manchester: *Tramwaymen's Hours.*—The request of the tramwaymen for a universal eight-hour day has been refused by the City Council on the ground that this will involve an extra cost of £23,000 per annum.

Trolley Omnibuses.—It is anticipated that the Tramways Committee will have a trolley 'bus in service in a few months' time.

Position of Gas and Electricity Committees.—The Management of the Gas and Electricity Departments is still a matter of some discussion in Manchester, owing to the competition that is taking place between the two. The Lord Mayor is shortly to entertain the two Committees at an informal conference to deal with the matter. The complaint is made that whereas the Electricity Department is allowed to utilise, at any rate a portion of its profits in reducing the charge to consumers, the Gas Committee are definitely called upon each year to contribute £60,000 to the relief of rates.

Northumberland: *Tramways.*—A tramway scheme is proposed for linking up Blyth, Bedlington, Ashington, and Newbiggen.

Pontefract: *Electric Lighting.*—The Council have decided to lease their electric lighting Order to the Wakefield and District Light Railway Co.

South Shields: *Street Lighting.*—The offer of the Electricity Committee to provide 12 standards each containing three 100 c.p. metal filament lamps at £6 3s. 3d. per standard per annum, and to reduce the cost of the present 94 arc lamps from £22 10s. to £21 each per annum, has been accepted by the Corporation.

Wigan: *Tramways Renewals.*—In their report the elective auditors comment upon the provision made by the Tramways Committee for renewals, and recommend that in addition, if necessary, to meet each annual loss out of the district rate, provision should be made for a further sum of £5,000 annually, part of which should be utilised for working capital, and the remainder placed to renewals fund.

Worthing: *Tramways and Trolley Omnibuses.*—The Council have decided to oppose the two schemes for running tramways and trolley omnibuses in Worthing.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia.—Tenders are invited by the Postmaster-General's Department, 51 Spring Street, Melbourne, by March 14th, for the erection of wireless telegraph stations on Thursday Island and on the coast of Papua. Forms of tender can be seen at 72 Victoria Street, or 73 Basinghall Street, London.

Barnes.—Tenders are invited by the Electricity Committee for (1) straight tube water-tube boiler fitted for machine stoking; (2) 600–750 kw. dynamo; (3) surface condenser, motor-driven air and circulating pumps, river work and piping. Particulars from the Electrical Engineer. (See an advertisement on another page.)

Blandford.—A company has placed a proposal before the Town Council for an electric lighting scheme.

Burnley.—The Borough Electrical Engineer has recommended considerable extensions to the generating plant, and estimates are to be prepared for a 1,000 kw. generating set.

Cheltenham.—A new motor generator is to be installed, at an estimated cost of £1,285.

Halifax.—Extensions at the Electricity Works are to be

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made at an estimated cost of £7,954. It is intended to instal a steam turbine plant. The Committee proposed to repay the capital in 10 years, but the Council resolved that the new plant shall be paid for out of revenue.

Hull.—The proposals of the Lighting Committee to spend about £100,000 upon electrical extensions (see ELECTRICAL ENGINEERING, December 29th, p. 827) have been adopted by the Corporation.

Kendal.—A 1,000 kw. steam engine and dynamo, switchboard panel, and other extensions are contemplated, at £1,450.

London: *Hackney.*—An expenditure of £545 is recommended upon replacing the coal conveyor chain and altering the position of the bunker, and providing a tramway and turntable.

Peterborough.—A loan of £2,000 is to be taken up for economisers, superheaters, and mains.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Rebuilding of Wimbledon Hospital.

Girls' School, Higham Hill, Walthamstow.

Mess-room for nurses at North-Western Fever Hospital, Hampstead.

PROVINCES.

Annfield Plain.—Tenders are invited by January 23rd for the electrical installation at the electric theatre. L. H. Armour, 16 West Street, Gateshead.

Birkenhead.—Masonic Hall in Brook Street.

Birmingham.—New public baths.

Cardiff.—Kitchener Road Council Schools. Specifications by City Electrical Engineer.

Carnarvon.—Institute. Architect, R. Lloyd Janes, 14 Market Street.

Chatham.—Rebuilding Theatre of Varieties.

Cleckheaton.—Buildings for Temperance Society.

Devonport.—Extension of Post Office. H.M. Office of Works, Storey's Gate, London.

Eastbourne.—Proposed new workhouse.

Folkestone.—Theatre in Tontine Street.

Hastings.—Workhouse buildings.

Hereford.—New Art Gallery, etc.

Holyhead.—New church hall.

Larne.—New school.

Llandudno.—Extension of Gogarth Abbey Hotel.

Macclesfield.—Branch of Manchester & County Bank, Ltd.

Newmarket.—Technical school building. Architect, C. H. Waithman.

Stockport.—New police buildings.

Wakefield.—New school in Lawefield Lane.

Wallasey.—New Town Hall.

Wigan.—New Council School, Beechhill.

Winchester.—New school.

York.—New stores. York Equitable Industrial Society, Ltd. Architect, H. B. Beck, 28 High Street, Doncaster.

MISCELLANEOUS

Argentine.—The Department of the Interior propose to spend about £122,000 on telegraph and cable extensions, says the *Board of Trade Journal.*

Australia.—The Deputy Postmaster-General at Melbourne requires a branching multiple magneto lamp-signal switchboard and accessories. Tenders by March 7th.

The Deputy Postmaster-General at Perth invite tenders by April 18th for the supply of a common battery switchboard and accessories. Copies of the specifications, &c., in both cases can be seen at 72 Victoria Street, London.

The Deputy Postmaster-General, Melbourne, invites tenders by February 21st for 29 miles of lead-covered, paper-insulated telephone cable. Specification forms, &c., can be had from 72 Victoria Street, S.W., or 73 Basinghall Street, London, E.C.

The New South Wales State Railways Administration require two electrically-worked elevators for the tramway repair shops, Randwick. As the tenders are required by January 30th, this intimation is, therefore, only of use to those firms having agents in Australia, who can be instructed by cable.

Tender forms have been received at 72 Victoria Street, London, for (1) motor generators and accumulators, and (2) 10,000 telephone protectors. Tenders for (a) by February 28th, and (b) by March 3rd.

Tender forms in connection with the supply of 29 miles of telegraph cable can be obtained at 72 Victoria Street, London. Tenders by February 21st.

Bexley.—A fresh supply of meters is required, and the Lighting Committee recommend that they be purchased out of revenue.

Bournemouth.—The Tramway Manager recommends the borrowing of £4,640 for fitting certain improvements in the braking arrangements on the cars.

Leicester.—The Tramways Committee have decided to fit 19 additional cars with canopy tops, at an estimated cost of £102 each.

London: *Battersea.*—Tenders will shortly be invited for the supply of general stores for the Electricity Department, including arc lamp carbons, meters, cables, Nernst lamps, joint boxes, incandescent lamps, etc.

Islington.—Tenders are invited by February 3rd for general stores, including arc lamp carbons and globes, transformers and accessories, meters, cables, lamps, arc lamp parts, network boxes, etc. Particulars from Borough Electrical Engineer.

South Africa.—The Klerksdorp Council have taken up a loan of £7,500 for an electric lighting scheme.

Switzerland.—According to the *Board of Trade Journal*, the Zurich-Oerlikon-Seebach Electric Tramway Co. have been granted permission to extend their lines from Oerlikon to Affoltern, near Zurich, and from Schwamendingen to Dübendorf, a total length of 10 miles. The estimated cost is £29,640.

TENDERS RECEIVED AND ACCEPTED

Argentine.—The firm of Messrs. José Bernasconi and Co. have received an order for the electrical installation in the building now in course of erection intended as a residence for the President of the Republic. The cost is estimated at about £25,800.

Bournemouth.—The following firms tendered for the reconstruction to the overhead system of the different tramways in Bournemouth:—Messrs. Clough, Smith & Co.; the British Insulated and Helsby Cables, Ltd.; and W. Griffiths & Co. The lowest tender, namely, that of Messrs. Clough, Smith and Co., at £1,726, was accepted.

Halifax.—The Electricity Committee have accepted the following tender of the British Thomson-Houston Co., Ltd.:—1,500 kw. steam turbo-generator, £3,073; Worthington condenser, £1,216; two 750-kw. rotary converters, £2,091.

London: *County Council.*—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained the contract for the supply of metal filament lamps for the ensuing twelve months to the Stores Department and also to the L.C.C. Asylums Board.

Stepney.—The tender of Messrs. Reavell & Co., Ltd., at £245, has been accepted for a motor-driven air-compressor at the Blyth's Wharf power station.

Sheffield.—The tender of the British Electric Transformer Co., Ltd., for transformers and choking coils at £872, and for six sets of transformers with series gear at £211 per set, has been accepted.

The tender of Messrs. Wellerman Bros. has been accepted for extensions to the buildings at the Neepsend power-house at £14,700.

Whitby.—Then tender of Mr. G. Booth for the installation of electric light in the Guardians' Board Room at £13 17s. has been accepted.

Wireless Telegraph Notes.—It is expected that the new wireless telegraph station at Scarborough will be completed before next spring.

It is stated that naval officers are visiting the southern portion of Ceylon to select a site for a wireless telegraph station. An agitation for a wireless telegraph station in Ceylon has been going on for more than five years.

It is stated that M. Farman has successfully carried out some preliminary experiments with wireless apparatus fitted on an aeroplane at the Buc Aerodrome, Paris. Messages are said to have been transmitted over a distance of ten kilometres.

The Italian Government have confirmed a law made last year decreeing that all immigrant ships trading with Italian ports must be equipped with Marconi wireless telegraph apparatus. The specified range of the equipment is put at 300 km., and the wave length at 600 metres.

It is stated that the North German Lloyd and the Hamburg-America shipping companies will not renew their contracts with Marconi's Wireless Telegraph Co., which expire shortly, but will, in accordance with the desires of the German Government, adopt the Telefunken system.

OSRAM·LAMPS

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APPOINTMENTS AND PERSONAL NOTES

The late Mr. Gustav Byng, Chairman of the General Electrical Co., Ltd., left estate valued £100,700.

The recommendation to increase the salary of Mr. R. Foster, Borough Electrical Engineer at Aston, from £500 to £600 per annum has been sanctioned by the Council.

Mr. J. McMillan, Borough Electrical Engineer at Falkirk, has resigned. We understand that it is Mr. McMillan's intention to go abroad.

Mr. P. W. Freudemacher, formerly in the sales department of Messrs. Crompton and Co., Ltd., has started business on his own account, under the style of P. F. Williams and Co., at 34 Bargery Road, Catford, S.E. The new firm is specialising in the manufacture and installation of organ-blowing plant.

An assistant junior demonstrator at a salary of £80 per annum is required at the Northampton Institute. (See an advertisement on another page.)

Mr. W. S. Wilson has resigned his position as outside manager of the electrical department of Messrs. Clarke, Chapman & Co., Ltd., to take up the position of branch manager for Messrs. Johnson & Phillips, Ltd., at 44B Blackett Street, Newcastle-on-Tyne. Telephone No.: Central 1691. By an error in our last issue we stated that Mr. Wilson was joining Messrs. Pinchin, Johnson & Co., Ltd., instead of Messrs. Johnson & Phillips, Ltd.

Pending Electrical Lawsuits.—The Cause List for the Hilary Sittings, which commenced on Wednesday, contains very few actions of electrical interest. There is the patent action by the Marconi Company against the British Radio-Telegraph and Telephone Company, before Mr. Justice Parker, who will also have to deal with a petition for an extension of time of a patent No. 11,575 of 1897 granted to Sir Oliver Lodge. This patent relates to a system of wireless telegraphy in which the receiving apparatus is syntonised, and resonates in response to a sufficiently prolonged series of waves of definite frequency, and covers various arrangements of the oscillatory circuits. Sir John Benn is appealing against the verdict of Mr. Justice Ridley, who awarded £8,000 damages against him for libel in respect of the G.B. system in the Mile End Road, and a new trial is also asked for. The Divisional Court will have to deal with certain points of difference which have arisen between the British Westinghouse Electrical and Manufacturing Co. and the Underground Electric Railways Company of London, and there are a few actions for injuries on the London electric railways and tramways.

L.C.C. Westminster Technical Institute.—A special course of lectures on "Illumination," by Mr. J. S. Dow, will be given on Fridays at 7.30 p.m., commencing to-morrow. Fee for the course, 2s. 6d.

Calendars.—We have received an office calendar, with changeable date cards for each day of the month, from the Atlas Metal & Alloys Co., Ltd., 52 Queen Victoria Street, E.C.

The Bowesfield Steel Co., Ltd. (110 Cannon Street, E.C.), are sending to their friends, with their New Year's greetings, a combined blotting-pad and diary of convenient form.

The Central London Railway have kindly sent us one of their desk calendars, in which the paper strip containing the dates is wound on rollers, so that one month appears through the window at a time.

The calendar being issued by Ferranti, Ltd., is a very neat production on a fumed oak base, and bears an illustration of one of the company's non-metallic motor starters.

The Electrical Standardising, Testing, and Training Institution.—Among the special lectures for this term at Faraday House are the following:—Dr. W. H. Eccles began a course of lectures on "Wireless Telegraphy and Telephony," and Mr. A. B. Clark, of Lot's Road generating station, gave the first of his demonstrations on "Fuel Testing" to the senior students of Faraday House this week. In connection with the commercial training of the students at Faraday House inaugurated by a lecture on "Depreciation" by Major O'Meara (Engineer-in-Chief to the Post Office), Mr. A. Schneider (Managing Director, Evershed & Vignoles, Ltd.), has given a lecture on "Works Management," and Mr. Robert Hammond will shortly deliver a series of lectures on "Electricity Undertakings."



MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 10s. to £58 15s. per ton (last week, £58 15s. to £59).

A meeting of the Davey Electric Co., Ltd., will be held on January 31st at 3 p.m., at the office of Mr. J. Andrews, 20 North John Street, Liverpool, to hear the liquidator's account of the winding-up.

D.P. Battery Company.—Messrs. Pemberton and Clark, of Colmore Row, Birmingham, have been appointed the company's Midland agents in place of Mr. J. Hilton, the latter having joined the staff of Messrs. Bruce Peebles and Co., and will look after their interests in the Midland district.

Belfast Electrical Exhibition.—Messrs. Siemens Brothers and Co., Ltd., have an attractive stand at this exhibition, where their well-known O.S. wiring system with "Stannos" fittings was exemplified. Fittings with tantalum and one-watt lamps were shown, as well as heating apparatus, cables, fuses, batteries, etc., and a fine display of holophane glassware.

Branch Office.—The British Thomson-Houston Co., Ltd., have opened a branch office at Castle Buildings, Swansea. The telephone No. is 123 Central, and the telegraphic address "Asteroidal, Swansea."

Bankruptcies.—The last day for receiving proofs in the bankruptcy of A. J. Hollington, electrical engineer, late of 37 Walbrook, London, is January 21st. The Official Receiver is Mr. G. W. Chapman, Bankruptcy Buildings, Carey Street, London.

The trustee in the bankruptcy of R. E. Joy has been released.

Agency.—Messrs. Feld Bros. & Co., Ltd., 25 Budge Row, London, E.C., have taken over the sole agency for Great Britain and the Colonies for Messrs. Brenne, Hangarter and Co., Haspe, Westfalia, for permanent magnets.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Mexico Tramways Co.—A quarterly dividend of 1¼ per cent.

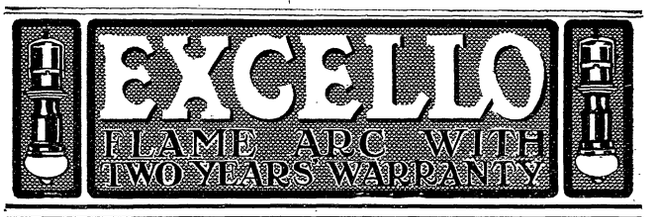
Mexican Light & Power Co.—A quarterly dividend of 1 per cent.

Rio de Janeiro Tramway, Light & Power Co.—This company is issuing further capital to the extent of 23,750 shares of £25 each, in order to provide funds mainly in connection with the extension of works in Rio.

Dublin United Tramways Co.—Dividends at the rate of 6 per cent. per annum on both the preference and ordinary shares are recommended, after setting aside £12,000 to renewals.

Prosecution of Telephone Engineers in Antwerp.—In May last year, four telephone engineers were placed on trial at Antwerp on the charge of stealing trade secrets and documents belonging to the Bell Telephone Co. on their leaving that firm to take up engagements with the General Electric Co., Ltd. The evidence occupied the Court from May 27th to May 29th, but early in June the accused were acquitted. Last week the Bell Telephone Co. appealed against the verdict, but the Appeal Court has confirmed the acquittal.

Electrical Exhibition at Belfast.—An electrical exhibition was opened by the Belfast Electricity Department on Monday. A prominent feature is an "electric house," fully equipped with electric lighting, heating, and cooking apparatus, and electrically-driven laundry machinery. A number of well-known electrical firms have separate stands, among whom may be mentioned the British Thomson-Houston Co., the Electric & Ordnance Accessories Co., Ferranti, Ltd., the General Electric Co., Ozonair, Ltd., Purcell & Nobbs, Simplex Conduits, Ltd., Wright & Wood, and Siemens Brothers & Co.



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ELECTRICAL ENGINEERING

No. 212 [Vol. VII., No. 3] THURSDAY, JANUARY 19, 1911. [Price One Penny.
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The Engineering Journal of the Electrical Industry

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SUMMARY

A Special Literary Supplement is included in this issue, containing notices and reviews of books, and a carefully revised list of selected works on electrical engineering and allied subjects.

The stage and general lighting arrangements of the Palladium Variety Theatre are described. Tantalum lamps are mainly employed, and some fine special electrolier fittings are installed. For dimming the lamps of the stage floats, &c., a new pattern of metallic resistance regulator is used. (Page 29.)

Illustrations are given of some new turbo-alternator sets recently supplied by Messrs. Dick, Kerr and Co. (Page 31.)

A new electrically-driven van, with a four-wheel drive, has recently been brought out. (Page 31.)

A specially protected telephone set for use in proximity to high tension transmission lines is described on page 31.

The Marconi and Telefunken interests in the German mercantile marine have been combined by the formation of a new German company, which will hold the rights of either system as regards German shipping, and install both Marconi and Telefunken apparatus. (Page 32.)

In connection with the substitution of Parsons for Westinghouse turbines at the Lot's Road power house of the Underground Electric Railways Co. of London, Ltd., the High Court has decided that the Westinghouse Company must pay to the Underground Co. the cost of the difference in steam consumption between the guaranteed and actual figures obtained whilst the Westinghouse machines were at work, plus the cost of installing the Parsons turbines. (Page 32.)

The hearing of the action by the Marconi Co. against the British Radio Telegraph & Telephone Co. for alleged infringement of the Marconi 1900 patent continues. The defendants argue that the patent does not cover the use of a coreless auto-transformer as employed by them, as it was not known in 1900. Further, they hold that there was no subject matter for the patent, as tuning was inevitable in the transformer arrangement of Braun's 1899 patent. (Page 33.)

Among the specifications published by the Patent Office on Thursday last was one by Bruce Peebles and Co. for a machine which can be used as a double-current D.C. generator, a rotary converter giving two D.C. voltages, a D.C. transformer, or a constant-current generator. F. Broadbent covers an automatic motor starter for push-button control with some novel features. Special damping grids for preventing the flashing over of rotary converters on excessive overload are described by Miles Walker. A lamp-holder locking device for use in existing lamp-holders, devised by H. Brooker and W. A. Hooper, is also described. A patent by the Westinghouse Brake Co. for the electrical control of mechanically interlocked railway signals and points expires on Thursday next, after the full life of fourteen years. (Page 34.)

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AT a recent meeting of the Glasgow Local Section of the Institution of Electrical Engineers, Mr. W. W. Lackie gave a short address dealing with the advantages of electric heating, ventilation, and power. (Page 35.)

THE Greenock Corporation have been informed that all their electric lighting profits must go to reserve.—The St. Pancras Electric Lighting Committee have objected to certain criticisms in a local paper.—A dispute has arisen between the Manchester Tramways Department and their employees, whose Association have asked for arbitration.—The Rhyl Borough Electrical Engineer reports considerable reduction in works cost by the use of a Diesel engine.—The legality of allowing 50 per cent. discounts at Sheffield has been questioned. (Page 35.)

SPECIFICATIONS are being prepared in connection with a large electric power scheme in Bombay. The Calcutta Electric Supply Corporation require sub-station switchboards; the Hammersmith Council a 3,000 kw turbo-alternator, E.H.T. and L.T. distributors; a mixed pressure turbo-alternator is required by the Oldham Corporation; and electric lighting apparatus at Turton. The Bacup Corporation require high and low tension cables; West Ham Corporation, electrical accessories; and Bournemouth and Sheffield Corporations, tramway stores. A supply of arc lamp carbons is required by the Antwerp Corporation. (Page 36.)

THE Musselburgh & District Electric Light & Traction Co. are issuing new capital, and the Sao Paulo Tramway, Light & Power Co. invite subscriptions for £300,000 five per cent. debenture stock. (Page 37.)

"Pay as You Enter" Tramways.—It is stated that "pay as you enter" tramways, which are used to some extent in America, will shortly make their appearance upon a London tramway system.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JANUARY 19TH.

Rugby Engineering Society.

8 p.m. At Benn Buildings, High Street. "Electric Power in Collieries," by J. Miller.

FRIDAY, JANUARY 20TH.

Institution of Mechanical Engineers.

8 p.m. At Storey's Gate, Westminster. "Modern Electrical Dock Equipment, with Special Reference to Electrically Operated Coal Hoists," by W. Dixon and G. H. Baxter.

TUESDAY, JANUARY 24TH.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At Municipal School of Technology. "Switchboard Measuring Instruments," by H. T. Warner.

WEDNESDAY, JANUARY 25TH.

Dynamicables.

7.30 p.m. Dinner at Trocadero.

THURSDAY, JANUARY 26TH.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. (1) "Modern Long-distance Transmission of Electrical Energy," by W. T. Taylor. (2) "Extra High Pressure Transmission Lines," by R. Borlase Matthews and C. T. Wilkinson.

FRIDAY, JANUARY 27TH.

Physical Society.

5 p.m. At University College, Gower Street, London. Agenda:—(1) "A Demonstration of Phase Difference between the Primary and Secondary Currents of a Transformer by Means of a Simple Apparatus," by Prof. F. T. Trouton, F.R.S. (2) "A Note on the Experimental Measurement of the High-frequency Resistance of Wires," by Prof. J. A. Fleming, F.R.S. (3) "The Measurement of Energy Losses in Condensers Traversed by High-frequency Oscillations," by Prof. J. A. Fleming, F.R.S., and G. B. Dyke.

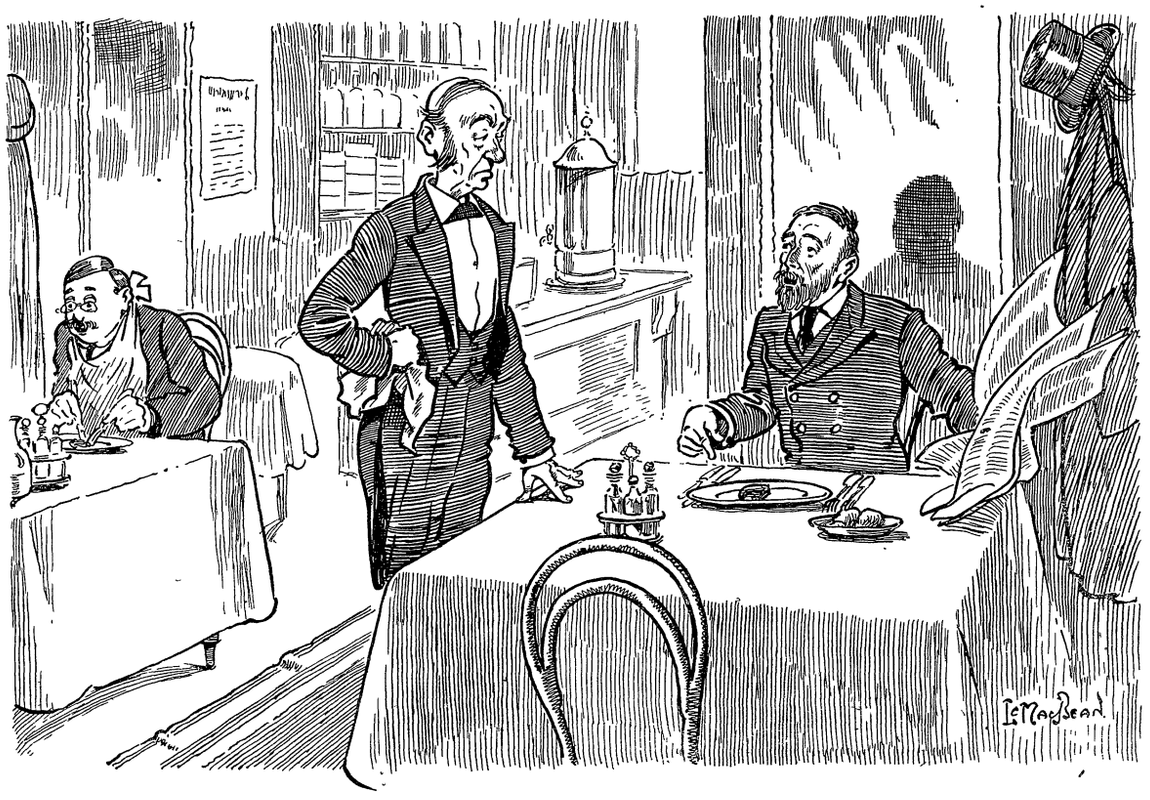
Royal Institution.

9 p.m. Evening Discourse by Prof. W. H. Bragg, F.R.S., on "Radioactivity as a Kinetic Theory of a Fourth State of Matter."

SATURDAY, JANUARY 28TH.

Association of Mining Electrical Engineers.

6.30 p.m. *Lancs., &c., Branch.* At Grand Hotel, Manchester. Address by President, Mr. W. Maurice, and discussion on Mr. E. K. Scott's Paper, "Electricity in New South Wales Coalfields."



CRITICAL DINER (who has been reading a report of Mr. Lackie's recent discourse at Glasgow): I'm thinking that ninepence is verra expensive for this wee bit meat. Ye wad na hae gi'en more than 4¾d. for it at the flesher's, and the heid of the electricity depairtment o' the great City of Glasgow says that the cooking is one-thir-r-d of a far-r-thing. Y'r weages should be a'most a neegative quantity, y'r stand-by losses are sma', and I dinna expect to peay lar-r-ge estaiblishment char-r-ges.

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"ELECTRICAL ENGINEERING"

LITERARY SUPPLEMENT

REVIEWS OF BOOKS

Encyclopædia of Municipal and Sanitary Engineering. Edited by W. H. Maxwell and J. T. Brown. 561 pp. 10¼ ins. by 7½ ins. Many illustrations. (London: Constable & Co.) 42s. net; by post to British Colonies, 43s. 8d.

THOSE who are interested in local administration must long have felt the need of a book of this character. Borough councillors cannot be expected to possess a thorough general knowledge of the numerous branches of municipal and sanitary engineering which are carried out under their authority, and, although they must necessarily be guided by their professional advisers and officials, yet, as a help to the proper understanding of these gentlemen's reports, the value of a superficial acquaintance with the various subjects, or, failing this, of a sound book of reference, cannot be over-estimated. The volume before us provides such a reference book in the convenient "dictionary" form. Its print, and most of the illustrations, are clear and good, and in general the treatment of the subjects is the correct one for the purpose—neither too "popular" nor too technical.

The sections dealing with water supply, and with sewage disposal, and other branches of sanitary engineering are excellent, but those relating both to electrical engineering and gas engineering could have been improved upon considerably. It is true that the main article on electricity is interesting and practical—it could hardly be otherwise from the pen of Mr. H. M. Hobart—but it leaves untouched some of the most important matters to the municipal councillor. Nothing at all is said with regard to the mains, and the whole question of the statutory powers and obligations of a municipality owning electricity works is neglected. This is rather the fault of the editors than of the author, and we are at a loss to apportion the blame for the incorrect footlines to two out of the six poor illustrations, but Mr. Hobart must take responsibility for the term "megakelvin." We can picture the face of a borough electrical engineer who is suddenly asked by his chairman the number of his yearly megakelvins. On the other hand, the general description of the equipment of generating stations and the functions of the more important parts of the plant, given in Mr. Hobart's article, is excellent, and its value is enhanced by frequent numerical examples. The article on tramways, which is very poor stuff, is evidently by another writer.

The Foundations of Alternate-current Theory. By C. V. Drysdale. 300 pp. 8¾ by 5¾ in. 190 illustrations. (London: Edward Arnold.) 8s. 6d. net; abroad 8s. 9d.

STUDENTS who find it difficult to form a mental picture of what is taking place in alternating-current problems will welcome this volume. The author explains, in a clear and convincing manner, all the effects of the various combinations of resistance, inductance, and capacity in alternating-current circuits, with the aid of mechanical models and familiar illustrations of the analogous results of friction, inertia, and elasticity in everyday life. Physical conceptions of the phenomena of electrical working are invaluable for a proper understanding of the problems which arise, and mechanical analogies are of undoubted help in elementary work. On the other hand, we believe that the advanced student's imaginative powers are sufficient to enable him to form mental pictures of electrical and magnetic phenomena independent of mechanical ideas, and that the author's extension of mechanical analogies to problems of mutual induction, transformers, and polyphase currents is unnecessary.

Steam Turbines: Their Design and Construction. By Rankin Kennedy. 101 pp. 8½ in. by 5½ in. 62 figs. (London: Whittaker & Co.) 4s. 6d. net; abroad, 4s. 9d.

THERE is no attempt in this book at competition with the larger standard works on the subject, but it is designed for the use of engineers and students who desire to obtain an insight into the methods whereby the principal dimensions of steam turbines are calculated, referring to first principles. The work is, therefore, more of an introduction to the correct point of view of looking at steam turbine problems than a treatise on design—as might, perhaps, be inferred from its title—and as such it is clear and straightforward.

The Deinhardt-Schlomann Series of Technical Dictionaries in Six Languages. Vol. X.: Motor Vehicles. 996 pp. 6¾ ins. by 4 ins. Numerous illustrations. (London: Constable & Co., Ltd.) 12s. net; abroad, 12s. 8d.

THIS volume of the now well-known series of technical dictionaries is arranged in the same way as the previous volumes on other branches of engineering, that is to say, the ideas are arranged according to subject matter with the German, English, and French expressions on one side of the page, and the Russian, Italian, and Spanish on the other, while suitable illustrations are given in the central space. The latter part of the book consists of alphabetical indices with the Russian words separately, owing to the difference in alphabet. The greater part of the volume does not, of course, concern electrical engineers, but there is a considerable section devoted to electric cars with the extraordinary title "Engine Equipment of Electromobiles." Motor-boats as well as motor-cars are dealt with, and the latter part of the book is devoted to airships and aeroplanes. The production is under the official auspices of the Royal Automobile Club of Great Britain and Ireland, and the cover bears their badge. This would lead one to expect an accuracy and correctness which, we are sorry to say, is wanting, for when we examine the work in detail we find numerous proofs that the revisers were not acquainted with the expressions in common use in England. We should have thought that every member of the Expert and Technical Committee of the Club, which professes to have revised the proofs, would have known, for example, that the words "monoplane" and "biplane" are always used in this country for what are here described as "single-deck aeroplanes" and "double-deck aeroplanes." Again, a front glass on a motor-car is never spoken of as a "window." In spite of its imperfections, however, the work is wonderfully complete, and in the absence of a better should be of considerable use.

Exercises in Electrical Engineering. By Prof. T. Mather and G. W. O. Howe. 71 pp. 7½ in. by 5 in. 22 figures. (London: Edward Arnold.) 1s. 6d. net.; by post in U.K. or abroad, 1s. 8d.

THIS is a collection of questions set in the second-year exercise classes and examinations at the Central Technical College. They will afford an excellent test for the student to ascertain whether his knowledge of the various subjects is up to a proper standard, and the answers at the end of the book to the numerical examples will enable him to check the correctness of his replies. The book will also be invaluable to teachers.

Water Turbine Plant. By Jens Orten-Böving. 197 pp. 11½ in. by 9 in. 216 illustrations. (London: Raithby, Lawrence Co.) 10s. 6d.; by post, U.K. 11s., abroad 11s. 9d.

THE author of this work, which is correctly described on the title-page as a short practical treatise, is too well known in connection with water-power schemes and the design of hydraulic plant to need any introduction. The book is intended to be partly a text-book on water turbines, and partly as a sort of catalogue of types, sizes, and dimensions of a particular series of designs. Its interest is also enhanced by a collection of brief descriptions, with excellent illustrations, showing the general arrangement of numerous hydro-electric installations in various parts of the world. We understand that the basis of the text-book portion of the volume is the material of a series

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From Mr. EDWARD ARNOLD'S List.

The Foundations of Alternate Current Theory.
By C. V. DRYSDALE, D.Sc., Lond., M.I.E.E. xii+300 pages. 8s. 6d. net.

A Text-Book of Electrical Engineering.
By Dr. ADOLF THOMÄLEN. Translated by G. W. O. HOWE, M.Sc. Second Edition. viii+464 pages. 15s. net.
"This book is undoubtedly one of the best of its kind."—*Electrician.*

Exercises in Electrical Engineering.
For the Use of "Second Year" Students in Universities and Technical Colleges.
By T. MATHER, Whit. Sch., F.R.S., M.I.E.E., Professor of Electrical Engineering, Central Technical College; and G. W. O. HOWE, Whit. Sch., M.Sc., M.I.E.E., Assistant Professor of Electrical Engineering, Central Technical College, South Kensington. viii+72 pages. 1s. 6d. net.

Electrical Traction.
By ERNEST WILSON, Whit. Sch., M.I.E.E., Professor of Electrical Engineering in the Siemens Laboratory, King's College, London; and FRANCIS LYDALL, B.A., B.Sc. Two volumes, sold separately. Vol. I., 475 pages, Direct Current; Vol. II., 328 pages, Alternating Current. 15s. net each volume.

Power Gas Producers: Their Design and Application.
By P. W. ROBSON, formerly Vice-Principal of Manchester School of Technology. 250 pages and 105 illustrations. 10s. 6d. net.

Applied Mechanics for Engineers and Engineering Students.
By JOHN GRAHAM, B.A., B.E., Demonstrator and Lecturer on Applied Mathematics in the City and Guilds of London Institute's Technical College, Finsbury, 5s. net.

Machine Sketches and Designs for Engineering Students.
By A. CRUICKSHANK, A.M.I.Mech.E., and R. F. MCKAY, M.Sc. 4to. 1s. 6d.

LONDON: EDWARD ARNOLD, 41 & 43, MADDOX ST., W.

of lectures given by Mr. Böving before the Japanese Association of Mechanical Engineers. There are many curves, tables, and figures which should be of great use to those studying water-power schemes. The information is clearly put and practical, and represents the practice which is the outcome of extensive experience in the rapidly increasing water-power installations in the author's native country, Sweden.

The Journal of the Municipal School of Technology, Manchester. Vol. III. 392 pp. 9¾ in. by 7¼ in. Many figures and plates. (Manchester: Municipal School of Technology.)

IN this large volume are included a number of reprints and abstracts of Papers which have been published by various technical societies, &c., embodying original research and contributions to technical literature by members of the teaching staff and students of the school.

Mechanical World Pocket Diary and Year Book for 1911. 330 pp. 6 ins. by 4 ins. Numerous figures. (Manchester: Emmott & Co.) 6d. net; by post in U.K., or abroad, 8½d.

FOR the last three years purely electrical subjects have not been dealt with in the "Mechanical World Year Book," but have been reserved for a companion work. The mechanical volume has, however, had added to it more than was taken away to form the electrical pocket book, and this, the twenty-fourth annual issue, is further enlarged. On the other hand, revision in the form of condensation of old matter has also taken place. Among the sections which have been extended are those on high-speed cutting tools, gearing, hardening, &c., of steel, details of gas engines, and an explanatory introduction to the tables of logarithms has been included. The dimensions of a true pocket book have not been exceeded, and a wonderful amount of information is given for the money.

"Mechanical World" Electrical Pocket Book for 1911. 208 pp. 6 in. by 4 in. 100 figs. (Manchester: Emmott & Co.) 6d. net; by post in United Kingdom or abroad, 7½d.

THIS wonderful sixpennyworth, which is a companion volume to the *Mechanical World* pocket diary, has been considerably revised since last year's issue, and tables, &c., have been added relating to current densities, temperature rise and losses of machines, illumination, and incandescent lamps. The sections on accumulators, circuit breakers, electricity in mines, and boosters have also been re-written. The whole appears to be clearly written, concise, and up to date, but we would suggest that a little more information regarding modern metal filament lamps might have been included with advantage.

Fowler's Mechanics' and Machinists' Pocket Book, 1911. 460 pp. 6 in. by 4 in., numerous figures. (Manchester: Scientific Publishing Co.) 6d. net; by post, 8d.

THIS handy little volume, which is now in its third edition, contains a mass of information and practical rules for draughtsmen, foundrymen, pattern makers, fitters, &c. Chapters are included on machine-tool design, shop practice, wheel gearing, belt and rope drive, materials used in engineering, &c., with numbers, tables, and illustrations. Some tables from the Engineering Standards Committee's reports dealing with bolts, nuts, spanners, screw threads, and running fits, are included in this edition.

The "Practical Engineer" Pocket Book and Diary, 1911 (703 pp), and **The "Practical Engineer" Electrical Pocket Book and Diary, 1911** (567 pp). 3½ in. by 5½ in. Many figures. (London: Technical Publishing Co.) 1s. 6d. net; by post, 1s. 9d.

BOTH of these are still true pocket books, although the number of pages in the larger one is somewhat increased since last year's issue. There has also been considerable revision of the electrical volume, which includes articles on dynamo design, &c., by Mr. C. C. Hawkins. New matter appears on the Ilgner and other power equaliser systems, but it is a pity such antiquated information is allowed to remain as the statement that the Osmium lamp has not yet reached the commercial stage, in the otherwise fairly up-to-date section on metal filament lamps.

The Electrical Engineers' Diary, 1911. 11 in. by 6½ in. (London: S. Davis & Co.) 2s. 6d.; abroad, 3s.

IN addition to being a diary, this book contains a considerable amount of information of a useful character relating to various applications of electricity for factory driving, lighting, cooking, heating, &c., with figures of cost. There is also a list of London streets in which electric supply mains are laid, together with particulars of the various supply authorities.

NEW PUBLICATIONS

We shall be pleased to send any of the undermentioned works to addresses in the United Kingdom, at the net prices quoted. The price for sending to the Colonies and abroad is also quoted when there is an increase. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Electric Motors." By F. B. Crocker and M. Arendt. (London: Crosby, Lockwood & Son.) 10s. 6d. net; abroad 12s. 2d.

"Fowler's Mechanics' and Machinists' Pocket Book," 1911. 460 pp., 6 in. by 4 in., numerous figures. (Manchester: Scientific Publishing Co.) 6d. net; by post 8d.

The "Practical Engineer" Electrical Pocket Book and Diary, 1911. 567 pp., 3½ in. by 5½ in., many figures. (London: Technical Publishing Co.) 1s. 6d. net; by post, 1s. 8½d.

The "Practical Engineer" Pocket Book and Diary, 1911. 703 pp., 3½ in. by 5½ in., many figures. (London: Technical Publishing Co.) 1s. 6d. net; by post, 1s. 9d.

The Practical Electrician's Pocket Book and Diary, 1911. 363 pp., 5¼ in. by 3½ in., many figures. (London: Rentell and Co.) Cloth, 1s. net; by post, 1s. 2d. Leather, 1s. 6d. net; by post, 1s. 8d.

"Hazell's Annual, 1911." 592 pp. 7¼ in. by 4¾ in. (London: Hazell, Watson & Viney, Ltd.) 3s. 6d. net; abroad, 4s. 1d.

"The Journal of the Municipal School of Technology, Manchester." Vol. III. 392 pp. 9¾ in. by 7¼ in. Many figures and plates. (Manchester: Municipal School of Technology.)

"Electrical Engineering Abstracts" (Section 2 of the Journal of the International Institute of Technical Bibliography). Vol. I., in monthly parts, January to December, 1910. 662 pp., 10 in. by 6½ in. (London: International Institute of Technical Bibliography.) Subscription per section: 24s. per annum, post free.

Proceedings of the National Electric Light Association Thirty-Third Convention, St. Louis, 1910. Two vols. 9 in. by 6 in.; Vol. I., 960 pp.; Vol. II., 800 pp.; illustrations and plates. (New York: National Electric Light Association.)

"Elementary Principles of Alternating-Current Dynamo Design." By A. G. Ellis. 300 pp. 8¾ in. by 6 in., 145 figures. (London: Blackie & Son.) 12s. net; abroad, 12s. 8d.

"The Electrical Ignition of Petrol Engines." By J. W. Warr. 76 pp. 7¼ in. by 4¼ in., 60 figures. (London: H. Alabaster, Gatehouse and Co.) 2s. net; by post, 2s. 1½d.

The Electrical Engineers' Diary, 1911. (London: S. Davis and Co.) 2s. 6d.; by post, 3s.

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ELECTRIC LIGHTING OF THE PALLADIUM

THE electrical equipment of the Palladium, London's latest variety theatre, includes several features of particular interest. Holophane lighting is employed to a large extent; a new pattern of dimming switch with metallic resistances is used; the lamps are all metal-filament, mostly Tantalum, and some very fine fittings, especially designed for the purpose, are installed. The contractors for the whole of the electrical equipment were Siemens Brothers Dynamo Works, Ltd., of London, who sublet the wiring work to Rashleigh, Phipps & Co., of Oxford Street, London.

The supply is taken from the three-wire 220-volt mains of the St. James' & Pall Mall Electric Light Co. A pressure of 110 volts is employed for all the lighting, and of 220 volts for the motors, fans, &c. Special mains are brought into the back of the building for the stage lighting, and into the front of the building for the house lighting. A small alternative supply is also provided for the house lighting by the London Electric Supply Corporation, in accordance with the rules of the London County Council, and alternate fittings in some parts of the auditorium are wired off this supply.

The stage equipment comprises a stage switchboard, regulator and dimmer, a "special effect" switchboard, stage lift, and the stage fittings. The latter consist of seven battens 52 ft. long, each with 250 32-c.p. Tantalum lamps of three colours, 250 footlights, "hanging lengths," "bunch lights," and "proscenium lights." Altogether over 2,400 incandescent lamps of three different colours are in use on the stage. In addition, there are 18 arc lamp projectors, 9 being on the stage and 9 in the auditorium.

The equipment in the house comprises the house switchboards, an electrically-driven "Vortex" suction cleaner plant, and electric fans. The fittings were designed by Messrs. Siemens Brothers Dynamo Works to correspond with the decorations of the building, and are of the Georgian type. The auditorium is lighted from the roof by means of two 50-light electroliers, each 12 ft. high and 9 ft. in diameter, one of which is illustrated in Fig. 1. All the shades of these fittings are of the Holophane type. The large Holophane bowls at the foot contain 100-c.p. "One-watt" drawn tungsten filament lamps. There are, of course, a large number of other smaller fittings in the auditorium. The electric direction and other signs about the building are of the Cloisonnée pattern, with the lettering set out in coloured glass beads. The exterior of the building is illuminated by 22 flame arc lamps. The total number of incandescent lamps in the whole building is close on 4,000, and altogether the lighting and power represents over 400 h.p. The building is wired with Siemens vulcanised india-rubber wires ranging from 3/22 to 37/14, drawn into enamelled steel conduits. "Stannos" wiring is used in the dressing-rooms and elsewhere. Upwards of 30 miles of wire and about 8 miles of conduit were used.

The main supply cables for the stage lighting consist of two lead-covered, armoured cables, each 0·8 sq. in., and one of 0·4 sq. in. section. Four lead-covered, armoured cables of 0·5 sq. in., and two of 0·25 sq. in. section lead from the meter room to the stage switchboard, forming two 110-volt circuits on each side of the three-wire system, and one 220-volt circuit for the fans and other motors. The stage switchboard, illustrated in Fig. 2, is probably the largest of its kind that has yet been installed in this country. It controls lamps taking a total of 2,100 amperes at 110 volts. In order to comply with the regulations of the London County Council, all connections have been arranged on the front of the board, and this has necessitated a somewhat special design so as to accommodate the larger number of cable thimbles, &c. The board is divided into four horizontal sections, two on each side of the three-wire system, and the circuits are approximately balanced on two sides of the system. The circuits are grouped into four sections, viz., stage lighting through dimmers, general stage lighting, stage arc lamps, and those



FIG. 1.—LARGE ELECTROLIER IN AUDITORIUM.

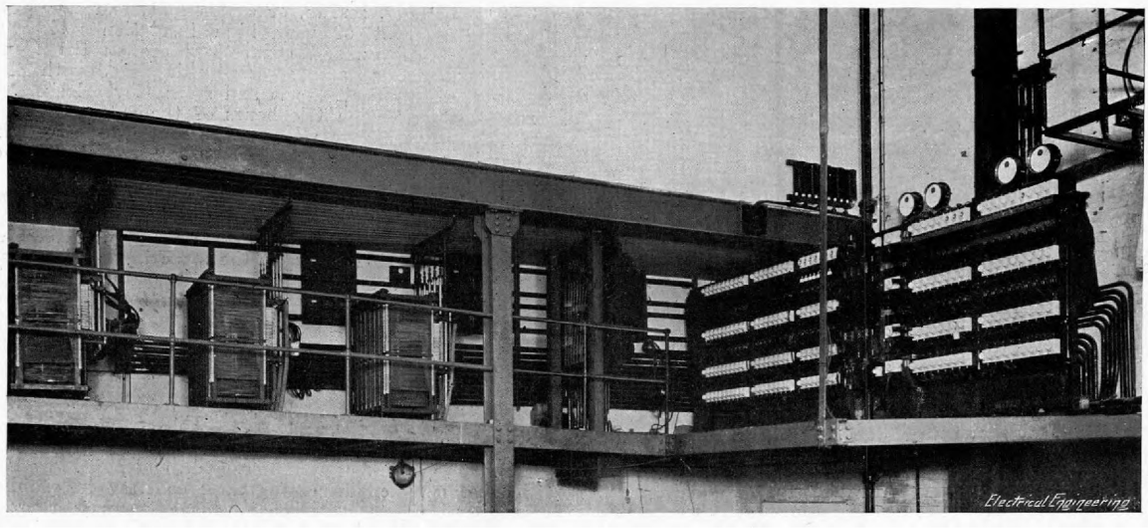


FIG. 2.—STAGE SWITCHBOARD, DIMMER RESISTANCES, ETC.

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auditorium lights which are controlled from the stage. An additional panel carries the "black out" switches by means of which nearly all the stage lights can be switched on or off simultaneously for scenic effects. About 90 circuits are provided for, and each is fitted with double-pole "Zed" fuses and a single-pole knife switch. A slate panel with circular orifices, in which a stock of spare cartridges is kept ready, is provided.

The regulation of the stage lighting in respect of colour, dimming, and illumination is effected by the stage regulator or dimmer, the most important part of a theatre installation. This is shown in Fig. 2, while the operating levers are shown in Fig. 3. This regulator differs in construction from those usually employed, in that metal resistances are used in place of liquid resistances. These resistances are placed in series with the various groups of lamps, and owing to the very fine subdivision of the resistances, the light may be reduced gradually without visible steps from the full candle power of the lamps until they are completely dark. The adjustment is effected by means of regulating discs, all the lamps of one colour in each fitting being controlled by one of these discs. The discs are rotated by means of levers, and each is constructed in the form of a pulley, over which a cord, held in tension by a counter-

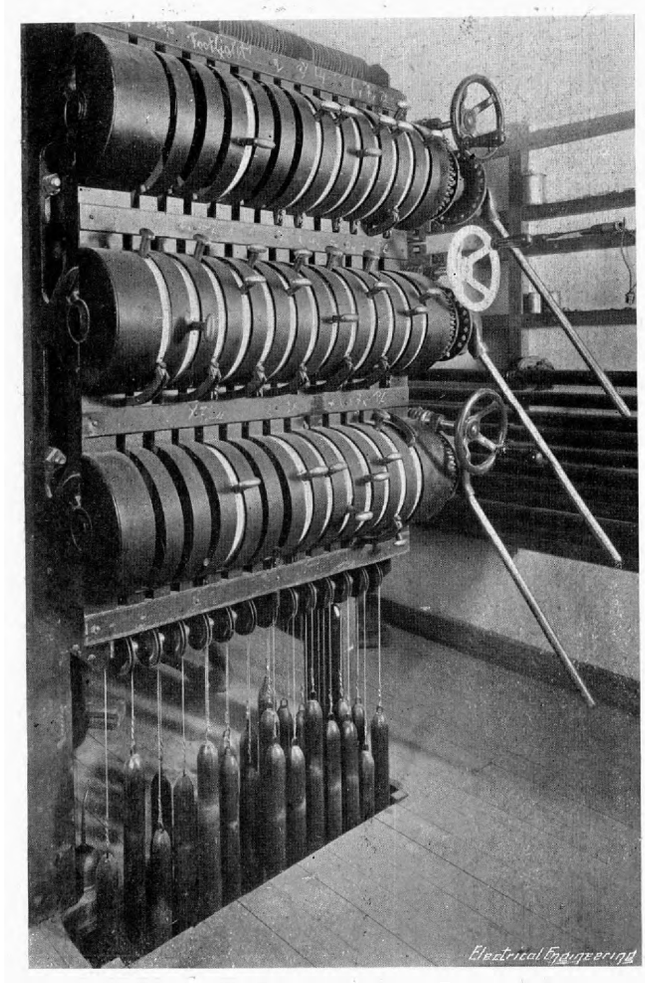


FIG. 3.—DIMMER CONTROL BOARD.

weight, leads to the sliding contacts of the corresponding resistance. An automatic tappet switch cuts out the contact brushes when all resistance is cut out. All discs for the same colour are mounted in one row, and any number of them may be coupled together on to a common spindle in their rear. The coupling device connects the separate regulating levers with the common spindle, so that by turning the single hand-wheel situated at the side, uniform movement of any or all the coupled levers is obtained, and any desired groups of lamps of one colour may be brightened or dimmed simultaneously. The hand-wheels can also be fitted with a fine regulation in order to obtain a slow and steady movement of all the coupled levers. The discs are provided with scales and pointers, which permit of reading off the light intensity at any moment. The total current arranged for on this regulator is 1,140 amperes; it has 33 regulating discs, arranged in three rows of 11 discs each. A switchboard for special lighting effects is situated at the back of the stage, for providing lights for properties and effects introduced by the various "turns," as required.

In order to provide a raised platform for scenic effects, and to facilitate the removal of scenery and properties to the basement, a portion of the stage floor, measuring approximately 20 ft. by 10 ft., and supported by ironwork capable of sustaining a load of 20 tons, is arranged as an electrically-driven lift, which is operated by a Siemens motor. The latter with its gear is capable of raising the lift with a load of 30 cwt. The control is of the Eastman semi-automatic push-button type, with separate push-buttons for the up and down journeys. The lift comes to a standstill immediately the push-button is released, and, therefore, permits of obtaining very correct adjustment of level. A suction cleaning service is installed in the auditorium, saloons, corridors, &c. This consists of a Siemens "Vortex" suction cleaner fixed in a basement underneath the stalls, and connected to a system of air pipes, which run to eleven connection points distributed throughout the house. The machine is direct-coupled to a 5-h.p. 220-volt D.-C. motor. About 500 ft. of 2-in. and 1½in. steel piping are run in the body of the walls, &c., and serve nickel-plated connection pieces fixed on the surface of the plaster or in sunk boxes. Flexible hose in lengths of 16 ft. can be connected to any of these points so as to reach all seats, carpets, &c., and a number of nozzles of various shapes are supplied, which can be readily connected to the flexible hose by simple airtight conical plug and socket joints.

The leads for the batten lights are connected through the dimmers to multiple stage plugs fixed on the flyrail. Similar plugs are mounted on the battens. Lengths of flexible multiple connecting cables connect the battens to the flyrails, and enable the battens to be disconnected easily when it is required to raise or lower them. These cables are fitted with plug sockets at each end, and at the points of connection are laid in grooves formed in the handle portion of the socket and strongly bound round with leather. The plugs are fitted with a locking attachment to prevent accidental disconnection. A number of "Lightning" arc lamps are provided, one being fixed on each batten length, at the right and left ends alternately of the battens. These lamps are connected to a multiple way switch of the rotating type, and when the handle is moved round rapidly the lamps are switched on in rapid succession for the fraction of a second only, whereby a forked "lightning" effect is produced. The projector lamps are very powerful, and are similar to those employed for marine work. The larger projectors, of which three are in use in the biograph room at the back of the roof, and two in the projector room in the centre of the roof, take a current of 45 amperes each. The small lamps which are fixed at the sides of the proscenium and on the stage perches, as well as the portable ones, take 35 amperes each

The switchboard situated in the front part of the building is similar in design to the stage switchboard, and consists of three sets of panels controlling the general lighting, exterior arc lamps, and that portion of the auditorium lights not controlled by the stage switchboard, but which have to be "blacked out" for certain "turns." Fifty-four circuits are provided for, each of which is fitted with double-pole "Zed" fuses, and a single-pole knife switch. A smaller switchboard connected to the alternative supply is mounted alongside. There are 14 "Typhoon" fans about 50 in. diameter, mounted on the ceilings under the balconies, for assisting in the ventilation of the auditorium, and a number of table fans are provided for the saloons, &c. The whole of the wiring on the stage and in the auditorium is controlled from some 60 teak and iron distribution boxes. These have "Zed" fuses and switches fixed on enamelled slate panels in such a manner that the back is free from drilling, screws, or connections, and this has resulted in the attainment of very high insulation resistance. All terminals, 'bus-bars, and connections are on the front of the slate, and the cases are asbestos-lined, glazed with plate glass, and fitted with circuit labels and strong lever locks.

Inter-communication telephones of the automatic replacement line selector type give all offices, boxes, stage, &c., the means of communication without the intermediation of an operator. A central battery switchboard system connects all boxes with the bar, and also with each other. Calling and clearing signals are given simply by lifting the telephone from the automatic hook switch, and replacing it after close of conversation. A loud-speaking system connects the stage manager's office and the Royal Box with the stage, and permits of directions being given to the assembled artists on the stage by the stage manager, who may be seated in his office or watching a rehearsal or performance from the Royal Box. The receivers were found to be too loud, and the circuits have been choked so as to give only a small proportion of the usual effect.

We are indebted to Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd., for the information contained in this article, and to Mr. Walter Gibbons, managing director of the London Theatre of Varieties, Ltd., and Mr. F. J. Humphrey, the supervising engineer, for their courtesy in enabling us to view the complete installation. Some Siemens' representatives conducted a party of friends connected with the electrical Press round the building on Friday last, and afterwards entertained their guests to dinner.

New Telegraph Cable between England and Norway.—This cable, which was described in our last issue, was manufactured and laid for the Post Office by Messrs. Siemens Bros. & Co., Ltd.

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A DICK, KERR MIXED-PRESSURE TURBO-ALTERNATOR

THE accompanying illustrations show two views of 500-kw. mixed-pressure steam turbines supplied by Messrs. Dick, Kerr and Co., Ltd. (Preston), to a colliery in Scotland. The sets, which are driven by turbines of the impulse type (Bergmann system), are designed to give 500 kw. at 3,000 r.p.m., with exhaust steam at 16 lbs. per sq. in. absolute, or with dry saturated live steam at 90 lbs. per sq. in., or with a combination of both pressures, and to give their full output when working condensing with a vacuum

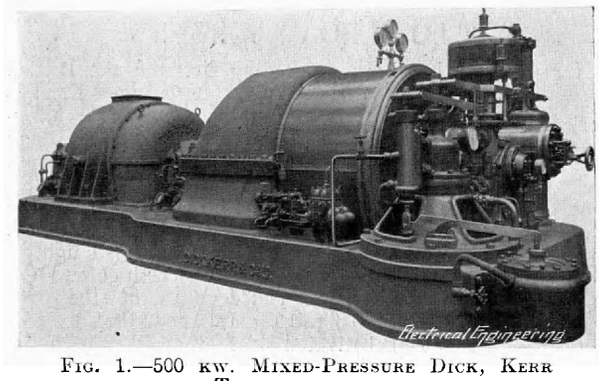


FIG. 1.—500 KW. MIXED-PRESSURE DICK, KERR TURBO-ALTERNATOR.

of 27·5 in. They are capable, under any of these conditions of steam pressure, of giving an overload of 25 per cent. for two hours, and 100 per cent. for five minutes. Each turbine is mounted on a combination base, and is complete with two bearings, and direct-connected to its alternator through a flexible coupling. The turbines are provided with high-pressure and low-pressure main stop-valves, high-pressure steam separator, governor, steam and oil gauge pipes, emergency device for stopping turbine when normal speed is exceeded by 10 per cent. (this safety device closing the main turbine stop-valve and not the throttle-valve), oil receptable with filter, direct-connected oil pump, separate steam oil pump for flooding the bearings before starting up, speed

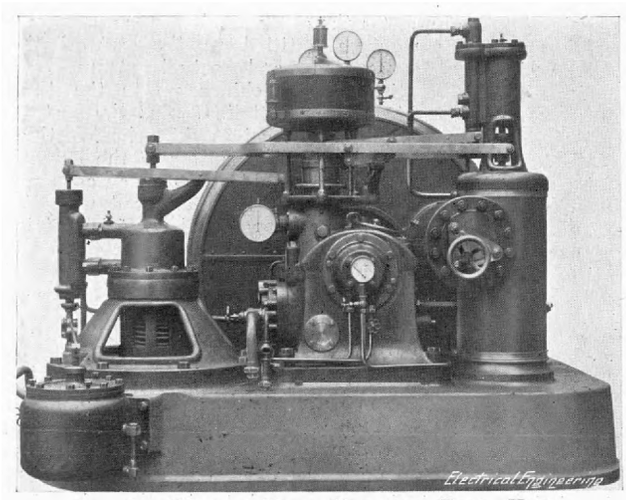


FIG. 2.—500 KW. MIXED-PRESSURE DICK, KERR TURBINE, SHOWING GOVERNOR, &C.

adjusting device, &c. The governor is extremely sensitive, and is based on a principle which allows steam to enter into the turbine in a continuous and steady flow, whether running on mixed-pressure or on live steam, or when changing from one to the other.

The alternators are designed to give 625 k.v.a. (500 kw. at 80 per cent. power factor), at 3,000 volts, and 50 cycles, and the temperature rise does not exceed 70° F. above an air temperature of 77° F., after an eight hours' run at full load.

The Polytechnic.—The fund for rebuilding the Polytechnic, Regent Street, as a memorial to King Edward VII., to which £20,000 has been contributed by the London County Council, and some £50,000 has been subscribed privately, is being kept open till Easter, as many persons who have been identified with the institution may wish to take part in the scheme.

A NEW ELECTRICALLY-PROPELLED VAN

IN view of the efforts that are being made at least by one enterprising supply authority to popularise electric vehicles, the new van illustrated here, which the India-Rubber, Gutta-Percha, & Telegraph Works Co., Ltd. (Silvertown), have just produced, is of considerable interest. The principal peculiarity which distinguishes it from most others is the system of four-wheel drive by two motors geared respectively to live front and rear axles, with differential gear, and, in case of the front axle, with special steering joints. This four-wheel, which has been thoroughly tested on passenger vehicles of the type described in ELECTRICAL ENGINEERING, Vol. III., p. 580, is found to give a better tractive effort, and greatly to diminish side slip. The weight of the particular vehicle illustrated is about 32 cwt., and of the battery with a crate, 13 cwt. The



SILVERTOWN ELECTRIC VAN.

battery consists of 38 KyA 14 type Tudor cells of 210 amp.-hour capacity at the 42-ampere rate, and is arranged so that it can be released from the chassis by turning a key on the front cross member of the frame, and so releasing the four supporting bolts. The controller provides for connection of the motors in series or parallel, and a switch is provided by which either motor can be cut out, and the vehicle driven by the other alone.

We understand that the company are prepared to build vans for special work to suit purchasers' requirements; to erect charging plant complete for any number of cars to work from existing electricity supply, or from a self-contained generating set: to fit up garages complete with battery charging plant, and necessaries for proper maintenance of battery and car, and to work out systems of maintenance and running generally to suit special conditions.

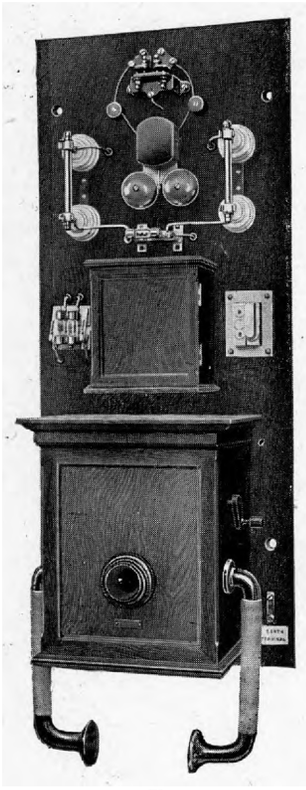
The Tramways & Light Railways Association.—Commencing with the January number, the official circular now becomes the *Journal* of the Tramways & Light Railways Association. This number contains a detailed list of Tramway Bills, or Bills containing provisions relating to tramways, deposited in Parliament in the current Session; an article on rail wear (illustrated), by a member of the Association; matters relating to the Association, and the annual list of members. It is announced that the annual dinner and smoking concert will be held during the month of February, if possible on Friday, the 17th.

Institution of Electrical Engineers.—The following is the list of candidates for election at the meeting on Thursday:—Associate Members:—J. S. Burgis, J. E. Grant, T. H. Haigh, P. G. Hay, J. A. Hunt, E. Lack, W. F. Marshall, J. W. Wyles. Students: T. H. Andrew, H. H. Bagnall, E. A. Beavis, H. C. Burrowes, F. Carr, P. V. Chari, E. J. Chawner, S. N. Chopra, G. C. Clark, W. E. Clark, L. E. Cooke, H. S. Craig, A. J. Dannhorn, J. A. Donald, E. T. Driver, M. Enver, A. Furtado, H. J. Gwyther, C. L. Hall, L. E. Harris, N. F. Hecht, G. Henderson, C. J. Hews, P. R. Hughes, H. Humphreys, E. Hutchison, H. Y. V. Jackson, S. C. Jarrett, B. M. Kazalbash, R. Lewis, A. Lisle, G. K. Loveday, L. A. McDougald, E. G. Mabbs, J. B. Malpass, R. R. Mann, E. L. Mathias, A. A. Maytham, E. R. Mecredy, A. B. Mein, A. W. Miller, D. Milner, M. J. Mitchell, P. J. Mitchell, A. K. Modi, F. L. Otter, C. G. Panayotopoulos, H. E. Park, W. A. Perrett, H. H. Phillips, A. G. Ramsey, A. Rolfe, J. Rosen, G. F. R. Schmidt, A. M. Searle, A. Sild, C. P. Smith, S. H. Smith, V. M. Soffia, T. H. Solomon, H. D. Steers, H. A. Stewart, T. Taylor, H. M. Theaker, J. Tudhope, H. A. Underwood, P. Wardle, G. J. Websdale, J. White, S. Willis, T. G. Woolley.

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A TELEPHONE FOR USE ON HIGH-TENSION CIRCUITS

THERE are many cases where it is convenient to run telephone lines on the same poles as or near to high-tension transmission lines, and special precautions must be taken to avoid danger to the users of the instruments in case of accidental contact between the high-tension circuit and the telephone wires. To meet such cases, Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster), have brought out the special equipment illustrated here. The telephone is so arranged that the user is not brought into contact with any current-carrying part, the sound being transmitted by means of insulated tubes. The lines enter at a point lightning arrester and then pass through two retardation coils for preventing residual discharge, and continue through two H.-T. non-arcing fuses which cut off the apparatus in case of a cross with a power circuit. A vacuum arrester bridged across these fuses serves to short-circuit the instrument in the event of a difference of potential arising between the lines. Each line then traverses a combined spark gap and vacuum arrester fitted with a heat coil. These arresters will actuate at 300 volts, and thus afford protection against every power circuit. The heat coil is arranged to fuse at 0·3 ampere, thereby protecting the instrument from "sneak" currents.



SIEMENS TELEPHONE FOR USE ON HIGH-TENSION CIRCUITS.

AMALGAMATION OF THE MARCONI AND TELEFUNKEN INTERESTS IN GERMANY

AN important agreement was concluded on Saturday last between the Compagnie de Télégraphie sans Fil of Brussels, the licensees of the Marconi patents in Germany, and the Gesellschaft für Drahtlose Telegraphie of Berlin, the owners of the Telefunken system, together with the Allgemeine Elektricitäts Gesellschaft, Siemens & Halske A.-G., and the Braun-Siemens Gesellschaft, by which the interests of all the above in wireless telegraphy for the German mercantile marine have been transferred to a new company, the Deutsche Betriebs-Gesellschaft für Drahtlose Telegraphie, m.b.H. The directors of this new company are Herr Mamroth, director of the Allgemeine Elektricitäts Gesellschaft; Mr. G. Marconi; Col. Thys, director of the Banque d'Outremer, Brussels; Dr. Franke, director of Siemens & Halske A.-G.; M. Travailleur, director of the Compagnie de Télégraphie sans Fils; and Count G. d'Arco, director of the Telefunken Co.

We have ascertained that this agreement relates to the German mercantile marine only, and will not affect the remaining business of either the Marconi Co. or the Telefunken Co. The new company will equip German merchant ships with apparatus of either the Marconi or the Telefunken pattern according to the desire of the shipowners, and whatever the system, the apparatus will be known under the name of "Debeg" (the telegraphic address of the new company). From the results of the litigation regarding the Lepel patent, referred to on page 22 of our issue of January 12th, it would seem that the use of the present Telefunken system might involve difficulties as regards patents, and, consequently, the more extended adoption of the Marconi system seems probable. The exact significance of the refusal of the Telefunken patent has not yet been made known, and further developments will be awaited with interest. It will be of particular interest to see which system the German Government will finally adopt for the Post Office and naval stations.

With regard to the statement that the North German Lloyd and Hamburg-Amerika shipping companies are being persuaded by the German Government to adopt the Telefunken system on the expiry of their contracts with the Marconi Co., we are informed officially by the Marconi Co. that this is wholly incorrect, and that there is every reason to believe that the original Marconi apparatus will be retained. A similar denial is being issued by the Telefunken Co. We understand that there are about 45 Marconi installations distributed amongst the ships of the larger German shipping companies, while the Telefunken Co. have installed equipments on some 40 smaller vessels.

THE LOT'S ROAD TURBINES

AN arbitration has been proceeding between the British Westinghouse Co. and the Underground Electric Railways Co. of London with regard to the eight Westinghouse turbines, which were installed at the Lot's Road power-house between 1902 and 1906. These turbines from the commencement never came up to the contract figures for steam consumption, and although in 1907 one of the machines was taken away by the makers and reconstructed, yet it was found impossible to give the guaranteed figures. Consequently it was agreed between the Westinghouse Co. and the Underground Co., in consequence of the very superior steam consumption figures guaranteed, that Parsons turbines should be substituted for the Westinghouse machines. Then arose the question of how much the Westinghouse Co. should be paid for their machines on the one hand, and the amount of compensation which the Westinghouse Co. should pay the Railway Co. on the other hand. The matter was referred to the Hon. Alfred Littleton, K.C., M.P., but he found himself in some difficulty in determining the principle, and referred the matter to the Courts for a decision. The matter was dealt with on Thursday by a Divisional Court consisting of the Lord Chief Justice and Mr. Justice Hamilton and Mr. Justice Avory. On the one hand, there was a question as to whether the commercial life of the Westinghouse machines should be determined and the difference between the guaranteed consumption and the actual steam consumption over this long period ascertained and converted into a money value. This obviously would have involved a very considerable sum, and the Underground Co. did not wish to assert their rights upon this basis of reckoning. On the other hand, the Underground Co. claimed that they were entitled to the cost of the difference in the guaranteed and actual steam consumptions of the Westinghouse machines up to the time that the Parsons machines were installed, plus the cost of installing the Parsons machines. Against this, the Westinghouse Co. claimed that, as by the installation of the Parsons machines the Underground Co. were able to effect an economy in working which they would never have achieved with the Westinghouse guaranteed figures, they could not fairly claim for the cost of the Parsons machines, and that in effect the Westinghouse turbines had become obsolete at the time of installing the more efficient Parsons machines. It was claimed on their behalf that, having in mind the very considerable difference between the best steam consumption which the Westinghouse Co. had hoped to get, and the steam consumption guaranteed by the Parsons machines, any business concern would have scrapped the Westinghouse machines immediately, as the extra capital cost of the Parsons machines would have been quickly repaid by their greater economy in working. The Lord Chief Justice, in giving judgment, which was agreed to by the other two judges, held that the Underground Co. were entitled to the cost of installing the Parsons machines, plus the difference between the actual and guaranteed steam consumptions of the Westinghouse machines, whilst they were at work. On this basis, the Underground Co. will pay the remainder of the contract price of £250,000 for the original eight Westinghouse machines, but the matter has to go back to the arbitrator for decision as to the amount of compensation.

Rubber Trades Exhibition.—An international rubber and allied trades exhibition is to be held at the Royal Agricultural Hall from June 24th to July 11th next. A number of trophies, medals, and other prizes will be awarded, and arrangements have been made for several rubber-producing countries to exhibit officially through their Governments. An international congress will be held in connection with the exhibition. Full particulars can be obtained from the organising manager, Mr. A. Staines Manders, 75 Chancery Lane, W.C.

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(See also Steam, Gas, and Water Plants.)

Central Electrical Stations. C. H. Wordingham. 24s. net; abroad, 24s. 9d.
Central Station Electricity Supply. Gay and Yeaman. 10s. 6d. net; abr., 11s. 2d.
Heavy Electrical Engineering. H. M. Hobart. 16s. net; abr., 17s. 3d. (*Reviewed July 15th*, 1909.)
Electric Cables, Their Construction and Cost. Coyle and Howe. 15s. net; abr., 15s. 8d.
Electric Power Conductors. W. A. Del Mar. 9s. net; abr., 9s. 8d.
Theory of Electric Cables and Networks. Alex. Russell. 8s. net; abr., 8s. 8d. (*Reviewed Oct. 7th*, 1909.)
Localisation of Faults in Electric Light and Power Mains. F. C. Raphael. 2nd edition. 7s. 6d. net; abr., 8s.
Long Distance Electric Power Transmission. R. W. Hutchinson. 12s. 6d. net; abr., 13s. 4d.
Practical Calculation of Transmission Lines. L. W. Rosenthal. 8s. 6d. net; abr., 9s. (*Reviewed Oct. 14th*, 1909.)
Electricity Control. A Treatise on Electric Switchgear and Systems of Electric Transmission. Leonard Andrews. 12s. 6d. net; abr., 13s. 3d.
Electricity Meters. C. Gerhardi. 9s. net; abr., 9s. 8d.
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Fuel, Gas, and Water Analysis for Steam Users. J. B. C. Kershaw. 8s. net; abr., 8s. 6d.
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Electric Lighting Accounts. G. Johnson. 5s. net; abr., 5s. 5d.
Electricity *v.* Gas for Street Lighting. Reprinted from ELECTRICAL ENGINEERING of August 25th, 1910. 3d. net; abr., 4d.

Steam and Gas Engines, Water Plants, and General Engineering.

Steam Turbine Engineering. Stevens and Hobart. 21s. net; abr., 22s. 4d.
Steam Turbines. A. Stodola. Translation by L. C. Loewenstein. 2nd edition. 21s. net; abr., 22s. 4d.
The Steam Turbine. R. M. Neilson. 4th edition. 15s. net; abr., 15s. 10d.
The Steam Engine and other Heat Engines. J. A. Ewing, F.R.S. 2nd edition. 15s.; abr., 15s. 6d.
Steam Turbines, Their Design and Construction. Rankin Kennedy. 4s. 6d. net; abr., 4s. 9d. (*See Review this week.*)
Elementary Manual of Steam and the Steam Engine. A. Jamieson. 12th edition. 3s. 6d.; abr., 3s. 9d. (*Reviewed Dec. 31st*, 1908.)
The Indicator Handbook. C. N. Pickworth. *Part I.*, The Indicator: Its Construction and Application. 3s. net; abr., 3s. 4d. *Part II.*, The Indicator Diagram: Its Analysis and Calculation. 3s. net; abr., 3s. 4d.
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The Internal Combustion Engine. H. E. Wimperis. 6s. net; abr., 6s. 6d. (*Reviewed July 29th*, 1909.)
Construction and Working of Internal Combustion Engines. R. E. Mathot. Translated from the French by W. A. Tookey. 24s. net; abr., 25s. 3d. (*Reviewed Dec. 15th*, 1910.)
Gas and Oil Engines. H. Allen. 12s. 6d. net; abr., 13s. 6d.
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Hydroelectric Developments and Engineering. F. Köester. 21s. net; abr., 22s. (*Reviewed Oct. 21st*, 1909.)
Hydraulic Motors and Turbines. G. R. Bodmer. 3rd edition. 15s.; abr., 15s. 8d.
Cranes. A. Bottcher. Translated and supplemented with descriptions of English, American, and Continental Practice, by A. Tolhausen. 42s. net; abr., 45s. (*Reviewed Nov. 5th*, 1908.)
American Tool Making and Interchangeable Manufacturing. J. V. Woodworth. 17s. net; abr., 17s. 10d.
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Dies. Their Construction and Use for the Modern Working of Sheet Metals. J. V. Woodworth. 12s. 6d. net; abr., 13s. 2d.
Engineering Workshop Machines and Processes. F. Nedden. Translated and revised by J. A. Davenport. Introduction by Sir A. B. W. Kennedy, F.R.S. 6s. net; abr., 6s. 8d. (*Reviewed Dec. 15th*, 1910.)
Precision Grinding. H. Darbyshire. 6s. net; abr., 6s. 8d.
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Elements of Machine Design. W. C. Unwin, F.R.S. *Part I.*, General Principles, Strength of Materials, &c. 7s. 6d. net; abr., 8s. *Part II.*, Chiefly on Engine Details, 6s.; abr., 6s. 6d.
The Strength of Materials. J. A. Ewing, F.R.S. 2nd edition. 12s.; abr., 12s. 6d.
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Application of Arc Lamps to Practical Purposes. Justus Eck. 2s. 6d. net; by post, 2s. 9d. (*Reviewed Dec. 15th*, 1910.)
Electrical Circuits and Diagrams. N. H. Schneider. In two parts, 1s. 6d. each net; by post, 1s. 9d. each.
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Electrical Testing for Telegraph Engineers. J. E. Young. 10s. 6d. net; abr., 11s. 3d.
Handbook of Electrical Testing. H. R. Kempe. 7th edition. 18s. net; abr., 19s. (*Reviewed July 29th*, 1909.)
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Technical Electricity. Davidge and Hutchinson. 2nd edition. 4s. 6d. net; abr., 4s. 10d. (*Reviewed Oct. 14th*, 1910.)
Electrical Engineering. A. Thomälen. Translated by G. W. O. Howe. 15s. net; abr., 16s. 4d.
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Practical Testing of Electrical Machinery. Oulton and Wilson. 4s. 6d. net; abr., 4s. 9d. (*Reviewed Dec. 15th*, 1910.)
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Standard Polyphase Apparatus and Systems. M. A. Oudin. 12s. net; abr., 13s. 4d.
Modern Electric Furnace. 2nd edition. In Six Vols. Edited by Magnus Maclean. 54s. net, or in nine monthly instalments of 6s. (Abroad, carriage forward.) Detailed prospectus on application. (*Reviewed Nov. 11th*, 1909.)
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Theory and Calculation on Transient Electric Phenomena and Oscillations. C. P. Steinmetz. 21s. net; abr., 22s. 4d. (*Reviewed August 12th*, 1909.)
Radio-active Transformations. E. Rutherford, F.R.S. 16s. net; abr., 16s. 9d.

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Electrical Engineer's Pocket Book. H. A. Foster. 5th edition. 21s. net; abr., 22s.
Walker's Loose-leaf Pocket Book for Engineers. Tables, &c., N. R. Corke. 10s. 6d. net; abr., 10s. 9d. (*Reviewed June 30th*, 1910.)

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Mechanical World Electrical Pocket Book for 1911. 6d. net; post free, 7½d. (*See Review this week.*)
Mechanical World Pocket Diary and Year Book for 1911. Cloth, 6d. net; by post, 8½d. Leather, 1s. 6d. net; by post, 1s. 9d. (*See Review this week.*)
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Text-book of Electrochemistry. S. Arrhenius. Translated by J. McCrae. 9s. 6d. net; abr., 10s. 3d.
Practical Methods of Electrochemistry. F. M. Perkin. 6s. net; abr., 6s. 6d.
Electrochemistry. *Part I.*, General Theory. R. A. Lehfeldt. 5s.; abr., 5s. 5d.
Electrometallurgy. W. G. McMillan. Revised by W. R. Cooper. 3rd edition. 12s. 6d. net; abr., 13s. 6d.
Electrometallurgy. J. B. C. Kershaw. 6s. net; abr., 6s. 8d.
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The Law of Electric Lighting, Traction, and Power. J. Shiress Will. 25s.; British Colonies, 26s. 8d.
The Patents and Designs Act, 1907. J. Roberts and H. F. Moulton. 4s. net; abr., 4s. 4d.
Rating of Electric Lighting, Electric Tramway, and Similar Undertakings. W. G. Bond. 2s. 6d. net; abr., 2s. 9d.
Form of Model General Conditions. Issued by the Institution of Electrical Engineers. 1s.; by post, 1s. 2d.
Lightning Conductors and Lightning Guards. Sir Oliver Lodge. 15s.; abr., 15s. 8d.
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Electric Bells. N. H. Schneider. 1s. 6d. net; by post, 1s. 8d.
Practical Electric Bell Fitting. F. C. Allsop. 3s. 6d.; abr., 3s. 10d.
Dynamo and Motor Attendants and their Machines. F. Broadbent. 1s. 6d. net; by post, 1s. 9d.
Electric Ignition for Motor Vehicles. W. Hibbert. 2nd edition. 1s. 6d. net; by post, 1s. 8d.
The Electrical Ignition of Petrol Engines. J. W. Warr. 2s. net; by post, 2s. 1½d.
Quick and Easy Methods of Calculating: A Simple Explanation of the Theory and Use of the Slide Rule, Logarithms, &c. R. G. Blaine. 3rd edition. 2s. 6d.; abr., 2s. 9d.
The Slide Rule. A Practical Manual. C. N. Pickworth. 2s.; abr., 2s. 3d. (*Reviewed Nov. 12th*, 1908.)
Logarithms for Beginners. C. N. Pickworth. 1s.; by post, 1s. 2d. (*Reviewed Nov. 19th*, 1908.)
Commercial Organisation of Engineering Factories. H. Spencer. 10s. 6d. net; abr., 11s.
Depreciation of Factories. E. Matheson. 4th edition. 10s. 6d. net; abr., 11s.
Factory Accounts. Garcke and Fells. 7s. 6d.; abr., 8s.
Electrical Dictionary: A Popular Encyclopædia of Words and Terms used in the Practice of Electrical Engineering. T. O'Conor Sloane. 4th edition. 7s. 6d.; abr., 8s. 3d.
Technical Dictionaries in Six Languages: English, Spanish, German, Russian, French, Italian. Edited by Deinhardt and Schlomann:—
Vol. II., Electrical Engineering. Cloth, 25s. net; abr., 25s. 10d. Leather, 30s. net; abr., 30s. 10d.
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THE WIRELESS TELEGRAPH PATENT CASE

THE hearing of the action between Marconi's Wireless Telegraph Co. and the British Radio Telegraph & Telephone Co. was resumed in Mr. Justice Parker's Court on Wednesday of last week. A report of the proceedings previous to the Christmas recess was given in ELECTRICAL ENGINEERING, December 15th and 22nd. On Wednesday, Mr. Terrell concluded his opening speech for the defendants, his main argument being that the Marconi 1900 patent in question was invalid, as it was merely a combination of the transformer circuit described in Braun's 1899 patent with what was common knowledge in 1900 as regards tuning. Given the Braun specification at that date, an electrical engineer would, he said, have used a Tesla coil, and would have tuned. Mr. Justice Parker pointed out that in Braun the aerial was not shown as earthed, that no mention was made of tuning or loose coupling, which was essential to tuning, but Mr. Terrell argued that a reference to the "well-known vertical sending wire" implied an earthed aerial, that the only suitable transformer, the Tesla, had a loose coupling, and that tuning between the two circuits was inevitable. With regard to infringement, he held that the auto-transformer without an iron core was not known in 1900, and, therefore, the Marconi patent did not cover it. If it could be proved that it was known, then the patent still did not cover it, as it should have been included in the patent as a known alternative to a two-coil transformer.

Mr. W. Duddell, F.R.S., in giving evidence, said that Marconi's specification referred only to two-coil Tesla transformers; at that date the only one-coil device which would have been suitable for the purpose was called an Oudin resonator. At that time, the word auto-transformer was only applied to devices with iron cores. To carry out Braun's arrangement in 1900, he would have used a Tesla transformer and would have tuned the two circuits, although there was no mention of tuning in the specification. Braun introduced a large capacity in his oscillatory circuit, and was thus enabled, for a given amount of energy, to use a short spark and a larger current with less damping so as to produce a longer train of waves. Mr. Astbury, however, argued that the sole object of Braun was to produce a lower frequency of oscillation, and that a statement in the specification as to avoiding damping meant only such damping as would entirely prevent oscillations taking place. Mr. Duddell stated that the mutual induction in the defendants' apparatus only amounted to a few per cent. and was not needed. Apart from this, it had been argued that the inductance acted as a one-to-one auto-transformer, but, in his opinion, an inductance shunted across a circuit in that manner only took a magnetising current, and gave no transformer action whatever. In connection with the question of infringement, Mr. Colefax drew attention to the fact that in books by Zenick and other authorities, a metallic connection of the aerial with the inductance of the oscillatory circuit was called a Braun direct coupling, while when a transformer was used, it was called a Marconi inductive coupling.

Prof. E. W. Marchant was then examined as to the meaning of the words transformer and auto-transformer, and the defendants then called Prof. C. B. Boys, F.R.S., who admitted, on cross-examination, that Braun did not refer in his specification to any benefit to be obtained by the use of a transformer. Mr. Justice Parker suggested that Braun only wished to increase the voltage in the aerial, and said that, in his opinion, there was no indication of tuning in the specification. He thought that Braun wished to force the oscillations of the closed circuit on to a plain aerial, and did not think of building up the oscillations in a tuned aerial circuit as Marconi did. Mr. N. Maskelyne then gave evidence on behalf of the defendants, stating that, given Braun in 1900, he would certainly have used a Tesla coil, which had a loose coupling and would have tuned.

At this point, as the result of a complaint by Mr. Astbury that too many experts were being called by the defendants, Mr. Justice Parker said that Mr. Maskelyne must be the last, and, consequently, the defendants were unable to call Prof. Silvanus Thompson. Permission was given, however, to call three witnesses on certain points. Mr. W. H. Patchell was examined on the meaning of the word transformer in 1900, and Mr. R. S. Wright (Newton & Co.) and Mr. L. B. Miller gave evidence as to having adjusted the circuits of Tesla coils by varying the number of turns and the capacity previous to 1900. Mr. Astbury recalled two experts for the Marconi Co. to give evidence on certain new points which had arisen, and Mr. Colefax then commenced summing up for the defendants.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

SWITCHES.—A card from Siemens Brothers' Dynamo Works, Ltd., gives illustrations and prices of single throw, quick break knife switches with knee type handles, from 15 to 1,000 amperes.

BED WARMERS.—An electric bed warmer, provided with a heating element which can easily be renewed, is described in a leaflet from Messrs. Frampton & Paine (29 Old Queen Street, S.W.).

CALENDAR.—The wall calendar being issued by the Jandus Arc Lamp & Electric Co., Ltd., is an artistic production, with a most effective reproduction of a pencil study of a head.

ELECTRIC BRAKING CONTROLLERS.—A leaflet from the Allgemeine Elektricitäts Gesellschaft of Berlin describes the main features of several types of controllers for cranes and hoists, with positions in which electric braking is effected by causing the D.C. motor to act as a dynamo, the energy being dissipated in suitable resistances.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

CORONATION ILLUMINATIONS.—The price list of electrical illumination devices for the Coronation, which has just been issued by the General Electric Co., is a magnificent production. Besides detailed price lists of selected switches, enclosed fuses, junction boxes, connectors, wall plugs, adaptors, lampholders, ceiling roses, cables, &c., there are numerous pages attractively printed in colours showing a complete range of illuminated devices from the simplest to those of most ambitious nature. Another special feature is the information regarding the company's "Pixielite strip," which is particularly well adapted to this sort of work. A number of types of sign flasher are also included, and a complete code for ordering enhances the utility of the list. The company ask us to state that both application for copies of this list and orders from it should be made early to avoid disappointment. There is no doubt that the trouble the General Electric Co. have taken in these preparations will result in opportunities for a great deal of business to the trade, and will assist in making the displays at the time of the Coronation a fine advertisement for electricity.

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to the Editor, ELECTRICAL ENGINEERING, *203-6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.*

W. J. W.—Diversity factor is the ratio of the sum of the consumers' maximum demands to the maximum demand on the station. The method of calculating the load factor customarily employed is to multiply the units *sold* during the year by 100, and to divide by the maximum demand on the station, multiplied by the number of hours in a year. The number of units is arrived at from the books of the undertaking (*i.e.*, the total registered by the consumers' meters), and the maximum demand on the station from the switchboard log-book. The maximum demand should be taken as that supplied to the feeders.

J. PERREN.—In addition to the information given last week, a Bill has been deposited for the next session of Parliament by the Metropolitan Electric Supply Co. for the purchase of the Acton Council's electricity undertaking for a sum of £5,000, plus the capital charges on the outstanding capital. This is the result of a resolution by the Council to part with the undertaking because it was not successful.

Electrical Propulsion of Ships.—A note appeared on page 23 of our issue of last week to the effect that a patent had been granted to the British Thomson-Houston Co. for a system of electrical propulsion of ships in spite of opposition. Mr. W. P. Durtnall desired the insertion of a specific reference to his original patent for polyphase drive for ships, *i.e.*, No. 17,248 of 1905, or, if the Comptroller thought this unnecessary, a general disclaimer to "the use for propulsion purposes on a vehicle or boat of a combination comprising a prime mover, a polyphase generator having a stationary armature, and a polyphase motor." The Comptroller has granted the patent as already stated, but requires the following amendments:—(*a*) a reference in the specification that the invention relates to the propulsion of ships by plant of a known kind, and (*b*) the insertion in the complete specification of the words: "Neither do we claim generally for propulsion purposes the use in combination of a prime mover, a polyphase electric generator, and a polyphase electric motor."

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published January 12th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

24,137/09. **Rotary Transformer.** BRUCE PEEBLES & CO., LTD., and P. D. DE LA COUR. This machine has an armature wound for n poles, a $2n$-pole field, and $2n$ brushes, arranged in two sets connected to two external circuits. The magnet frame is split into two ring parts, each carrying half the number of poles excited by shunt windings across the two circuits respectively. The brushes are so arranged that the armature M.M.F.'s are in the same axes as the corresponding field M.M.F.'s, and two series compensating windings are provided, one in each circuit. The uses of the machine are as follows :—Rotary D.C. transformer; double-voltage D.C. generator; double D.C. voltage converter from A.C.; constant current motor-generator for welding, arc lighting, &c.; generator and transformer for battery or flywheel load equalising plant. Nineteen figures.

29,339/09. **Motor Starter.** F. BROADBENT (London). An automatic starter suitable for push-button control is described. On pressing a starting button, a solenoid pulls up the starter arm quickly to the position in which all resistance is in the armature circuit, and on reaching this position a tappet switch is closed and the main switch solenoid energised so that the armature circuit is closed. On releasing the starting button, the resistance arm falls slowly against the resistance of a dash-pot and the motor speeds up. Although the tappet switch is released, the main switch remains closed as the solenoid is energised by means of a bye-pass connection through the main switch contacts. To stop the motor, a second button is pushed, and this breaks the circuit of the main switch solenoid. Six figures.

29,411/09. **Heating System.** S. L. R. PRICE (Dublin). An electrical system for heating buildings consists in the use of a series of horizontal pipes connected at intervals to hollow uprights provided with adjustable openings. Pipes of smaller diameter are inserted in the horizontal pipes, and a heating resistance of asbestos-covered wire is wound in the annular space between. The heated air from the pipes flows into the room through the openings in the uprights. Five figures.

29,511/09. **Battery Plate Separators.** H. F. JOEL (Forest Gate). Separators for use between the plates of primary or secondary cells consist of a backing of perforated ebonite and a sheet of porous acid-proof fabric, such as woven asbestos, fixed together by binding strips and rings of celluloid. Five figures.

29,944/09. **Automatic Battery Switch.** L. SUNDERLAND and G. C. PILLINGER. This patent covers an automatic switch for starting up a petrol- or gas-engine driven set by motoring the dynamo, and for controlling automatically the charging of the battery. Four figures.

30,482/09. **Rotary Converters.** MILES WALKER. To enable rotary converters to withstand heavy overloads without flashing over, the pole-shoes are provided with damping rings or grids which surround the rear but not the leading pole tip. This enables a heavy armature current to neutralise almost completely the flux at the leading tip, while increased magnetisation of the rear tip is prevented and the induced voltage reduced. Two figures.

6,132/10. **Lamp-holder Locking Device.** H. BROOKER and W. A. HOOPER (London). This is a metal band provided with two vertical grooves to take the bayonet pins, and two spring catches pointing inwards. The band is placed over the lamp-cap and is slid over the holder until the catches slip over the bends of the bayonet slots. At the same time two detents on the band enter the slots. The lamp can be removed only by breaking the band with a pair of pliers. Four figures.

7,212/10. **H.-T. Insulators.** BRITISH THOMSON-HOUSTON CO., LTD. (*General Electric Co., U.S.A.*). An insulator for high pressures and to withstand severe mechanical stress consists of a cast-iron bell supporting the H.-T. wire and enclosing the head of a porcelain insulator. The insulator has a cavity into which enters the strain bolt. This is provided with a ball-retaining flange, and balls of copper or brass or of steel with an outer coating of a soft metal, are inserted between this flange and the insulator to distribute the mechanical pressure. Eight figures.

16,441/10. **Manufacture of Glass.** A. G. BLOXAM (*Siemens & Halske A.-G.*). This specification covers improvements on a process described in Patent No. 9,563 of 1908 for the manufacture of glass in an electric induction furnace. The walls of the furnace are constructed of a conducting mixture of silicon or graphite with fireclay. This heats up and melts the glass mixture, which then conducts, so that both direct and indirect heating is obtained.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: SIEMENS BROS. & CO., HIRD and BRADLEY [Twin projectors] 27,914/09; CARBONE ARC LAMP SYNDICATE (*Carbone*) [Method of enclosing the arc] 8,167/10; GEB. SIEMENS & CO. [Electrodes] 9,076/10.

Distributing Systems, Cables & Wires, Insulating Materials, &c.: WILLIAMS [Cables for burglar and fire alarm systems] 11,667/10; PETERSON [Manufacture of insulating material] 23,671/10.

Dynamos, Motors & Transformers: CROMPTON & CO., MACFARLANE and BURGE [Machines] 7,488/10; ALLGEMEINE ELEKTRICITÄTS GES. [Method of securing rotor to shaft] 15,293/10; DASSENOY [Synchronous motors] 23,174/10.

Electric Ignition: DELAGE and WOOG [Electric lighting of gas burners] 6,154/10; BAKER [Magnetos] 7,096/10; BERGMANN [Igniting devices] 10,260/10; R. BOSCH [Magnetos] 18,095/10.

Electrometallurgy & Electrochemistry: GADOMSKY [Extracting copper from ores] 3,965/10; REID [Induction furnaces] 9,459/10; ESTELLE [Depolarising agents for primary cells] 11,837/10; STANTON [Ozonising apparatus] 17,138/10.

Storage Batteries: FOX, LATTIN, and DRAKE & GORHAM, LTD. [Battery regulating switch mechanism] 1,843/10.

Switchgear, Fuses, and Fittings: CURTIS and ADAMS MANUFACTURING CO. [Controllers and starters] 30,566/09; ANSELL [Motor starters] 205/10; MURRAY [Switching mechanism] 16,152/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co., U.S.A.*) [Resistance controllers] 16,985/10.

Telephony and Telegraphy: BROWN [Telegraphy and telephony] 29,985/09; CORDES [Insulation of condensers for telephones] 30,548/09; JAHNKE and TATE [Wireless telephone transmitter] 1,518/10; KITSEE [Telegraphic relays] 2,348/10.

Traction: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Electric braking] 3,011/10; PRENTICE [Train control system] 7,621/10.

Miscellaneous: BARKER [Coal conveyers] 30,123/09; WILSON [Coal face conveyer] 30,127/09; KOOPMAN [Electric welding] 71/10; THOMSON [Magnetic devices for holding riveting tools] 81/10; ALDRICH [Burglar alarms] 3,527/10; LUCAS and EDWARDS [Electric sounding horns] 6,632/10; ARENS [Electric massage finger stalls] 17,061/10; PONTELEC WELDING PATENTS, LTD. [Manufacture of cans] 18,090/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: SCHMIDT, 29,506/10.

Distribution Systems, &c.: PAUL [Overhead transmission system] 28,687/10.

Electric Ignition: R. BOSCH [Ignition of multi-cylinder engines] 19,241/10.

Electrochemistry, &c.: GES. FÜR CHEMISCHE INDUSTRIE IN BASLE [Electrolysis of fused alkali chlorides] 18,300/10; WILDERMAN [Electrolysis of alkaline salts] 26,568/10.

Heating: GEISSINGER [Automatic heat control] 29,463/10; ROCHE [Water heaters] 29,733/10.

Incandescent Lamps: ALLGEMEINES CHEMISCHES LABORATORIUM OSKAR H. ARENDT [Supports for metal filaments] 29,505/10.

Instruments: G. A. SCHULTZE [Resistance measuring arrangement] 29,465/10.

Miscellaneous: A.-G. BROWN, BOVERI ET CIE. [Safety device for thrust bearings] 15,370/10.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

2,094 of January 26th, 1897. **Railway Points and Signals.** WESTINGHOUSE BRAKE CO., LTD. (*J. G. L. Schreuder, U.S.A.*). This patent covers improvements in the signalling gear described in the previous specifications 2,443/91 and 24,702/95. The signals and points, which are operated by electric motors, are electrically controlled by switches mechanically interlocked so that when the switch and signal levers of a route have been moved, the levers of any opposing route are locked.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: R. ROUGÉ and G. FAGET [Rotary converter] 5,561/00; J. H. MAWDSLEY [Brush-holders] 19,368/05.

Switchgear, &c.: W. P. THOMPSON (*T. von Zweigbergk, U.S.A.*) [Prevention of arcing at contacts of motor controllers] 22,250/97; C. H. OFFORD [Automatic time switch] 21,229/02.

Traction: P. M. LINCOLN [Automatic switch for trains running on both A.C. and D.C. systems] 20,001/04.

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EVERYDAY USES OF ELECTRICITY

AT last Tuesday's meeting of the Glasgow Local Section of the Institution of Electrical Engineers, Mr. W. W. Lackie (Chief Electrical Engineer, Glasgow Corporation) gave a short address entitled "Notes on Everyday Uses of Electricity." The main reason for which he advocated the use of electricity for lighting was that it neither vitiated, exhausted, nor raised the temperature of the atmosphere and thus reduced the need for ventilation. As regards cost, electricity at 3d. per unit was about equivalent to gas at 2s. per thousand cubic feet on the basis of metal filament lamps and incandescent gas mantles.

Taking up the subject of ventilation, he pointed out the disadvantages of a coal or gas fire as a means of ventilation, as only the air in the lower part of the room was changed, and cold draughts across the floor were set up. The ideal method was to draw off the vitiated air at the ceiling, and he showed how much more efficient electric fans were than gas-jets for the purpose. Passing on to heating, Mr. Lackie showed that coal at 20s. per ton was equivalent to electric heating at 0·34d. per unit. Less than half the heat, however, would be required owing to the decreased necessity for air renewal, and taking into account also the superior way in which it was controlled and directed where required, it was evident that electricity at 1d. per unit would compare favourably with gas. Electric heating had great advantages where a uniform temperature had to be maintained in a sick room. He then summarised the results of the electric cooking demonstrations at the recent Smoke Abatement Exhibition in Glasgow, where, on the average, 1¾ lbs. of meat was cooked per unit. The difference in the efficiency of electric ovens was considerable. Four 7-oz. steaks were cooked in 14 minutes with a consumption of 0·35 units. One unit would, therefore, do twelve 7-oz. steaks or chops in 14 minutes. The heat required for potatoes and puddings was negligible, as they were done at the same time as the roasting. The reliability and steadiness of electric cooking was pointed out, and some figures of the time taken to perform various operations with particular pieces of apparatus were given. With regard to power, he desired to call attention particularly to the exaggerated statements made in some of the gas-engine manufacturers' catalogues, as to the comparative costs of electric power and the running of independent suction gas plants. Comparisons were made with actual records showing considerable discrepancy. It had not been sufficiently realised that an electric motor only takes energy in proportion to the work it is called upon to do, but that a suction gas plant does not vary its fuel consumption according to the demands made upon it.

DISCUSSION.

After some remarks by the chairman, Mr. Sam Mavor, Mr. PARSONS said that he did not agree that electricity at 0·34 pence per unit was equivalent to coal at 20s. per ton. He gave as an example of house heating figures relative to a small house of five rooms where the coal bill during the past six years averaged £6 11s. per annum, whereas with electricity at 1d. per unit this would be increased to £20. He would not advocate the use of electricity as a medium for ordinary heating until Mr. Ferranti's figure of ½ of a penny per unit had been reached. Although electricity cost twice as much as gas for roasting, which he considered the most suitable form of electric cooking, he could not see any advantage over food similarly cooked in a properly cleaned gas stove.

Professor BAILY thought that electric heating could not compare with the old coal fire. The results of a recent experiment in a house with three rooms and an occasional bedroom connected led him to assume that with electricity at 1d. per unit heating would cost £85 per annum. The electric radiator was suitable for putting under a desk or in a position where you could in a manner sit upon it, but otherwise as a heating adjunct he thought that it was of little use.

Mr. HENRY A. MAVOR pointed out a few contradictory remarks in the Paper. Electricity was bound to be more costly than coal for the general heating of a house, for the principal reason that the electric unit is produced from coal, steam, and a generating plant, from which a total of 10 per cent. thermal efficiency can only be obtained. He referred to the great convenience of electrically-driven vacuum cleaners, and advised the Corporation Electricity Department to advocate their extended use.

Mr. T. B. MURRAY confined his remarks to the consideration of the real cost of electrical power as compared with suction gas plant. At his firm's works, where they have a fairly constant load of about 40 h.p. driving machine tools, the annual cost of running a suction plant amounted to 0·455 pence per b.h.p. It would therefore appear that until electrical energy could be supplied at about ½d. per unit, it would not pay to adopt electric driving.

Mr. J. A. ROBERTSON, referring to experiments carried out by himself, mentioned that a 9 lb. roast could be cooked with 3 units, which at a 1d. per unit would be double the cost of cooking with gas at 2s. 8d. per 1,000 cubic feet. He did not think this expenditure extravagant when compared with the cost of the article to be cooked.

Mr. LACKIE, in reply, said he did not recommend the continuous use of electricity for heating at 1d. per unit. The question of electric heating should not be looked at solely from the point of view of cost, without considering atmospheric purification and absence of dirt and ashes.

LOCAL NOTES

Aberdeen: *Tramway Extension.*—The Tramway Manager has been instructed to prepare a report upon extending the tramway system to Footdee.

Bacup: *Tramway Construction Dispute.*—Some time ago the Corporation accepted a tender of Messrs. Macdonald & Deakin, of London, for tramway permanent way at £8,574. After paying, from time to time, sums amounting to £6,312, the Corporation declined to pay any further amounts, and when the contractors claimed to have the matter determined by arbitration, the Corporation set up the defence that, under the Public Health Act of 1875, municipal contracts over £50 must have the Corporation seal affixed to them. It has been held recently, however, that the affixing of a seal to a municipal contract is a mere formality once the work involved has been put in hand, or any goods supplied and accepted. In the Lancashire County Court at Liverpool, the Vice-Chancellor upheld this view, and gave the contractors the right to arbitration.

Birmingham: *Electrical Exhibit.*—The Electric Supply Department have exhibits at the Midland Institute Conversazione, held in the Town Hall and Midland Institute from January 10th to 14th, including a demonstration of electrical domestic appliances and electric welding.

Dawlish: *Electric Lighting.*—The Dawlish Electric Lighting Co. will shortly erect a generating station in Brook Street.

Dover: *Electricity Supply.*—The Electrical Engineer is to report upon giving a supply of electrical energy in St. Margaret's Bay.

Greenock: *Electricity Profits.*—The Secretary for Scotland has informed the Electricity Committee that all the profits from the Electricity Department should be placed to the reserve fund. Last year, of the net surplus of £3,000, the sum of £1,900 was applied to the relief of rates, and the remainder placed to reserve.

London: *St. Pancras: Criticism of Electricity Undertaking.*—It is stated that the Electric Lighting Committee is recommending the discontinuance of an advertisement in a local paper on account of the criticisms of the Electricity Department which have been made by the paper in question.

Manchester: *Tramwaymen's Hours.*—The Tramways Committee have sent a further communication to the Amalgamated Association of Tramway and Vehicle Workers with regard to the demand for an eight-hour day. It is pointed out that 63 municipal tramway undertakings work their men 60 hours per week, that only 15, including Manchester, work 54 hours per work, or nine hours per day, and that no tramway authority has adopted an eight-hour day. The Committee, however, are going into the question of making some further slight concessions in order to improve the men's pay.

In reply to this communication, the Secretary of the Men's Union asked for a definite answer as to whether the Committee will submit the whole case to arbitration.

Electricity and Gas Committees.—The Conference mentioned in our last issue to consider the policies and working methods of the Electricity and Gas Departments was held on Wednesday last week under the Chairmanship of the Lord Mayor. A statement was made by the Chairman of the Gas Committee, and the Conference was adjourned for the preparation of a statement on behalf of the Electricity Committee.

Rhyl: *Diesel Engine and Low Fuel Costs.*—The monthly report of Mr. E. H. Wright, the Borough Electrical Engineer, gives particulars of the reduction in generating costs since

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the installation of the Diesel engine set. In December the generating costs were 0·79d. per unit, compared with 1·3d. per unit for December, 1909.

Stannos Wiring.—The Electric Lighting Committee, in order to encourage the use of the Stannos system of wiring, have opened a shop in the High Street, where an installation on this system may be inspected.

Scarborough: *Winter Tramway Service.*—At the Scarborough Police Court on Wednesday the Scarborough Electric Tramways Co. were fined 10s. for each day in respect of 28 days during which they had failed to carry out an order of the Board of Trade to maintain a winter tramway service. It was stated at the Police Court that the company's undertaking is in the hands of the mortgagees.

Sheffield: *Legality of Discounts.*—At the Council meeting last week, the action of the Electricity Committee in offering a 50 per cent. discount to those consumers doing away with all other means of lighting than electric light, was criticised, but the Town Clerk's opinion is that such discounts are perfectly legal.

Truro: *Electric Lighting.*—Mr. J. A. Purves, whose firm intended to apply for an Electric Lighting Provisional Order, has been compelled to abandon the application, it is stated, on account of the difficulties met with through the operation of Clause 2 of the Electric Lighting Act of 1909, which stipulates that a generating station cannot be erected on land which has not been specified as required for this purpose in an Act of Parliament.

Watford: *Tramways.*—The Council have appointed a small sub-Committee to meet the Highways Committee of the Hertfordshire County Council with a view to removing the points of difference between them concerning the proposed tramway system. The powers which the Council possess in Watford lapse in April, and there is a desire on both sides to preserve them.

Winchester: *Purchase of Electric Light Co.*—Messrs. Merz & McLellan have been appointed consulting engineers to the Corporation for five years in connection with the purchase of the Winchester Electric Light & Power Co. The Electric Lighting Committee intend to give immediate attention to the present system of charging, which they regard as unsatisfactory.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bacup.—Tenders are invited by February 5th for high- and low-tension cables, ducts, transformers, and meters. Particulars from the Town Clerk.

Leith.—With a view to future extensions, the Town Council have purchased some additional land.

London: *Hammersmith.*—The Electricity Committee invite tenders for a 3,000-kw. turbo-alternator, E.H.T. feeders and L.T. distributors (see an advertisement on another page).

Oldham.—Mr. S. W. Newington, the Borough Electrical Engineer, who recently reported upon the need for considerable extensions at the Electricity Works, has been instructed to prepare a specification for a mixed-pressure turbo-alternator.

Turton.—Tenders are invited for the supply of overhead mains, poles, &c., for the electric lighting of the Bromley Cross area and Bradshaw Road. Particulars from Mr. R. B. Leach, Electrical Engineer, Council Offices, Bromley Cross, Bolton.

West Ham.—The Corporation require tenders by January 31st for engine-room stores, wattmeters, electrical fittings and accessories, single and two-phase motors, &c.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

PROVINCES.

Aberystwyth.—Additions to drill hall. Architect, G. T. Bassett.

Aldershot.—New secondary school.

Birmingham.—Telegraph stores, Bordesley. H.M. Office of Works.

Blackburn.—Additions to County Court. H.M. Office of Works, London.

Caterham.—Council offices and hall.

Enfield.—New infirmary. Consulting Engineers, Messrs. May & Hawes, London.

Farnham.—Extension to drill hall premises for Surrey Territorial Force Association. Secretary, Caxton House, Westminster.

Glasgow.—School buildings in Cathkin Road. Slaughter house, offices, &c., in Hill Street.

Gloucester.—Additions to School of Domestic Science. Architect, R. S. Phillips, Midland Bank Chambers.

Johnstone, N.B.—Proposed branch of the Clydesdale Bank.

Llanelly.—New church in Alban Road. Architect, E. M. Bruce Vaughan, Cardiff.

Maidenhead.—Administrative and laundry buildings at the Isolation Hospital.

Margate.—Concert hall, &c., at the Fort.

Oxford.—County offices in New Road.

Stoke-on-Trent.—Alterations at the Spittal Workhouse.

MISCELLANEOUS

Belgium.—Tenders are invited by January 26th by the Antwerp Municipal Authorities for the supply of carbons for arc lamps. Particulars at 73 Basinghall Street, London.

Bournemouth.—Tenders are invited by February 13th for the supply of stores for the Tramways Department, including electrical sundries. Particulars from the General Manager.

Hull.—The sum of £3,000 is to be expended upon converting the Sculcoats Bridge to electric working.

Leeds.—Tenders are invited for supplies of coal and for stores for the year ending March 31st, 1912. Tenders by February 21st. Tenders are also required for 1,500 alternating-current wattmeters by February 16th. Particulars from H. Dickinson, Borough Electrical Engineer. (See an advertisement on another page.)

Sheffield.—The Tramways Committee invite tenders for general stores, including car fittings, overhead line fittings, power station supplies, lamps, cables, &c. Particulars from the General Manager, and tenders by January 21st.

Turkey.—Tenders are invited by March 15th for the construction of tramways and the supply of electricity in Adrianople.

TENDERS RECEIVED AND ACCEPTED

Sunderland.—The tenders of Messrs. Rickard, Ltd., for V.I.R. service cable, and Messrs. Farrow & Co. for pavement boxes, wrought-iron tubing and bends, have been accepted.

Amongst recent orders received by the Mirrlees Watson Co., Ltd., for steam condensing plant are the following:—Surface condensing plants for Uxbridge & District Electric Supply Co., Ltd.; Anglo-Persian Oil Co., per Siemens Bros., two sets; M. Nairn & Co., Kirkcaldy, per C. A. Parsons & Co.; Usine de Tuiliere, Bordeaux, per Thomson-Houston Co., Paris. Barometric jet condensing plants for Chuwo Seito Kaisha, Formosa, per Okura & Co., London; C. & W. Walker, Ltd., Donnington; Durban Corporation, per Hubert Davies & Co., London (with three sets of hot-water and injection pumps and motors). Low level jet condensing plants for Edinburgh Corporation, per Brush Electrical Co., three sets; Dinnington Main Colliery, per British Thomson-Houston Co.

Messrs. David Bridge & Co., of Castleton, Manchester, inform us that they have placed another order for a Royce 10-ton electrical travelling crane for a further extension they have made. This now makes the third 10-ton electric travelling crane that has been installed to cope with the increasing business in friction clutches, hauling plants, and gearing installations generally.

Messrs. Willans & Robinson, Ltd., have recently received orders for four Willans Diesel oil engines, each to develop 282 b.h.p., for driving direct-coupled alternators. Two of these engines have been ordered by the Alianza Co., Ltd., London, and two by the Rosario Nitrate Co., London. In both cases, the consulting engineers are Messrs. Strain & Robertson, of Glasgow.

Electric Traction on the Brighton Railway.—It is announced that the London, Brighton & South Coast Railway have come to a decision to extend electric traction on their system as far as Croydon, provided the results of the extension now in hand are satisfactory. The Croydon Borough Council will supply part of the current required, and have sanctioned a further supply in their district being given by the London Electric Supply Corporation.

OSRAM·LAMPS

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APPOINTMENTS AND PERSONAL NOTES

Efforts are being made to raise the sum of £2,000 for the benefit of Mr. F. S. Pepperdené, of Bexhill, who has had the misfortune to contract X-ray dermatitis in connection with his early work with X-rays. Subscriptions will be received by Dr. Murdoch, of Bexhill.

A recommendation of the Carlisle Electricity Committee to increase the salary of Mr. S. T. Allen, the Borough Electrical Engineer, by £50 per annum, with annual increments of £20 up to £450, has been postponed.

A draughtsman is wanted by a firm of telephone engineers and instrument makers (see an advertisement on another page).

The Limerick Corporation have appointed Mr. Cloran Borough Electrical Engineer at a salary of £200, rising to £300 per annum. The appointment was made at a somewhat stormy meeting, the general feeling being that an Irishman should be appointed. The Council's consulting engineer had recommended Mr. F. Swarbrick, of Leigh, Lancs.

The salary of Mr. R. Smith, Chief Assistant at the Worcester Electricity Works, has been increased from £140 to £156 per annum.

Mr. C. A. Frost, Assistant Electrical Engineer at Bexhill, has been given a gratuity of £25 for the efficient manner in which he carried out the duties of Chief Electrical Engineer during the absence of Mr. Le Feuvre, who met with an accident whilst in camp.

The following have been selected as the short list for the position of Tramways Manager at Oldham in succession to Mr. Lewis Slattery, who has been appointed to the L.C.C. Tramways Department:—C. Burgess, Wigan; J. W. Dugdale, Ashton; A. F. Eardley, Stockport; T. J. Kendrew, Southport; W. Murray, Walthamstow; A. Wolstencroft, Ilford.

An assistant installation inspector is required at the Stepney Electricity Works. (See advertisement in this issue.)

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 10s. per ton (last week, £58 10s. to £58 15s.).

Liquidations.—The Alsop Flour Process (1906), Ltd., is to be wound up voluntarily. Mr. F. A. Greenaway, 21 Mincing Lane, London, is liquidator.

Dissolution of Partnership.—H. Ward and E. J. Cox, Electrical Engineers, of Castleford and Dewsbury, have dissolved partnership. Debts by H. Ward.

Agency.—The Globe Electric Co., Ltd. (11 Farringdon Avenue, E.C.) have appointed Messrs. Walters & Co., Ocean Chambers, Waterloo Street, Birmingham, as their agent for Birmingham and the Midlands.

Bankruptcies.—The trustee in the bankruptcy of H. J. Burdett, Electrical Engineer and Contractor, 16 Regent Street, Rugby, has been released.

The G.B. System in the Mile End Road.—In the Appeal Court, before Lords Justices Vaughan-Williams, Farwell, and Kennedy, on Wednesday last week, an application was made, on behalf of Sir John Benn, to have the appeal against the judgment of Mr. Justice Ridley awarding £8,000 damages against him in respect of statements made concerning the G.B. system in the Mile End Road expedited. Mr. F. E. Smith, K.C., M.P., who opposed the application, stated that, so far, Messrs. Griffiths and Bedell had only been able to recover £100 of the £5,000 for which it was agreed security should be given. Most of Sir John Benn's furniture was claimed by other members of his family, and his shares in Benn Bros., Ltd., and the *Hardware Trade Journal* had been disposed of, with the exception of 50 shares in the latter. In the course of a discussion, it was stated that it was not usual to allow a bankruptcy petition to be made effective when an appeal was pending, but Mr. Smith said he did not know what the position would be in this case, as the stay of execution had been removed, through Sir John Benn not having given the security for the £5,000. Sir Edward Clark, who appeared for Sir John Benn, said that a judgment stood against him in respect of which he had apprehensions of very serious consequences to his public as well as private life. The Court refused the application on the ground that no good reasons for expediting the appeal had been put forward.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Chatham & District Light Railways Co.—The net revenue for the half-year to December 31st amounts to £10,198, of which £4,500 has been transferred to depreciation. After meeting a 5 per cent. dividend on the preference shares and 4 per cent. on the ordinary shares, a sum of £638 is carried forward.

Direct United States Cable Co.—A balance of £4,706 is carried forward for the December half-year, after paying interim dividends of 4s. per share for each of the two quarters and a bonus of 2s. per share for the December quarter, and placing £5,000 to reserve.

Musselburgh & District Electric Light & Traction Co.—It is stated that a new issue of capital will shortly be made.

Sao Paulo Tramway, Light & Power Co.—An issue of £300,000 five per cent. perpetual consolidated debenture stock is being made.

City & South London Railway.—A dividend at the rate of 1¾ per cent. has been declared, with £1,500 transferred to renewal fund and £1,788 carried forward.

Montreal Light, Heat & Power Co.—A dividend of 2 per cent. for the quarter ending the 31st inst. has been declared.

Telegraph Traffic and Movements of Cable Ships.—The El Arich route between Adana and Beyreuth was down on 13th inst.; while the Hanekin route was interrupted between Constantinople and Diarbekir and Constantinople and Aler.—The *Pouyer Quertier*, of the French cable company, has repaired the cable between Paramaribo and Cayenne, thus re-establishing connection with Dutch Guiana *via* Salinas. The route *via* Hayti is still down, as the cable between Puerto Plata-Martinique now requires attention.—The c.s. *Minia*, of the Anglo-American Telegraph Co., returned to Halifax, N.S., on the 28th Dec. Since her return she has been busy working on the main cable off Newfoundland, and has repaired three breaks.—The c.s. *Mackay-Bennett*, of the Commercial Cable Co., is still engaged on the Havre-Waterville section, which is being renewed.

Primary Cells for Telephone Purposes.—With further reference to the improved pattern of Leclanché cell devised by Mr. J. G. Lucas and Mr. A. Fraser, and described on page 3 of our issue of January 5th, we learn that the Post Office prepare these cells themselves, but that probably any suitable firm would supply them to order. If desired, the chemicals can be purchased separately from firms such as Townson & Mercer, Griffin, &c. We understand from Mr. Lucas that some 50 per cent. more manganese chloride than salammoniac is required. This means about 2·35 grammes of manganese chloride per ampere-hour. The cost per cell, we are informed, works out about the same for large quantities.

John E. Raworth,
Queen Anne's Chambers, 30, Broadway, Westminster, London, S.W.
Chartered Patent Agent.

THE 'PATENTEES' HANDBOOK,'
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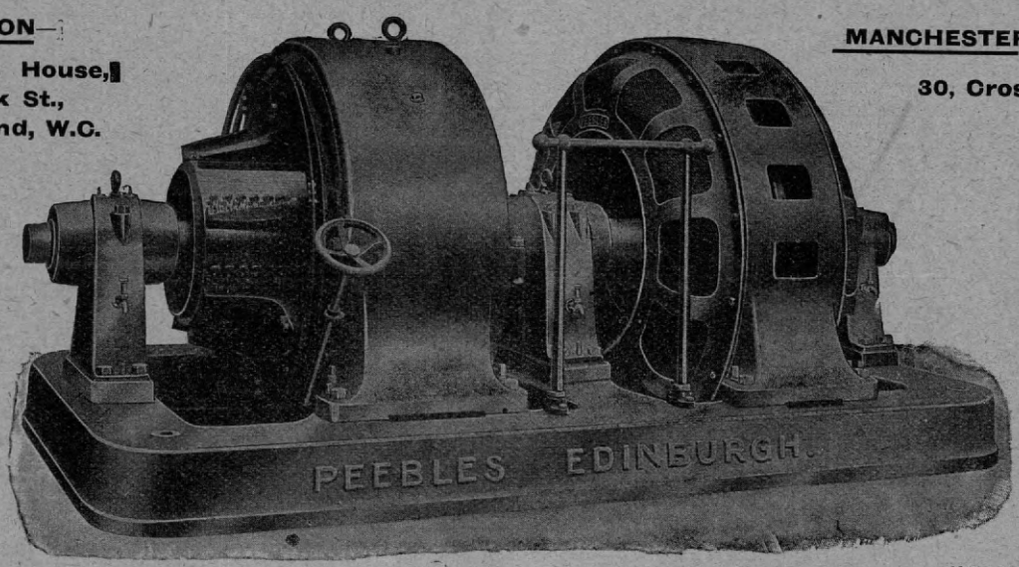
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ELECTRICAL ENGINEERING

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SUMMARY

We publish a description of the Brimsdown Lamp Works, in which several thousands of metal filament lamps are manufactured per week. The filament itself is made at the works. The various processes are briefly described, and illustrations are given of the filament "sintering," the welding, and the exhausting departments. (Page 41.)

An illustrated article describes some new electric cooking apparatus. (Page 43.)

The adjourned discussion of Major W. A. J. O'Meara's Institution Paper on long-distance submarine telephone cables was opened by the Postmaster-General. Mr. F. Gill, of the National Telephone Co., spoke of the use of loading coils on their underground circuits, and also dealt at some length with the question of "duplexing." Mr. D. Sinclair supported Sir John Gavey's advocacy of continuous loading, and Mr. A. Campbell and Mr. Mordey discussed the properties of iron at the low values of magnetisation obtained in continuous loading. Mr. F. Tremain pointed out the great saving in the land lines consequent upon a slight improvement in a short length of submarine cable in the circuit. Large conductors lightly loaded were advocated by Mr. W. P. Granville, while Mr. B. S. Cohen said that the reverse had given better results. (Page 44.)

A discussion on library lighting was commenced before the Illuminating Engineering Society on Monday, January 16th. All the speakers agreed that electricity is the only possible illuminant. In an endeavour to arrive at a standard of illumination in the various rooms of a public library, figures of the present illumination in many London libraries have been taken, these showing very inconsistent results. The standard of table lighting fixed for the Carnegie Library in Pittsburg is five foot-candles. (Page 45.)

Mr. H. Gray, in a Paper on electric cooking, read before the Manchester Local Section of the Institution of Electrical Engineers, gave results of tests to show that the cost of electric cooking with energy at $\frac{3}{4}$d. per unit could work out cheaper than gas at 2s. 6d. per 1,000 cu. ft. (Page 46.)

Messrs. Faye-Hansen and Harlow's Paper on the Merz-Price system of protection and certain modifications thereof, has been further discussed by the Birmingham Local Section of the Institution of Electrical Engineers. (Page 47.)

The anti-vibration metal-filament "Metalik" lamp recently introduced can now be obtained for the higher voltages. (Page 47.)

Among the specifications published by the Patent Office on Thursday last was one by S. G. Brown covering certain features of his telephone relay. A microphone transmitter for heavy currents and suitable for wireless telephony is described by A. Jahnke. Carborundum granules between iridium-platinum electrodes are cooled by the evaporation of alcohol in the granule chamber. The opposition to a patent by the Westinghouse Metallfaden-Glühlampenfabrik Ges. for a process of decarbonising tungsten filaments has been withdrawn. A patent by A. W. Leonard for an electric advertising device is opposed. The fundamental patent covering the construction of the well-known Berry transformer expires on Thursday next after the full life of fourteen years. (Page 48.)

In the patent action brought by the Osram Lamp Works, Ltd., against Messrs. G. M. Boddy & Co., judgment has been entered against the latter firm. Messrs. Philips, of Eindhoven, who manufacture the lamps sold by Messrs. Boddy, have taken a licence under the Osram patents. Under the terms of the licence, a royalty is to be paid, importation is to be kept within a certain scale, and there is an agreement to maintain prices and control discounts. We give summaries of the two patents under which the action was brought, and of two other patents which may influence the general situation. (Page 49.)

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THE Coventry Tramway Company have been given notice to sell their undertaking to the Corporation.—The Scottish Office has modified its request with regard to the electricity profits at Greenock.—The members of the Islington Electric Lighting Committee, who recently resigned as a protest in connection with municipal wiring, have consented to continue in office.—The Metropolitan Electric Supply Co. have succeeded in getting their rateable value in Willesden reduced from £13,000 to £8,900.—The Manchester Tramways Committee and the Tramwaymen's Union are still in dispute as to the question of hours, &c.—An arbitration took place in London last week with regard to the purchase by the Hartlepool Corporation of certain tramway lines in their district. (Page 50.)

THE Wakefield Corporation require an 800-kw. alternator; a 600 or 750-kw. turbo-generator is required at Ipswich; and a Diesel engine set at Leek. An extension to the H.T. switchboard at Rawtenstall is required; H.T. and L.T. sub-station switchboards are wanted by the Calcutta Electric Supply Corporation; additional generating plant at Mansfield; additional boiler, economiser, &c., at Luton; and a new battery and generating machinery at Swindon. Edinburgh Corporation have been granted a loan of £75,000 for electrical extensions. Electrical stores are required by the Halifax Corporation and the Midland Railway Co. of Ireland. Leeds Electricity Committee require 1,500 A.C. wattmeters, and telephone material is required by the Australian Postmaster-General. (Page 51.)

THE conversion of the East London Railway Co. to electric traction is at present the subject of a survey by a leading electrical company. The considerable increase in the third-class traffic on the L.B. & S.C. Railway is attributed to the service of electric trains. The Aron Electricity Meter, Ltd., are inviting subscriptions for £100,000 five per cent. first mortgage convertible debentures at 97. (Page 53.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JANUARY 26TH.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. (1) "Modern Long-distance Transmission of Electrical Energy," by W. T. Taylor. (2) "Extra High Pressure Transmission Lines," by R. Borlase Matthews and C. T. Wilkinson.

SATURDAY, JANUARY 28TH.

Association of Mining Electrical Engineers.

3.30 p.m. *Notts and Derbyshire Branch.* At University College, Nottingham. Discussion of Mr. E. K. Scott's Paper, "Electricity in New South Wales Coalfields."

5 p.m. *Yorkshire Branch.* At Royal Victoria Hotel, Sheffield. Discussion of Mr. E. K. Scott's Paper.

5.30 p.m. *Warwickshire and S. Staffs Branch.* At Imperial Hotel, Birmingham. Discussion of Mr. E. K. Scott's Paper. The question of Examinations will also be dealt with.

6.30 p.m *Lancs, &c., Branch.* At Grand Hotel, Manchester. Address by President, Mr. W. Maurice, and discussion on Mr. E. K. Scott's Paper.

MONDAY, JANUARY 30TH.

Junior Institution of Engineers.

7.30 p.m. At Caxton Hall, Westminster. Sixth and concluding lecture on "The Law Relating to Engineering," by Mr. L. W. J. Costello.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. Adjourned discussion on Library Lighting.

TUESDAY, JANUARY 31ST.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At University. (1) "Long-Distance Transmission of Electrical Energy," by W. T. Taylor; (2) "Extra High-Pressure Transmission Lines," by R. Borlase Matthews and Mr. C. T. Wilkinson.

WEDNESDAY, FEBRUARY 1ST.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At Victoria Embankment. "Telephony," by H. Clark.

THURSDAY, FEBRUARY 2ND.

Institution of Electrical Engineers.

7 for 7.30 p.m. Annual Dinner at Hotel Cecil.



MANAGING DIRECTOR OF THE GENERAL ELECTRIC CO.:—Gentlemen, your services have been invaluable, you know, but this agreement gives me all I want at present. These cigars have the best flavour, but Dutch ones will not be contraband if they have paid us duty.

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THE BRIMSDOWN LAMP WORKS

Manufacture of Metal Filament Lamps

THE making of metal filament lamps is one of the most interesting of electrical manufactures, and we therefore gladly accepted the invitation of the Imperial Lamp Works (Brimsdown), Ltd., to view their works last week. These works have only been in operation for a few months, yet the output is very great, as in addition to supplying a very wide general demand, they manufacture the large quantities of metal filament lamps which are sold by Simplex Conduits, Ltd. The machinery at present installed is working at its full output; 400 hands are regularly employed in manufacture, and when the works are completely equipped the estimated output of lamps will be 10,000 a day. The arrangement of the works has been carried out with a view to rapid and systematic manufacture, the organisation and supervision are excellent, and in the finely-built, lofty and well-ventilated shops the comfort of the operatives is secured, so that the product should certainly be of the highest possible quality.

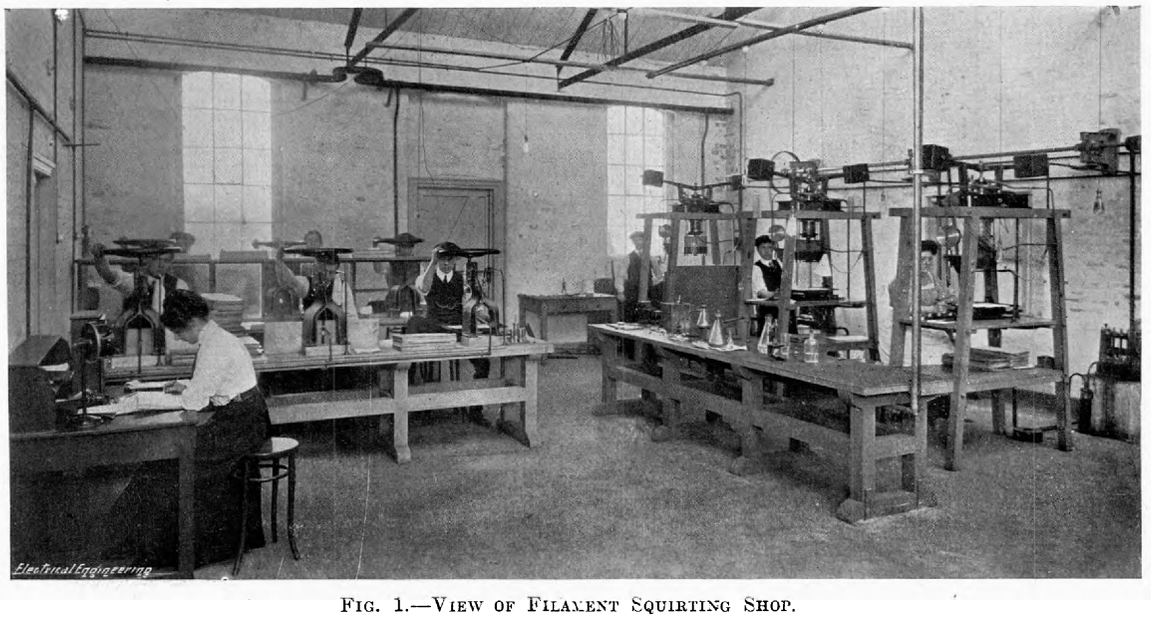


FIG. 1.—VIEW OF FILAMENT SQUIRTING SHOP.

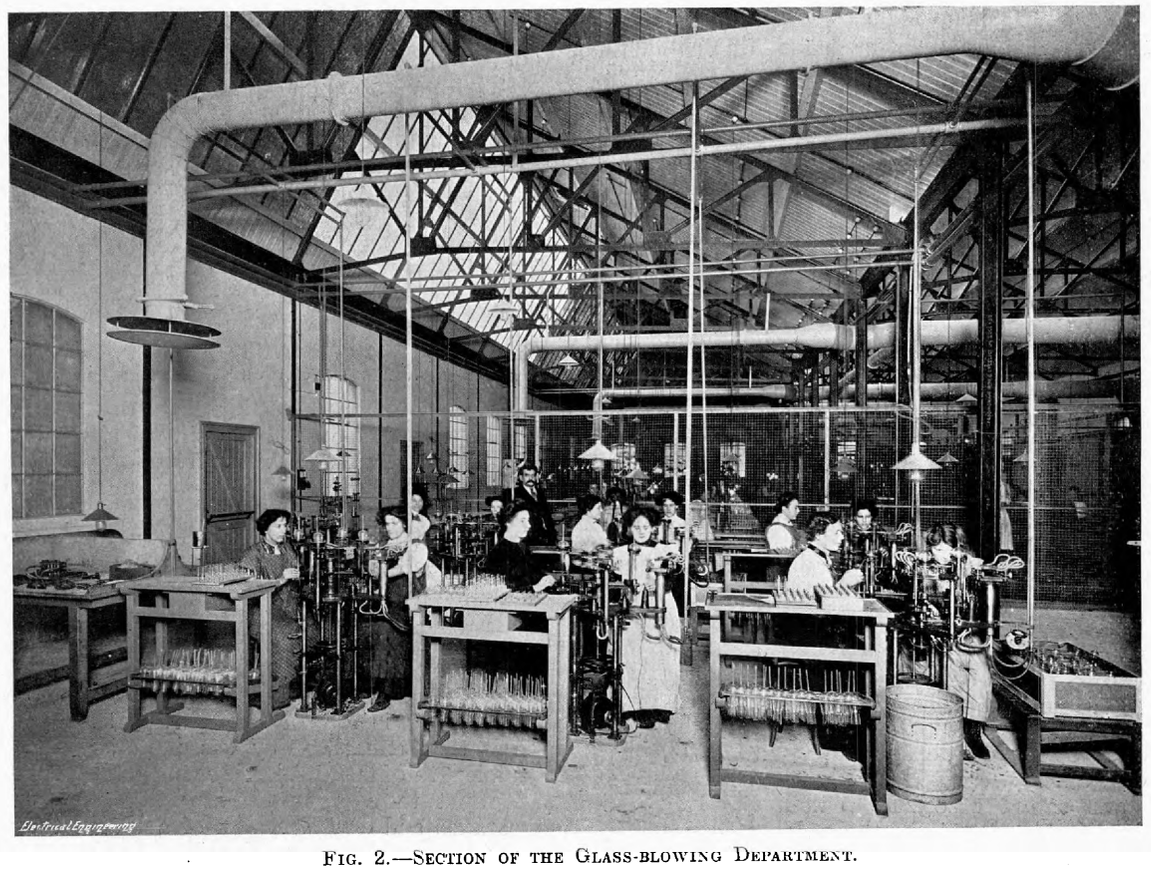


FIG. 2.—SECTION OF THE GLASS-BLOWING DEPARTMENT.

C

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The Kuzel colloidal process is employed in the manufacture of the filaments. Pure metallic tungsten is produced in a colloidal form—the very highest state of sub-division—and is then worked between calenders into a sufficiently coherent mass for "squirting." This so-called squirting process consists in forcing the metal through diamond dies, out of which the filament comes continuously at a rapid rate, and is guided on to a tray of white paper. The filaments for the lamps of ordinary size are finer than a human hair, ranging from about one-fortieth of a millimetre upwards in diameter. Fig. 1 is a view of the squirting shop. In some of the machines the pressure is applied by hand, but in others (those seen worked by girls in the illustration) hydraulic pressure is employed. The filament is then cut to the approximate length required, and laid up U-shaped in bundles, and after being baked is passed on to the forming shop. Here each filament is placed in a pair of clips under a bell jar, and a tungsten wire is hung at the bottom of the U as a weight. The jar is then partially exhausted, and a certain amount of ammonia gas is let in, and current is passed through the filament, bringing it up gradually to a white heat. This is controlled absolutely automatically by a motor, so that the current is gradually increased up to a certain value, and then automatically switched off. The weight at the bottom of the loop gradually draws it down to the elongated V-shape used in metal filament lamps. As an indication of the magnitude of the operations, we may mention that there are 80 girls employed at the forming benches, each of whom can form a maximum of 600 filaments a day, and that the shop will shortly be doubled in capacity. Next, the filaments are cut to accurate length, weighed on torsion balances, and sorted according to their weight. The weight of each filament is in the order of one milligramme, and the lightness of touch and dexterity of the girls in handling the fine and barely visible threads of wire throughout these processes is remarkable.

Equal lightness of touch but greater skill is required in the mounting shop, and the rapid and accurate work shows that the girls have had exceedingly good instructors, besides having displayed considerable aptitude in becoming adepts in the few months that the works have been in operation. The skill and certainty in the successive operations of joining up the leading-in wires, and mounting and pasting the filaments is marvellous. In the mounting shop, the glass tube for the leading-in wires is first cut into short lengths, and then opened out. The leading-in wires are formed of short lengths of copper, platinum, and nickel wire welded together, the platinum being a short length to pass through the glass. We understand that a new material is being introduced in place of the platinum, which has, as platinum, the same coefficient of expansion as glass. The leading-in wires are inserted in their glass tube, which is pressed round them after being softened in a blow-pipe flame, the central glass stem is made with its circle of thin and flexible nickel hooks at the other end, and the filaments are placed in position and "pasted" to the lower nickel wires with a paste of finely divided tungsten paste. Then the pasted joint is electrically welded in an atmosphere of hydrogen, this operation being performed under a glass bell (Fig. 3). A thick screen of glass is fixed in front of the bell jar to protect the operator's eyes in the event of a slight explosion and shattering of the glass, which might occur if the welding be started before the bell is entirely full of hydrogen.



FIG. 3.—FUSING THE FILAMENTS TO THE LEADING-IN WIRES AND SUPPORTS.

The filament, securely mounted on its support, is then welded into a stemmed bulb in the ordinary manner, and the lamp passes to the exhausting benches. Rotary mercury pumps are employed; the glass stem at the end of the bulb ultimately to be drawn down to the "pip" is dipped in a chemical compound, the bulb is then exhausted by the pump, and sealed off with a length of tube projecting, and finally the filament is brought to a state of incandescence until the appearance and disappearance of a bluish tinge in the bulb gives the signal for the final sealing off. These concluding processes in the manufacture of the lamps have been purposely described more or less superficially.

The lamps are then tested, classified, and capped in the usual way.

In concluding this article, we must express our thanks

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to Mr. E. Scharrer (General Manager and Secretary of the Company), Mr. G. Luedecke (the Works Manager), and Mr. J. J. Chiswell (the Sales Manager), for the indefatigable energy and patience with which they showed us over the works, explaining everything, replying to innumerable questions, and showing us a cordial and hospitable welcome.

SOME NEW ELECTRIC COOKING APPARATUS

SIMPLEX CONDUITS, LTD., are introducing a new system of electric cooking, to be known as the "Zoroaster" system. The only element used in the system consists of a high-resistance alloy mounted on mica in various ways, according to whether it is being applied to roasting, grilling, or boiling. In the water heating apparatus the application of the element differs considerably from what has been usual up to the present. The bottom of the water container carries a raised groove in which the element is inserted, so that practically an immersion heater is obtained which gives a very high efficiency.

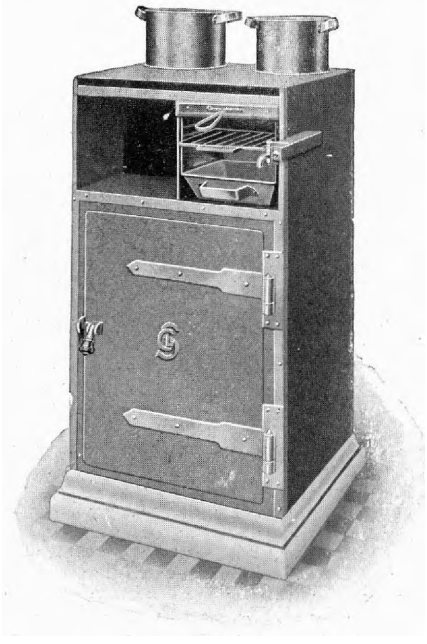


FIG. 1.—"ZOROASTER" LARGE OVEN.

Two types of ovens are now being introduced, the larger pattern being built of sheet steel plates with a cast-iron door resting on a suitable moulding. The internal dimensions of the oven are 18 in. by 14 in. by 14 in., and the whole of the oven is suitably lagged to the extent of 2 in., and is therefore thoroughly insulated against loss by radiation. The top of the oven is arranged for carrying out the subsidiary operations necessary in the preparation of a meal other than roasting; it is finished in bright polished steel, and divided into four sections. The two back sections are arranged as water boilers, a vessel containing the water, made of copper, being sunk into the top of the oven. The heating elements are arranged in the manner previously described. In addition to being able to boil water a steamer is supplied with the oven for using on top of the container, and although only one tier is included, two or three more may be added if necessary. These water boilers are of one gallon and three-quarter gallon capacity respectively, and suitable draw-off taps brought out to the front of the ovens are arranged for. The two front sections are also electrically heated, the right-hand side being arranged as a grill on top of which a kettle may be placed for water boiling. On the left-hand side there is a hot plate which may be used for frying and so forth. The chamber underneath the hot plate may be used for warming dishes. The total loading of this oven is 5 kw., degrees of heat (3 in the case of the oven) are arranged for in each case with the exception of the grill.



FIG. 2.—COOKING OUTFIT IN USE AT SIMPLEX SHOWROOMS.

The outfit can work for ten persons, and a recent test was carried out in the London showrooms of the company, putting into practice the oven for preparing a meal for seven persons, consisting of one quart of soup, six cutlets, 7 lbs. sirloin of beef, 2 lbs. of potatoes, 2 lbs. of sprouts, and twelve mince-pies. All this was prepared in slightly over two hours from the starting of the oven, at a consumption of 5·08 B.O.T. units, which works out at something under 1d. per person for the meal. Three or four additional persons could have been catered for without any great increase in the cost of current, as the oven was not fully occupied whilst the meat was being roasted. The actual outfit used is shown in Fig. 2. A smaller oven of similar nature is also made, and a combined cooker is being introduced, consisting of a grill and water-boiler similar to that used on the top of the oven, with a chamber for keeping food warm. This is shown in Fig. 3.

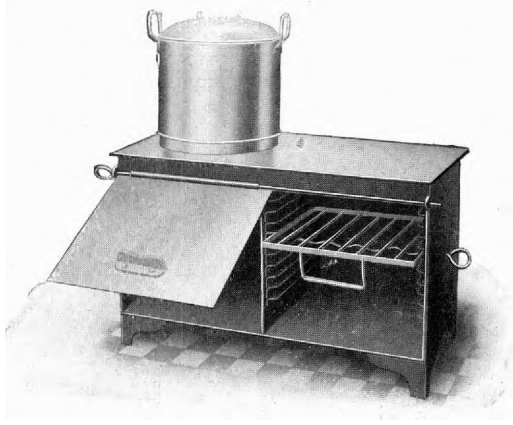


FIG. 3.—"ZOROASTER" COMBINED COOKER.

Osram-Robertson Dance.—A fancy-dress dance was held by the Osram and Robertson employees at the Brook Green Lamp Works on Saturday, January 14th. There were about 300 present, and prizes were presented by Mrs. C. Wilson to five ladies and three gentlemen for the most effective costumes.

The Buenos Aires Exhibition.—It is gratifying to learn from the revised list of awards at the recent Land Transport Exhibition in Buenos Aires that 83 Grand Prix were awarded to British exhibitors against 70 gained by Germany. The total number of awards is 926, of which 229 were taken by Great Britain, 170 by Germany, 155 by Italy, and 122 by France.

Leicester Chamber of Commerce Year-Book.—The first issue of a Year-book by the Leicester Chamber of Commerce is well calculated to stimulate interest in trade affairs in the important centre of the hosiery and elastic web trades. One of the objects of the publication is to demonstrate that Leicester possesses all the attributes of an economical manufacturing locality, and full particulars are given of the facilities for electric supply, communication, water supply, and so on. The book also contains an interesting historical sketch, and information as to sites for factories, &c.

Testing of Telephone Cables.—In a Paper read on January 16th at the Institution of Post Office Electrical Engineers, Mr. L. J. Sell described the tests applied during the drawing-in and jointing of paper-core telephone cables for electrostatic capacity, continuity, absence of crosses, resistance, freedom from contact, insulation resistance, absence of cross-talk, and pressure. The author advocated the use of the "looped end" (one end of the cable only being open) against the method of a "free end" (with both ends open), and discussed the advantages and defects of three methods of looping. In connection with the localisation of faults, the difficulty usually experienced with P.C. cable, of all wires being faulty, was noticed, and Messrs. Henley & Davage's patent for overcoming the difficulty by including an I.R.- or G.P.-covered wire in the cable was mentioned. The present method of desiccating with dry air was considered and criticised. Two alternative methods were suggested: one being to exhaust moist air by a pump and admit dry air; the other, the use of dry air with a varying pressure. In the discussion, the possibility of better results being obtained by other instruments (*e.g.*, the Secohmmeter and Bridge Megger) were suggested, and a graphic method of locating a pressure leak by taking observation of falling pressure at the two ends of the cable was described.

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LONG-DISTANCE TELEPHONY

THE adjourned discussion of the Paper read before the Institution of Electrical Engineers on December 15th by Major W. A. J. O'Meara (Engineer-in-Chief to the General Post Office), on long-distance submarine telephone cables was concluded on January 12th. The Paper, in an abbreviated form, together with a report of the discussion, was given in ELECTRICAL ENGINEERING, December 22nd, p. 807. The Paper was concerned mainly with the new cable between England and France, and reasons were given why coil loading was adopted in preference to continuous loading.

MR. HERBERT SAMUEL (the Postmaster-General) said that in his room at the House of Commons he had been able to test the difference in speech between London and Paris on the old and new cables, and commented upon the extraordinary superiority of the new cable. The Chief Engineer to the Post Office had promised, if the Treasury would provide the necessary means, he would even establish telephonic communication between London and Calcutta at no great distant date. It was the desire of the Post Office to extend as rapidly as possible the radius of telephonic communication and to reduce the charges. Thanks to the new cable, they would be able in the near future to reduce by 50 per cent. the charges for communication between London and Paris. The Post Office was no longer a mere institution which sold stamps and carried letters, but was already the largest electrical business in the country.

Mr. F. GILL (Engineer-in-Chief to the National Telephone Co., Ltd.) could not reconcile the attenuation constant given by the author for the new cable with the stated gain of 17 miles of standard cable. He believed the attenuation constant was correct, but that the gain should be 14·28 miles. He thought the author had shown that continuously loaded submarine cables had no claim except when the mechanical difficulty prevented the use of loading coils, and it would seem that Messrs. Siemens had got over this difficulty. In the case of land lines the unsuitability of continuous loading was even more evident on account of the extra diameter of the cable requiring increased lead sheathing and duct space. With regard to the continuously loaded cable designed by Sir John Gavey, assuming that this had a length of three miles, it could be replaced by a 70 lb. cable with two small loading coils, which would give equivalent speech. The National Telephone Co., he continued, had numerous short lengths, aggregating 2,500 miles of loaded cable, working. As an example, in a 3½-mile length of 20 lb. cable they had two coils, and the equated length was reduced from 3·5 to 1·9. At present they had no cable with only a single coil, but experiments indicated that with one coil only in a short length, an improvement of 1·2 to 2 could be obtained. He thought that if Dr. Thompson carefully considered his proposal for parallel loading, he would see that it was entirely unsuitable for telephone conditions. He did not think there was any need, as yet, for a change in nomenclature. It was useless to give the attenuation constant without stating at what frequency it was measured. He then described the method of "duplexing" two telephone circuits by forming a third "phantom" circuit by means of repeating coils. Although there would be a loss on the two "physical" circuits, after a certain length there would be a gain on the phantom circuit, which, in fact, would be better than the two physical circuits before the coils were introduced. Making certain assumptions with regard to the land lines, he estimated that the old circuit from London to Paris had an equated length of 23·4, and the new, an equated length of 15·18. If the old cable were duplexed, a gain of about 10 miles might be expected on the phantom circuit, so that it would give a better result than that obtained by the new cable. Still, there would be a loss on the two physical circuits; and the question arose as to whether it was not possible to limit these to short distances, and to let the phantom circuit take care of the long distances. He would like to know whether it was proposed to load the aerial circuit on the new cable, and also whether both sections of the line were to be duplexed. Mr. Carty had shown it was possible to make a further improvement by loading the phantom circuit, but, of course, this was not possible at the time the new Anglo-French cable was laid.

Mr. DANE SINCLAIR (British Insulated & Helsby Cables, Ltd.) said that although scientifically and practically the Pupin coil method was the best, yet it was the duty of every engineer to see if he could get something nearly as good or better in some other way. If Pupin coils were introduced every three miles between London and Glasgow, it would be like reintroducing the old test-boxes, which were the cause of so much trouble to telegraph engineers. Sir John Gavey had approached his company some time ago with a view to producing the same results without such an enormous number of boxes. They found they could get an improvement of something like 60 per cent. by putting iron round the copper, and 102 per cent. improvement was obtained on short lengths. He did not agree with Mr. Gill that the cost of the pipe was so important, as in most cases sufficient duct space was already available. His experiments went to show that at least 100 per cent. improvement in the speaking could be had at an extra cost of 50 per cent. by using a quantity of iron which was just equal to half the weight of copper.

Mr. F. TREMAIN (Engineer-in-Chief's Department, General Post Office) gave some further particulars of a composite core telephone cable designed by him in 1901 for the Anglo-Dutch service, and referred to in the appendix to the Paper. With regard to the possibility of establishing communication between London and Astrakan with 800 lb. conductors, he pointed out that this would involve the use of 1,600 tons of copper, which, including the cost of the wayleaves, would give a total cost of the aerial line for each submarine cable pair of £152,000. It would seem worth while, therefore, to pay a considerable sum for a slight improvement in the submarine cable connecting up the aerial line, as it might render possible a reduction of gauge for the aerial wire. Loaded aerial lines, he said, would be much more susceptible to interference from outside sources than unloaded wires. With regard to the objections against aerial lines, he believed that a pair of the London-Glasgow telephone wires, which weighed 300 tons, and should equal 9 miles of standard cable, were in practice only equal to 14 miles on account of the underground portions at each end. In connection with Dr. Thompson's suggestion, he had tried inductive shunts early in 1901, but had found that the improvement was very slight as compared with that obtained with much smaller inductances in series.

Mr. B. DAVIES (Eastern & Associated Telegraph Companies) described a number of experiments carried out on an artificial line in the laboratories of the Associated Telegraph Companies, with the object of producing a distortionless cable. An absolutely distortionless cable was produced, but although the signals came out crisp and sharp, they were very attenuated, and the idea of distributed loading was abandoned because the plain cable gave considerably higher speeds in the majority of cases.

Mr. W. W. COOK (National Telephone Co., Ltd.), referring to the possibility of speaking between London and Astrakan or Calcutta, thought the author had not attached sufficient importance to the point raised by Sir John Gavey regarding the reduction in the effective conductivity of these long lines. He hoped that the improvements in loading submarine cables would result in greater attention being paid to communication between England and Ireland. At present, to get from the south of England to the south of Ireland the route was by way of Scotland. Referring to the line between London and St. Margaret's Bay, he mentioned that 79½ miles of this was 800 lb. conductors, the remaining being of lighter gauge. A slight improvement in the short lengths of lighter wire would have enabled a 400 lb. wire to be used for the main length, thus saving 28½ tons of copper. From the tests in the paper he calculated that the experts had only just been able to speak over a distance of 95 standard miles, and if that were so, speaking between London and Astrakan could hardly yet be considered.

Mr. ALBERT CAMPBELL (National Physical Laboratory) gave the results of some tests carried out at the National Physical Laboratory for Sir John Gavey and Mr. R. K. Gray on lengths of cable continuously loaded with iron strip. Tests at different frequencies showed that the leakance was practically proportional to the frequency; inductance was constant, and the effective resistance was almost constant except at the highest frequencies. He thought there was more future for continuously loaded cables than there appeared to be at present. The important factor was the value of permeability for low values of $\mathbf{H}$. He gave some results of tests on the permeability of iron strip before and after winding on the copper core, which showed that to get the best results it was necessary to anneal the strip in hydrogen after it had been wound on the core, as winding the strip neutralised the good effects of annealing. This annealing more than doubled the initial permeability for very low values of $\mathbf{H}$. With such cables he thought it would be possible to calculate the constants accurately from the known value of the permeability. He had previously recommended the use of silicon and aluminium alloys of iron annealed in this manner for this purpose.

Mr. W. M. MORDEY showed a permeability curve for stallov iron at very low values of $\mathbf{H}$. Up to a value of $\mathbf{B}$ equal to 2, the induction was proportional to $\mathbf{H}$. A curve of retentiveness showed that this was zero at about $\mathbf{H}=0{\cdot}1$. There would, therefore, be no hysteresis at this point, and it would seem to be the most favourable condition for continuous loading. These irons also gave a very high specific resistance, which was also advantageous. Winding the strip on the core would not reduce the permeability much, but might increase the hysteresis considerably.

Mr. W. P. GRANVILLE thought the statement that a three-fold

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improvement had been obtained by the use of loading coils, whilst perfectly correct, was somewhat fallacious. It really came to a consideration of what could be done with a given amount of money. By using 400 lbs. of copper and 270 lbs. of gutta-percha instead of 160 and 300 respectively, he said that a gain of double could be obtained without the use of loading coils. Such a cable would give the maximum effect with only 20 milli-henrys of inductance against the 50 rendered necessary by the use of a small conductor, which was used in the new Channel cable, whilst there was a 25 per cent. gain in the attenuation constant. Further, this cable would enable the use of fewer inductance coils, enabling them to be spaced further apart, thus reducing the mechanical difficulties. He thought they would have to look to larger conductors lightly loaded in order to get the best results, with perhaps some form of air space, and this really brought them back to the continuous form of loading introduced by Krarup on the Continent.

Mr. B. S. COHEN (National Telephone Co., Ltd.) said the National Telephone Co.'s experience went to show that light conductors heavily loaded were better than heavy and unloaded cables. Probably better results would have been obtained from the Channel cables if the end loading coils on either side had been placed in the cable house instead of half a knot out; the improvement might have been 10 per cent., as it would have given a certain amount of loading on the open wire line serving the submarine cable. He showed some curves to demonstrate the effect of leakance on a 200-mile length of 200 lbs. open copper line loaded to 0·052 henrys per mile. When the insulation resistance was about 0·2 megohms per mile loop, the loaded line was no better than the unloaded as regards speaking. When the insulation resistance was 2 megohms per mile loop, the loaded cable showed to its full advantage above the unloaded and remained at this value almost independently of the insulation resistance. Thus, with ordinary maintenance, leakance should not play a serious part in reducing the efficiency. He agreed with Mr. Gill as to the inadvisability of departing from the present "standard-mile," and also mentioned instances in which different expressions were used by different people for the same thing in connection with attenuation constant and wave-length constant. He thought they would be able to do away with speech testing in the future and substitute some method which would eliminate the personal equation, but he could not follow Mr. Whalley's argument when he stated that the speech tests made on the Anglo-French cable were not satisfactory. The people making the tests had not become expert, and this accounted for the discrepancy in the results. With regard to Dr. Thompson's method of parallel loading, curves were shown giving the variation with frequency in the attenuation constant on a 20½ miles lines. For ordinary cable, the attenuation constant varied between 0·09 for a frequency of 600 and 0·12 for a frequency of 1,100, while with parallel loading a very much greater variation was obtained.

Mr. J. G. HILL gave comparative figures in support of his contention that speech tests were in close agreement with the results of electrical tests.

Mr. J. E. KINGSBURY disagreed with the possibility of eliminating the human element, as any instrument used would have to be calibrated by the human voice. He rather thought that Major O'Meara intended his statement as to talking between London and Calcutta to be illustrative.

Major O'MEARA briefly replied to one or two points, and will communicate his full reply in the Journal. He had been reported as having said in Paris that it would be difficult or impossible to maintain a loaded cable, but this was not correct. The point was that cables broke down in the majority of cases because ships in distress dropped their anchors and got hold of the cable, and the easiest way to release themselves was to cut the cable. Only three faults on the cable between London and France were due to different causes, and none to faults in manufacture. Successive repairs might easily result in a 100 yards or so of additional cable being added, and then, of course, an unequal spacing of loading coils arose, and that was the point which he had wished to make in Paris. If Dr. Thompson would give some further information as to the inductance that should be inserted and the spacing for some particular cable, he would be only too pleased to give his system of loading a trial on a subterranean circuit, but there were reasons why parallel loading was not one that could be considered in the case of submarine cables. With parallel inductances considerable difficulty would be experienced in localising faults. Professor Fleming had asked whether the dielectric current was a true conduction current; he rather thought it was a polarisation current. These cables were tested with continuous current at 100 volts, and so far there was no appearance whatever of anything in the nature of conductance leakage. In reply to Mr. Whalley, he said that the voice tests did not agree exactly because they were made under very different conditions. Of course, there might be certain reflection losses owing to the arrangement of the circuit. In the speech tests the average frequency was taken, and the differences to which Mr. Whalley drew attention were due to the fact that on the Continent they used a different testing frequency. He hoped that eventually one frequency would be used in all countries.

LIBRARY LIGHTING

ON January 16th the Illuminating Engineering Society commenced a discussion in conjunction with the Library Association, on the lighting of libraries. The subject was introduced, in a non-technical manner, by Mr. J. Duff Brown, the Islington Borough Librarian, and Mr. L. Stanley Jast, Croydon Borough Librarian, who indicated the chief requirements of efficient library lighting. Neither of these gentlemen spared their criticism of the attitude of architects hitherto in sacrificing efficiency of illumination to their love of symmetry of the fitting, with the general architectural features of the buildings with which they deal. Mr. John Darch, an architect, suggested that there should be legislation to enforce sensible illumination of public libraries in the same way that there had been legislation in connection with factory lighting. The one general principle agreed upon at the meeting was that there should be some form of general lighting of the rooms, with local lighting of tables, book shelves, &c. The object of the discussion was, if possible, to arrive at some standard of illumination in this connection. Mr. L. Gaster and Mr. J. S. Dow had been conducting an investigation into the illumination of various public libraries, in order to assist in achieving this object.

Mr. L. GASTER said that in connection with the lighting of the Carnegie Library, Pittsburgh, it was decided that all naked lights should be avoided. Holophane globes were used for the general lighting, and there were also table standards from which the reader's eye was completely protected, the shades being so arranged that considerable light was distributed sideways. The standard of illumination for the tables was fixed at 5 ft. candles. Reference was next made to the Patent Office library. Standards had recently been put upon the tables, and whereas originally the illumination was only 1·6 ft. candles, it was now from 10 to 12 ft. candles. At the same time he thought the standards were too far apart, as it left a considerable portion of the tables in comparative darkness. The library in the new building of the Institution of Electrical Engineers was very inefficiently lighted, but he would not criticise this installation because it was still being experimented with. Undoubtedly, table lamps would have to be installed.

Mr. J. S. Dow said that after a tour of many public libraries in London, his impression was that he rarely met a case in which the intensity of the illumination on the book was too low. One fault was the too frequent use of naked lamps, and the glare resulting from them could easily be avoided by a small change in the shade. Prof. Weber had laid it down that when the relative brightness on the book to that of the surroundings was more than 100 to 1, then there was an effect which was trying to the eye. He had not come across a case in which this existed. At the North Islington library the illumination on the tables was only 2 ft. candles. There was a very inefficient shade used at Islington, and in this connection he expressed the belief that it would be easy to devise a shade which had a polar curve, so that more light would be thrown sideways than downwards. At the Fulham reading room the newspaper standards were badly lighted, the illumination at one portion of the sheet being 4 ft. candles, and at another 0·4 ft. candle. Indeed, the ceilings had a greater illumination than parts of the newspapers. In the students' reference room in this library the illumination was 3 to 4 ft. candles, and the surface brightness of the surroundings 0·3 ft. candle, giving a very pleasant effect. The defect at the Islington Central library was that the lamps projected below the shades, and affected the eye of the reader. The lighting of the Surveyors' Institution, London, was one of the worst examples which he investigated. The illumination on the tables was only 0·5 ft. candle, and on the bookshelves it varied from 0·4 to 0·16 ft. candle. At the Royal Colonial Institute there was only general lighting by means of holophane globes, but owing to the surface brightness, the lighting was quite good. He believed the Patent Office officials preferred the table standards a good distance apart in order to provide room for books which were only being referred to occasionally by the reader. One of the best examples of library lighting was to be seen at the British Museum. There was an immense dome with five arc lamps hung very high up in specially frosted globes, and, in addition, 300 shaded table lamps, and nowhere was the illumination less than 3 to 4 ft. candles on the tables. It should be pointed out that all the speakers in the discussion were of the opinion that electricity is the only possible illuminant for libraries.

The discussion was adjourned until Monday next, January 30th.

Electric Power in German Mines.—According to *The Mining Journal*, over one thousand million units were utilised in German mines during 1909, 700,000,000 units being used in the coal mines of Westphalia and Upper Silesia. It is also stated that in some collieries where the electricity is generated from waste heat, and where from 5 to 10 million units is consumed per annum, the cost per unit, including interest and depreciation, amounts to from 3/16d. to ⅜d.

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ELECTRIC COOKING

A PAPER entitled "Electric Heating as Applied to Cooking Apparatus," by Mr. H. Gray was read at the meeting of the Manchester Local Section of the Institution of Electrical Engineers on January 17th. The author emphasised the importance of robustness and reliability in electric cooking appliances, and strongly advised all such apparatus to be earthed. Passing on to questions of efficiency and cost, he said that gas (at 2s. 6d. per 1,000 cu. ft.) gave 20,000 B.Th.U. for 1d., while electricity (at ¾d. per unit) gave 3,400 B.Th.U. On this basis he worked out results of tests of water evaporation by gas and electrical heating, showing, in the case of gas, an average cost of 0·156d. per lb. of water evaporated, including heat required to raise the water and cooking vessel from cold. The efficiency varied a good deal with various types of electrical apparatus, being, for example, 91 per cent. for a self-contained saucepan and 62·4 per cent. for a flat-bottomed earthenware pot on a hot plate. The best figure arrived at was 0·275d. per lb. of water evaporated, including heating up. Tests with ovens in which a known quantity of bread was baked in a measured time gave 0·116d. per lb. of bread for gas, and 0·076d. for electricity at the same prices as above. The fact that the electrically-cooked bread took a shorter time to cook than that done in the gas stove is attributed to the more uniform heat in the electric oven, and the door not having to be opened so often. From the tests generally, it is seen that with the small cooking vessels gas is cheaper than electricity at the prices named, but with ovens there is a great advantage lying with electricity. The total amount of energy taken by the small pots and pans in working practice is only a small proportion of the energy taken in oven work, so that in general practice there is little reason to doubt that for overall economy electricity can and does compete with gas in price if suitable apparatus is forthcoming.

Comparing various classes of apparatus, he said that the hot-plate system had the advantage that the plates, not having to be moved, could be efficiently earthed. The cost of the hot-plate system was less than the self-contained one, and the simplicity of operation was much improved. The principal objection is the lower efficiency; whether this low efficiency was a serious disadvantage or not depended on the price per unit paid. A price above ½d. per unit was likely to render this system prohibitive, except where price considerations are of no moment. In the self-contained system, no attempt was usually made at earthing, and the use of flexibles and plugs was also a disadvantage.

The design of ovens was then considered. A working temperature of about 350° F. should be attainable in about 15 minutes. There should be uniform heat throughout the cooking area, and a steady movement of the hot-air currents in the correct directions, to avoid "airlocks" round the food. The arrangement adopted by the writer (described in ELECTRICAL ENGINEERING, Sept. 8th, 1910, p. 573) was to generate the heat at the bottom, deliver it then into vertical "flues," the flues passing it into the oven proper at the top. The hot air is then forced from the tops by fresh hot air continually rising in the flues—through all the area containing food—to the bottom, where it again comes in contact with the heating elements, and the process then repeats itself. With regard to retaining the heat in the general body of the oven, the general practice is now to have the oven double-jacketed with the hollow walls filled with dry air retained in a cellular state by means of finely divided asbestos or slag wool. Both of these materials give excellent results if the jacket is made 1½ in. to 2 in. thick. The switchgear and connections require to be carefully thought out, and to be as simple as possible. The author prefers the use of a small controller operated by one handle for controlling the degree of heat to several tumbler switches.

The author described a convenient switchboard, mounted on a cooking table, in which the flexible leads are attached to the board, plugged on to the apparatus when required, and drawn out of the way when not in use by counterweights, after the manner of the cords on a telephone switchboard. It was sometimes inconvenient that a more continuous degree of heat regulation could not be obtained, and the use of a water-heater with three heats in series with an ordinary cooking utensil to give an extra number of steps was suggested.

The high cost of electric cooking apparatus was sometimes a source of complaint, but was principally due to the output as yet being limited, and the designs not firmly established, hence manufacture on factory lines with large outputs is not being undertaken. The price per unit at which power can be obtained for domestic uses, continued the author, will ultimately be the most important factor. Two public authorities already supply at ½d. per unit. A considerable number charge 1d., and the range of prices in the future is likely to generally be between these two figures. A charge of over a 1d. per unit will generally confine the use of electrical cooking gear to well-to-do people with whom the somewhat increased cost over gas or coal is negligible compared with the advantages obtainable. At ¾d. per unit, and with apparatus turned out in quantity, nothing should in the future stop great developments. It must not be forgotten that the amount of power and heat which houses can absorb must be throughout the country more than that taken in industrial works, and an enormous field is thrown open for development.

DISCUSSION.

Mr. S. J. WATSON (Borough Electrical Engineer, Bury) inclined rather to the hot-plate system, in spite of its lower efficiency, and was interested in Mr. Gray's system of regulation by a series water heater. He thought that the variation of the charges in different places from ½d. to 3d. per unit was absurd, and believed that the rateable value system of charging would be largely used in the future.

Mr. A. J. CRIDGE (Sheffield Corporation Electricity Department) thought that the term efficiency was rather misused in connection with heating apparatus, as the whole of the energy used was turned into heat. He considered that 3 kw. was excessive for an oven, and regarded the use of a thermometer as unnecessary. Cooking was not purely a question of temperature. The "Telephone" system of charging had the disadvantage that, being based on the size of the installation, it prevented people from installing apparatus as freely as they otherwise might. Light, shiny ovens, such as the "Tricity" oven, wasted much less heat than black, heavily-lagged apparatus, as the latter radiated much more. Threepence should cook a lunch for twelve persons.

Mr. F. S. GROGAN (Berry Construction Co.) showed some examples of "Tricity" apparatus, and said that the extended adoption of electric cooking was largely a matter of educating the public. He advocated hiring out of appliances by the supply authorities at a moderate rental. He had shown by tests that gas at 2s. 6d. per 1,000 cu. ft., and electricity at 1d. per unit gave a small balance in favour of electricity, and thought that Mr. Gray's figures for gas were too low. He was strongly in favour of the hot-plate system. He agreed with the last speaker that lagged ovens were very expensive to work, and regarded the complete outfit described by the author as being out of all proportion in first cost to what the public were prepared to pay. As regards boiling water in bulk, electricity could not compete with coke or gas.

Mr. J. FIRTH had made tests which agreed pretty well with the results in the paper. The thing that was keeping electric cooking back was the first cost of the apparatus. He suggested that rheostatic control would sometimes be found useful.

Mr. EUSTACE THOMAS called attention to the case of a country house with an independent suction gas installation. With a slightly larger plant than required for lighting only, the cost of the extra units required for working would be less than that of working by gas or coal.

Mr. J. S. PECK (British Westinghouse Co.), said that cooking apparatus was not so satisfactory for voltages of 200 or over, as for lower pressures.

Mr. T. H. HURST also spoke, and the author replied briefly.

Annual Dinner of the Birmingham Local Section of the Institution of Electrical Engineers.—The fourth annual dinner of the Birmingham Local Section of the Institution of Electrical Engineers was held on the 18th inst., at the Grand Hotel, Mr. M. R. Railing, Chairman of the Section, presiding over the assemblage, which numbered upwards of 100 members and their guests. Mr. Railing, in proposing the toast of the Institution, said that the Midlands were nearly the centre of the electrical industry of the country, and that the many large works in the district compared very favourably with those in any other country. Major W. A. J. O'Meara, C.M.G., responded, in the unavoidable absence of Mr. Ferranti. He regretted that the public did not appreciate the advantages which they derived from engineers. He considered that engineers were themselves to blame, as they did not take a sufficiently active part in public affairs. Mr. H. Hirst gave the toast of the Birmingham Local Section, and referred to the great advantage to trade, due to the existence in their midst of the Birmingham University and the Technical School. Mr. A. M. Taylor, Vice-chairman of the Section, in responding, said that the Section, which started ten years ago, now numbered 400 members. He prophesied plenty of work for all branches of the profession when the greater Birmingham scheme was approved. Mr. R. K. Morcom proposed the electrical industries and the guests, and Mr. C. H. Wordingham and Mr. T. Harding Churton replied.

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THE MERZ-PRICE SYSTEM

THE Paper by Messrs. K. Faye-Hansen and G. Harlow describing the Merz-Price system of protection and certain modifications thereof, recently read in Manchester, was further discussed last Wednesday by the Birmingham Local Section of the Institution of Electrical Engineers.

Mr. A. M. TAYLOR (Birmingham Electric Supply Department) pointed out that the systems described by the authors involved the scrapping of all the overload trips with fixed and inverse time limits which had only just been installed. He thought that the auxiliary resistance employed by the authors was good for current balancing. With regard to cutting out a faulty section, it did not appear that this was effected until the current had reached a very high value. Relays would operate in $\frac{1}{60}$ second, but oil switches required a much longer time, perhaps $\frac{1}{5}$ to $\frac{1}{2}$ second—a period sufficiently long to allow of serious damage being done. He had devised a switch which would operate in $\frac{1}{300}$ second, and which therefore broke the circuit before the current wave had reached more than, say, a quarter of its maximum value. He had also devised a relay, the action of which became more powerful as the voltage dropped, and he hoped to be able to arrange a system of discriminating relays which would obviate the necessity for the use of pilot-wires. These increased largely the cost of the cable system, and involved greater risk of breakdown. He inquired what was the effect of heavy faults on a system protected by Merz-Price gear with regard to the coming out of step of synchronous machines.

Mr. A. D. CHAMEN (South Wales Electric Power Distribution Co.) considered the Merz-Price system necessary on a large A.-C. distribution. The proposal to dispense with relays and batteries and use A.-C. trips was not a good one from the point of view of maintenance. It was a very simple matter to overhaul and test periodically a relay and battery, but it was a more difficult matter to do this in the case of an A.-C. trip. Although only two pilot wires were necessary, extra transformers and resistances were required, and he did not think there would be any great reduction in the cost. Capacity troubles had already been quite overcome. As regards sensitiveness, the short-circuit current at a fault initially reached a higher figure than that given by the authors, but in case of a fault the section was cut out before it had time to affect the running of synchronous plant. The Merz-Price gear did not entirely remove the need for overload relays, which were still required at places. He used fixed time-limit relays on feeders and instantaneous relays on interconnecting cables. In the case of a bank of generators the Merz-Price gear was very useful, even if it did not cut out a machine when a fault occurred between turns on one phase. As a rule, such a fault soon developed into one between phases when the gear came into operation. With an overhead system of supply mains, the breakage of a wire caused a high-resistance fault owing to the bad earth, and consequently the current was not large enough to operate the trips. To remedy this he had to run a catenary wire, which joined up all the earth wires on each pole.

Dr. KLOSS (Siemens Bros. Dynamo Works, Ltd.) thought that the great merit of the Merz-Price system was that it cut out a fault during development, whereas an overload relay required the current to reach a high value. He asked whether the harmonics which occur on E.H.T. systems would not have an effect in upsetting the balance. The switch suggested by Mr. Taylor would, by its rapid action, induce an extra high voltage due to the high rate of change in the value of the current.

Dr. GARRARD (General Electric Co.) put in a plea for simplicity. The Merz-Price system involved a quantity of auxiliary apparatus and pilot cables, which meant greater liability to breakdown and necessitated new trenching. Duplicate feeders, he thought, should not be connected to the 'bus-bars, as in that case they did not form a proper reserve. The balanced current system was the most easy to test. He saw no need to join up two generating stations to the same main; it was better to arrange for separate running with interconnecting links in case of necessity. The Merz-Price system of protection was not, in his opinion, of much use for generators.

Mr. G. HARLOW, replying to the discussion, said that fixed and inverse time-limit devices still had their place. No trouble was experienced with synchronous plant. The high value for short-circuit currents was only reached at points close to the station, and the saturation of the transformer magnetic circuits prevented this increasing beyond a certain value. The Westinghouse oil switch operated in one-tenth of a second. With reference to Mr. Chamen's criticism of the modification due to the authors, the A.-C. trip was quite easy to test. With the pilot wire broken, the trip operated with 30 per cent. of full load. He claimed that the cost of the authors' system was less than that of the relay and battery arrangement. It was a difficult matter to balance transformers exactly. Fixed time-limit overload protection was necessary at the generating end of a feeder. He agreed with Dr. Kloss that there was a possibility of trouble due to harmonics.

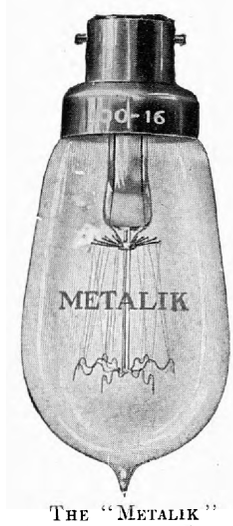
CATALOGUES AND PAMPHLETS, &c., RECEIVED

MINING SWITCHGEAR.—A pamphlet from Messrs. A. Reyrolle & Co., Ltd. (Hebburn-on-Tyne), contains a reprint from a contemporary of a paper by Mr. H. W. Clothier on "Mining Switchgear," which was read before the National Association of Colliery Managers at Edinburgh in November last.

AUTOMATIC SWITCHGEAR.—A new edition of the catalogue of "Empire" electric control gear has been issued by Electric Control, Ltd. (177 Reid Street, Bridgeton, Glasgow). An important production of this firm is the line of noiseless automatic A.-C. solenoid switches and controllers. Other specialities illustrated are controllers for A.-C. and D.-C. lifts, and suitable for car-switch or push-button operation, gear for the automatic and remote control of air-compressors, hydraulic accumulators, pumps, printing-presses and machine tools, A.-C. lift brakes, &c. All the contacts are of the individual lever type positively and separately operated, and there are no sliding contacts. Some hand-operated switches with quick make and break are also listed.

"METALIK" LAMPS

WE have from time to time referred to the various new and modified patterns of the "Metalik" lamp supplied by Messrs. G. M. Boddy & Co. (15 Gray's Inn Road, London), and we now have a further improvement to chronicle. In ELECTRICAL ENGINEERING, October 27th, 1910, p. 684, a description was given of a special lamp adapted for factories, &c., where there is much vibration. The composition of the filament itself is the same as that of the original "Metalik" filaments, and the efficiency is as high (namely, 1·25 watts per candle), but the filament is arranged in a larger number of shorter loops, which results in a much stronger lamp. As shown in the figure, each loop is supported at the bend by a hooked wire with a wave or loop at its centre to give increased elasticity. This lamp was then only supplied for pressures up to 125 volts, but can now be obtained in the high-voltage sizes, so that mill-owners and others, whose premises are wired for 200 or 240 volts, can now use the anti-vibration lamp.



THE "METALIK" ANTI-VIBRATION LAMP.

"Metalik" lamps are notable for their long burning lives. Results of life and efficiency tests carried out on these and other lamps by Mr. F. H. R. Lavender, and described by him in a Paper read before the Birmingham Section of the Institution of Electrical Engineers, were given in ELECTRICAL ENGINEERING, Vol. V., p. 1047, while further life curves of "Metalik" lamps were given on p. 1065 of the same volume. These showed that the drop in candle-power during the first 1,000 hours was negligible. The average life of these lamps is, we are informed, well over 2,000 hours, and in some cases very much longer lives have been recorded.

At the firm's showroom in Gray's Inn Road, is an ingenious motor-driven rocking apparatus, which subjects a bar, on which are mounted several "Metalik" lamps, to successive jerks. The lamps are not affected by this severe treatment, thus demonstrating the toughness of the filaments. Recently, the firm received a letter from the manager of a provincial theatre, stating that two 50 c.p. "Metalik" lamps had been in constant use for three years, the estimated burning hours being between 8,000 and 9,000. They had, he wrote, been taken down and cleaned dozens of times without injury.

All these lamps are manufactured by the Philips Metallic Glowlampworks, Ltd.

Aeronautics.—Mr. A. R. Low will deliver a course of eight lectures, together with drawing office work, on "The Design and Calculation of Aeroplanes," at University College, on Fridays, at 5.30 p.m., beginning February 3rd. A visit will be paid to the aviation ground at Brooklands. Further particulars may be obtained from the Secretary of the College.

Electric Fire Signals.—Messrs. Merryweather & Sons, Ltd. (Long Acre, London), have installed an electrically worked syren at the Letchworth Garden City for warning the inhabitants of an outbreak of fire. The syren itself is coupled direct to a small totally enclosed motor, and mounted in a weatherproof casing on the top of a high pole. A fire-alarm push with glass-fronted case is fixed at the base of the pole. The motor is worked from the main supply, the necessary fuses and series resistances being placed in a weatherproof box.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published January 19th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

29,985/09. **Telephone Relay.** S. G. BROWN (London). This specification relates to improvements in the type of relay described in Patent No. 11,135/08, in which the current variations in the secondary circuit are produced by the alterations in length of a minute gap. (See abstract of Mr. Brown's Institution Paper on this relay in ELECTRICAL ENGINEERING, Vol. VI., p. 305.) This patent covers the use of carbon or carbon and metal electrodes at the gap mounted on a vibrating metal strip, which can be adjusted. The length and resistance of the gap are regulated by an electromagnet in the local circuit, which includes the gap. The electromagnet is shunted by a resistance or a capacity, or is surrounded by a copper sheath, in which eddy-currents are set up, to neutralise the self-induction. Four figures.

30,548/09. **Telephone Condensers.** C. CORDES (Magdeburg). Insulating substances of high dielectric capacity are produced from vegetable or animal oils, such as castor oil, by treatment with hydrogen in the presence of a finely divided metal, which acts as a catalyser. Double the capacity for a condenser of given size is claimed as compared with paraffin condensers.

30,566/09. **Motor Starter.** A. H. CURTIS and ADAMS MANUFACTURING CO., LTD. This is a starter of the reciprocating rod pattern, described in ELECTRICAL ENGINEERING, Vol. VI., p. 247, but adapted for automatic or remote control by means of a solenoid or a motor and worm gear. Ten figures.

205/10. **Motor Starter.** W. R. ANSELL (London). A starter for small portable motors has, in addition to the usual stepped resistance, a second set of resistances controlled by another handle or switch for connecting in series so as to adapt the apparatus for working off different supply voltages. Three figures.

1,518/10. **Wireless Telephony.** A. A. JAHNKE and S. C. TATE (San Francisco). A heavy-current transmitter for wireless telephony consists of two iridium-platinum electrodes enclosed in a chamber filled with carborundum granules. One electrode is attached to the main diaphragm. The annular wall of the chamber is of porous material, and alcohol or other volatile hydro-carbon is forced into the chamber through this wall. The evaporation of the alcohol cools the granules. One figure.

7,488/10. **Machine Construction.** CROMPTON & CO., LTD., J. C. MACFARLANE and H. BURGE. A form of construction suitable for small four-pole dynamos and motors consists in making the yoke rectangular and parallel to the armature spindle, so that it forms a support for the bearings. The pole pieces are attached two at the top and two at the bottom, and are readily detached without removing the armature. One figure.

8,167/10. **Enclosed Flame Arc Lamp.** CARBONE ARC LAMP SYNDICATE, LTD. (*T. L. Carbone, Charlottenburg*). This patent covers an improved construction of globe for enclosed flame lamps, as described in specification No. 17,448/09. The lower chamber of the globe opens into long closed tubes, which rise on the outside of the globe, and in which the vapours are condensed. One figure.

9,076/10. **Arc Lamp Carbons.** GEBR. SIEMENS & CO. (Berlin). Carbons for flame arc lamps are impregnated with, or have cores of a mixture of one or more oxides of cerium, lanthanum, didymium, or zirconium, with oxides of calcium, strontium, and barium. A compound of calcium oxide with cerium peroxide is a suitable substance, and the addition of fluor spar tends to prevent hissing of the arc.

23,671/10. **Insulating Material.** C. F. PEIERSON (Schenectady). Fragments of mica are pressed together with an adhesive substance between layers of a yielding material, such as asbestos. Six figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: SIEMENS-SCHUCKERTWERKE GES., 12,483/10.

Dynamos, Motors and Transformers: MAVOR, HOBART, and MAVOR & COULSON, LTD. [System of obtaining variable speeds with polyphase motors] 30,556/09; MISSOTTEN [Automatic control of internal combustion engine generating set] 9,222/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Mfg. Co., U.S.A.*) [Motor control] 17,341/10; SIEMENS-SCHUCKERTWERKE GES. [Reversing polyphase motors] 28,661/10.

Electric Ignition: R. BOSCH, 19,242/10; UNTERBERG & HEMLE [Contact-breaker for magneto system] 22,040/10.

Electrometallurgy and Electrochemistry: BRYNE [Primary cells] 568/10; AKTIEBOLAGET ELEKTROMETALL [Regulating electrodes of smelting furnaces] 12,430/10; A. W. PENROSE & Co. (*Benedict*) [Electro-typing] 16,709/10.

Instruments and Meters: LUCAS, WALMSLEY and WALMSLEY [Apparatus for distributing electricity] 4,115/10; HEADING and WILLIS [Coin-freed meter] 6,902/10; SIEMENS BROS. & Co. (*Siemens & Halske A.-G.*) [Determining direction of equalising currents in A.C. apparatus] 22,224/10.

Switchgear, Fuses & Fittings: BENSTEAD and ARON [Motor-car lamps] 97/10; BEIN [Adjustable support and contact device for electric fans] 212/10; VENNER and GRIESBACH [Time switches] 1,296/10; MIDDLETON and BAKER [Fuses] 13,311/10; SIEMENS-SCHUCKERTWERKE GES. [Fuses] 18,528/10; VIETTE [Bell-call indicators] 18,678/10; HOUSKEEPER [Contact devices for moving conductors] 24,911/10.

Telephony & Telegraphy: BAKER [Electrical transmission of drawings and photographs] 361/10.

Traction: HARDY [Vacuum brakes] 20,584/10; WOODS and GILBERT [Machine for dressing rails] 22,669/10 and 22,670-1-2/10.

Miscellaneous: MORISON [Exhaust steam accumulators] 28,223/09; NEWITT [Commutator grinder] 28,340/09; SIEMENS BROS. & Co. and HIRD [Measurement of thrust of shafts] 28,353/09; CONNOR and WILKINSON [Signs] 510/10; JEVONS and GREEN [Electric welding] 6,553/10; SIEMENS BROS. DYNAMO WORKS and KIEFFER [Automatic non-return valves] 20,090/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: KUNKEL [Machines] 29,941/10.

Incandescent Lamps: SCHILLING [Manufacture of metal filaments] 23,639/10.

Instruments, &c.: BESANCON [Hour meter] 28,884/10 and [Meter mechanism] 28,885/10.

The following amended Specification can now be obtained.

PALMER [Prepayment meter] 10,802/10.

Opposition to Grant of Patents

22,783/09. **Smoke Consumption.** S. O. COWPER-COLES. Opposition has been entered to the grant of this patent. The specification describes a boiler furnace with a lining of refractory material at the rear of the firebridge with means of supplying air to it. Various constructions are illustrated, and an improved means of covering the cross tubes with refractory material is described.

28,210/09. **Advertising Sign.** A. W. LEONARD. This patent is opposed. It covers an electrically-driven and illuminated advertising device in which transparent advertisements are exhibited successively through apertures in a box. The advertisements are brought to rest for a time in front of the apertures, and are only illuminated during this period.

2,983/10. **Tungsten Filaments.** WESTINGHOUSE METALLFADEN-GLUHLAMPENFABRIK GES. (Vienna). The opposition to the grant of this patent has been withdrawn. The specification, abstracted in ELECTRICAL ENGINEERING, Nov. 3rd, 1910, p. 700, describes a process of decarbonising tungsten filaments in a vacuum furnace.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

2,801 of February 2nd, 1897. **Transformers.** A. F. BERRY. This is the fundamental patent covering the construction of the well-known Berry transformer, in which the iron laminations are arranged radially round a centre, so as to form a cylindrical iron shell, the primary and secondary windings being wound one over the other in the annular space between the core and outer members of the shell.

The following are the more important Patents that have become void through non-payment of renewal fees.

Instruments, &c.: R. BELFIELD (*E. M. Tingley and O. B. Shallenberger, U.S.A.*) [Phase-displacing arrangements for meters, etc.] 22,852/97; R. T. and J. G. GLOVER [Prepayment meters] 19,855/01; COMP. ANON CONTINENTALE POUR LA FABR. DES COMPTEURS À GAS [A.C. motor meters] 12,801/03.

Switchgear, &c.: H. LEITNER and R. N. LUCAS [Automatic regulator for train-lighting dynamo] 21,144/04.

Traction: G. GIBBS and H. PEARSON [Construction of motor coaches] 13,176/03; J. T. CADE [Automatic electrical signalling] 15, 737/03; J. W. CROSS [Vacuum brakes] 19,976/05; R. MAW [Braking and starting of electrical vehicles by compressed air] 20,005/05.

Miscellaneous: T. LOWE [Smoke consumption] 22,614/97; S. LAKE [Electric submersible winch for floating stranded vessels] 20,840/98; S. C. DAVIDSON (Sirocco Works) [Mounting of electric-fan casings] 21,821/02; E. BACHELET [Electro-medical apparatus] 21,138/04; I. H. PARSONS [Electric clock mechanism] 19,906/05; H. HAWTHORN [Fire alarms] 20,051/05.

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OSRAM, BODDY, AND PHILIPS LAMPS

Result of Patent Action: An Osram Success: Important Agreement

PREPARATIONS for an important patent action, to determine whether or not the lamps manufactured by Philips' Metallic Glowlampworks, of Eindhoven, Holland, and sold in this country by G. M. Boddy & Co., infringed the patents owned by the manufacturers of the Osram lamp, have been proceeding for several months. The Osram Lamp Works, Ltd., had retained the services of two of the leading counsel who are particularly eminent in patent cases, viz., Sir Alfred Cripps, K.C., and Mr. A. J. Walter, K.C., and also Mr. Colefax and Mr. Lunge, and as expert witnesses Sir James Dewar, Dr. Liepmann, Mr. James Swinburne, and Dr. Silvanus P. Thompson; while for Messrs. Boddy & Co., Mr. W. R. Bousfield, K.C., Mr. H. Terrell, K.C., Mr. H. Fletcher Moulton, and Mr. Kenneth Swan had been retained as counsel, and Prof. H. Ballantyne, Dr. Otto Hehner, and Mr. C. O. Bastian as expert witnesses.

On Monday last, however, it was announced in court, before Mr. Justice Parker, that an agreement had been arrived at between the parties, and that the defendants, Messrs. G. M. Boddy & Co. had agreed to judgment being entered against them, with costs.

We are in a position to state that the terms of the arrangement between the parties are mainly as follows: The Philips Metallic Glowlampworks have agreed to take a licence under the two patents in question and to pay the Osram Lamp Works, Ltd., a substantial royalty upon all lamps which they import into the United Kingdom. All these lamps, whether sold directly by Messrs. Philips or through their agents, are to be marked "Philips, U.K." A scale has been fixed by which the number of lamps imported by the firm year by year is to be limited, although the numbers which have been fixed will permit of a substantial business being done in them, so that undoubtedly a fair proportion of the lamps produced at the large Philips works at Eindhoven will still come to this country. In addition to these restrictions, a clause has been included to control prices and discounts, and thus to prevent price-cutting. The royalties paid will be chargeable on all lamps imported since January 1st, 1911, and up to the year 1918, towards the end of which the fundamental patent will expire. The claim for retrospective royalties previous to the beginning of this year has been waived.

We understand that it is not the intention of the General Electric Co., Ltd. (who are the selling agents of the Osram Lamp Works, Ltd.), to increase prices above the present figures, but, on the contrary, prices of Osram lamps will be reduced gradually, as hitherto, as the cost of production diminishes and the demand develops. In fact, it is not unreasonable to expect that the price of sizes of 100 watts and upwards will shortly be lowered, for the increased output of these is rendering it possible for special machines to be set aside entirely for the glass-blowing work on these sizes.

The two patents upon which the action was brought are No. 23,899 of 1904 and No. 16,503 of 1907.

No. 23,899 of 1904 granted to Dr. A. Just and F. Hanaman, of Vienna, describes a process of manufacturing filaments of pure tungsten by mixing finely divided tungsten or tungsten compounds such as tungstite, tungstic acid, or tungstic sulphide with an organic binding medium such as collodion, or a solution of cellulose in chloride of zinc or cupreous ammonia oxide. The filaments squirted from the resulting paste are then carbonised (in some cases after denitration), and the carbon is then removed by passing current through the filament and raising it to a high temperature in an atmosphere of steam and hydrogen. The carbon is oxidised to form carbonic oxide, and a filament of pure tungsten is left. The filaments are then rendered uniform by submitting them to the action of current in an atmosphere of volatile tungsten compounds in the presence of a large quantity of hydrogen, whereby the tungsten deposited equalises the filaments.

This patent was published in full in ELECTRICAL ENGINEERING of Sept. 9th, 1909, after the grant of an amendment by the Comptroller.

No. 16,503 of 1907, granted to Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft), relates to the leading-in wires and the wires which support the filaments. A platinum wire can be successfully fused round the end of the filament, but when nickel wire is used, frequent breakages occur owing to the tungsten forming an alloy with the nickel, which melts in the arc, and thus causes a reduction in the section of the filament near the joint. When copper wire is used there is difficulty in preventing the filament end from escaping out of the fused globule of copper before the latter has solidified. According to this invention, a wire of two metals, in the form of an alloy, or of two wires twisted together, or a wire of one metal coated with the other, is employed, for example, copper or silver wire coated with nickel or iron. The first claim of this patent is, broadly, for "attaching tungsten filaments to the fused ends of current leads, in electric glow-lamps, wherein said leads consist of two different kinds of metal, one of which forms an alloy with tungsten, whilst the other does not."

Although the Philips lamps will now be made under licence, and it is an open secret that definite agreements for "pooling" patents have been made with the British Thomson-Houston Co., the Sunbeam Lamp Co., and the Westinghouse Co., and possibly one other whose name is now familiar to our readers, we are waiting with interest to see whether there will be further developments of the patent situation; for the Osram people, in view of their victory in the present case, may, as they have already cleared their decks for action, use their formidable armament against other manufacturers. In addition to the two patents selected in the present case, the Osram Lamp Works, Ltd., own a large number of others, and these two are by no means the only ones relating to processes in metallic filament lamp manufacture to which they attach importance. Of these, two patents known as the "weighting" and "forming gas" patents respectively are particularly worthy of mention.

No. 8,563 of 1907, granted to the Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft) of Berlin, describes a method of ensuring that the contraction which takes place when a filament squirted from a paste is sintered, shall be uniform along the filament. If there is a lack of uniformity, there is a danger of the spots at which the resistance is higher attaining a higher temperature, and so shortening the life of the filament. To prevent these bright spots being formed, the filament is subjected to a slight tension during the process of sintering by hanging a small weight such as a tungsten hook from the filament at the bend of the loop. This not only ensures uniform contraction, but gives the sintered filament the required pointed shape.

No. 18,622 of 1906, granted to P. M. Justice, London, and communicated by the Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft), describes a process for removing the carbon from the carbonised filaments produced by the method described in 23,899/04, referred to earlier in this article. Instead of the carbon being oxidised, it is carried away in the form of a compound, not with oxygen, but with nitrogen and hydrogen. The carbonised filament is caused to incandesce in an atmosphere of ammonia (or a mixture of hydrogen and nitrogen), and the carbon is carried away in the form of cyanogen and hydrocyanic acid. This method is easier to carry out than the steam-hydrogen method, and there is no danger of the tungsten filament being attacked.

Telegraph Traffic and Movements of Cable Ships.—On 17th inst. the cable between Dakar and Konakry was interrupted, and on the 18th that between Hongkong and Macao broke down. —The *viâ* Hanekine route was restored on the 20th inst., and the El Arich route on the 22nd inst.—The Hongkong-Macao section was restored on the 21st inst.—The French company have still to complete the repair of the Cape Haiti-Puerto Plata section.—The French Cable Company's steamer, the c.s. *Contre Amiral Caubet*, was less busy than her sister ship in the West Indies, the c.s. *Pouyer-Quertier*, for she did not leave port during December last. The c.s. *Minia*, of the Anglo-American Telegraph Co., was engaged on a repair of the 1873 cable off Heartscontent, Newfoundland, and returned to Halifax, N.S., on Dec. 29th.

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Important Notice to the Public.

METAL FILAMENT LAMPS.

IN THE HIGH COURT OF JUSTICE, on the 23rd day of January, 1911, before the Hon. Mr. Justice Parker, an injunction was granted in favour of the Osram Lamp Works restraining G. M. Boddy & Co., their agents, etc., from infringing Letters Patent No. 23899 of 1904, and No. 16503 of 1907, under which amongst other Letters Patent

OSRAM LAMPS

are manufactured.

The Trade and the Public are hereby warned against selling or using infringing lamps.

The General Electric Company, Ltd.,

beg to notify the Public that no possible risk or liability can be incurred by the Public in purchasing or using Osram Lamps or lamps sold under license from them.

OSRAM LAMPS

can be obtained by the Public at all Electrical Contractors, Ironmongers, Stores, etc.

THE TRADE WILL BE SUPPLIED BY THE DEPOTS OF

The General Electric Company, Ltd.,

LONDON, MANCHESTER, GLASGOW, BIRMINGHAM, NEWCASTLE, CARDIFF, Etc.

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LOCAL NOTES

Beckenham: *Sales Department.*—Showrooms have been opened by the Electricity Committee at the corner of High Street and Manor Road. Demonstrations of electric cooking are given daily. The local contractors will receive the profits of any sales effected, after a small percentage has been deducted to assist in paying the establishment charges.

Berlin: *Trolley Omnibuses.*—A trackless trolley line is proposed at Gross Lichterfelde on the Lloyd-Köhler system, which is already in use at Bremen.

Coventry: *Tramway Purchase.*—The Tramway Company is to be given notice requiring them to sell their undertaking to the Corporation on agreed terms, or, failing agreement, by arbitration.

Emsworth (Hants): *Electric Lighting.*—The question of adopting public electric lighting has been referred back to the Lighting Committee.

Greenock: *Disposal of Electricity Profits.*—The Scottish Office has modified its request that all the profits of the electricity undertaking should be transferred to reserve fund. It is now agreed that the sum to be paid into reserve fund each year, shall be increased from £1,000 to £1,500.

Japan: *Water-power Schemes.*—The *Board of Trade Journal*, quoting from a report by the British Commercial Attaché at Yokohama, states that a Government Commission has been established with the object of promoting the development of water-power schemes, and preventing the water-power resources of the country from being exploited by financially unsound individuals or corporations.

London: *Islington: Municipal Wiring.*—The members of the Lighting Committee of the Borough Council, who resigned on the Council refusing to allow the Electricity Department to do wiring work, have withdrawn their resignations. The Committee will report on the question of electricity *v.* high-pressure gas for the public lighting.

Stepney: Periods for Repayment of Loans.—The Finance and Parliamentary Committee report negotiations with the London County Council with regard to closing the account for loans borrowed for a period of 42 years for the electricity undertaking, and to substitute varying periods for different portions of the machinery. This plan is to be adopted, subject to certain conditions.

Manchester: *Tramwaymen's Hours.*—Negotiations between the Tramway Committee and the Tramwaymen's organisation in Manchester are still continuing, but no definite decision has been come to with regard to sending the matters in dispute to arbitration. Before agreeing to this course, the Tramway Committee require certain guarantees from the Men's Union.

Middlesex: *Tramway Centre Poles.*—Many hundreds of residents in Finchley have petitioned the District Council in favour of removing the tramway centre poles in the Great North Road on the ground that they have resulted in the loss of several lives.

Morocco: *Telephones.*—It is stated that the Moorish Government is to purchase the Tangier telephone undertaking, which is at present worked by a Spanish company.

Nelson: *Proposed Tramways.*—A scheme for running tramways between Nelson and Colne is under consideration. If the scheme is carried through, it will be undertaken by the Colne & Trawden Light Railway Co.

New Zealand: *Water-power Development.*—The Board of Trade have been supplied with a few copies of the reports by the Government Engineer-in-Chief on utilising water-power in New Zealand, and also by Mr. Laurence Birks on the same subject. Copies may be obtained at 73 Basinghall Street, London, E.C.

Sheffield: *New Car Sheds.*—In order to accommodate the increase in tramway rolling stock, new car sheds have been erected in Shoreham Street at a cost of about £26,000. There is accommodation for about 100 cars.

West Hartlepool: *Tramway Purchase.*—An arbitration took place in London last week with regard to the purchase by the Corporation of the Foggy Furze and Park tramway routes. Mr. C. A. King was arbitrator, and Mr. C. C. Hutchinson, K.C., and Mr. Tyldesley Jones appeared for the Tramway Company, whilst Mr. Balfour Browne, K.C., and Mr. Clode represented the Corporation. The total claim by the Tramway Company amounts to £20,871 10s., whilst the estimates of the Corporation witnesses amount to between £8,000 and £9,000. The arbitrator reserved his award.

Willesden: *Rating Appeal.*—The Metropolitan Electric Supply Company's property in Willesden, which originally stood at £17,452 gross and £11,635 rateable value, was recently raised by the Assessment Committee to £20,000 and £13,000 respectively. The Company appealed last week at the Middlesex Quarter Sessions against the rateable value, and succeeded in getting this reduced to £8,900.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Edinburgh.—A loan of £75,000 has been sanctioned for electrical extensions.

Finland.—An application has been made on behalf of a London firm for a concession to use water from the Saima Lake for supplying electrical energy in St. Petersburg and Helsingfors, and for working the Finnish railways by electric traction. According to a Reuter telegram, it is proposed to carry the water by means of a tunnel a mile long to Kuurmanjoki, where a generating plant with a capacity of 168,000 h.p. is to be erected. The capital involved is said to amount to over £1,000,000.

Greenock.—An additional turbo-alternator is to be installed at the Electricity Works.

Ipswich.—A 600-kw. or 750-kw. continuous-current turbo-alternator, with surface condensing plant, is required by the electricity department. Particulars from the Chief Electrical Engineer, and tenders by February 9th.

India.—Messrs. Alfred Dickinson & Co., of Birmingham and London, who are the consulting and constructional engineers in connection with the Bombay water-power scheme, are preparing specifications. The preliminary hydraulic works have already been commenced, the contract having been given to Messrs. Pauling & Co., of Westminster.

The Calcutta Electric Supply Corporation require H.T. and L.T. substation switchboards. Particulars from the Secretary, Salisbury House, London Wall, London.

Leek.—A Diesel engine and D.C. dynamo is required for the electricity works. Particulars from the Electrical Engineer, and tenders by February 9th.

London: *St. Pancras.*—A loan of £3,997 has been sanctioned for electrical extensions.

Luton.—A loan of £2,396 has been sanctioned for an additional boiler, economiser, &c., at the Electricity Works.

Mansfield.—Additional plant is to be installed at the power house.

Mexico.—The *Board of Trade Journal* announces that a 20 years' concession for the utilisation of water from the River Cuautitlan, in the State of Mexico, for hydro-electric purposes, has been granted to Jose Luis Requena. Work must be begun within 24 months, and completed within seven years. The concessionaire may set up telegraph and telephone lines, and may build bridges for his private needs. All the machinery and apparatus required for the work may be imported free of duty.

Netherlands.—An electric power station is to be established in the East Friesland district by the Municipality.

Rawtenstall.—An extension to the high-tension switchboard at the electricity works is required. Particulars from the Electrical Engineer, and tenders by February 1st.

South Africa.—The Standerton Council, says the *British and South African Export Gazette*, are about to spend £5,000 upon electric lighting.

Swindon.—The Electricity Committee recommend an expenditure of £3,659 on a new battery, and £6,637 on new generating machinery.

Uruguay.—The *Board of Trade Journal* announces that a 25 years' concession for electric lighting in the town of Melo has been granted to Messrs. Silveria Hermanos, and a 20 years' concession with regard to the town of Trinidad to Messrs. Carbonell & Co.

Wakefield.—The electricity department require an 800-kw. alternator. Particulars from the Electrical Engineer, and tenders by February 14th.



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WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Rebuilding of the Cavendish Rooms, 51/55 Mortimer Street, W.

Cinematograph hall in Herne Hill Road. Messrs. H. Wakeford and Sons.

Buildings in Halpin Place, Walworth.

Buildings on eastern side of Stamford Hill, Hackney.

Extensions to South Eastern District Post Office. Architect, Mr. J. Ruthford, 22 Carlisle Place, S.W.

Gymnasium and Art Room at the Avery Hill College, Eltham. L.C.C. Architect's Department, 19 Charing Cross Road, W.C.

PROVINCES.

Aldershot.—New Secondary School. Architects, Kingham & Kingham, Bank House, Grosvenor Road, Aldershot.

Birmingham.—Extensions to school in Station Road, Harborne.

Bristol.—New Music Hall. Mr. Oswald Stoll.

Darlington.—Elementary School in Reid Street.

Edinburgh.—Electric theatre at 18 to 20 Nicholson Street.

Farnham.—Alterations and additions to Drill Hall premises, Bear Lane. Architects, Robinson & Rhodes, 8 New Court, Carey Street, London, W.C.

Hastings.—Electric lighting at Workhouse.

Hereford.—Secondary School in Widemarsh Street.

Heywood.—Theatre in Market Street.

Leek.—New schools at Baddeley Green.

Liverpool.—Proposed Accident Hospital at Garston.

Newmarket.—New Technical School.

Northampton.—Secondary school for girls.

Wakefield.—Headquarters for West Riding Constabulary.

York.—New lecture theatre at the Museum.

MISCELLANEOUS

Australia.—Tenders are invited by March 8th by the Deputy Postmaster-General at Brisbane for measuring instruments. Particulars from 73 Basinghall Street, London, E.C.

Beckenham.—The street lighting of the Shortlands district will be changed over from gas to electricity as from April 1st.

Glengarnock.—The Glengarnock Iron & Steel Co., Ltd., are to carry out some further public lighting in Glengarnock.

Halifax.—The Corporation require a twelve months' supply of various stores, including lighting fittings, electrical accessories, cable, &c. Particulars from the Town Clerk, and tenders by February 6th.

Ireland.—The Midland Railway Co. of Ireland invite tenders for general stores for twelve months, including telegraph wire, batteries, &c. Tenders by February 2nd.

Leeds.—The Electricity Committee require 1,500 A.C. wattmeters. Tenders by February 16th.

TENDERS RECEIVED AND ACCEPTED

Haslingden.—The tender of Messrs. Simpson Bros. has been accepted at £856 10s. for the electric lighting of the Pike Law Infirmary and other Union buildings.

Limerick.—The tender of Messrs. Johnson & Phillips, Ltd., at £198 has been accepted for the electric lighting of the technical schools, and for an installation of telephones at £23 15s. The tenders in the first case ranged from £198 to £424, and for the telephones from £23 to £44.

London: *County Council.*—The following tenders have been received for electric motors and a 25 kw. motor generator for No. 23 Belvedere Road:—Lancashire Dynamo and Motor Co., Ltd., £581 10s. (motor generator, £168); British Thomson-Houston Co., Ltd., £602 12s. (motor generator, £173); Electric Construction Co., Ltd., £741 10s. (motor generator, £207 10s.); Dick, Kerr and Co., Ltd., £788 (motor generator, £223 5s.); and British Westinghouse Electric and Manufacturing Co., Ltd., £419 18s. (motors only). The tender of the Lancashire Dynamo and Motor Co., Ltd., has been accepted.

The following tenders were received for the wiring at 23 Belvedere Road:—Edison and Swan Co., £385 15s., less 2½ per cent.; General Electric Co., Ltd., £396; Veritys, Ltd. (incomplete), £301. The first named tender has been accepted.

The tender of the Sunbeam Lamp Co., Ltd., has been accepted for a 12 months' supply of electrical fittings, and that of Messrs. Hoopers Telegraph Works, Ltd., for cables and wires.

Hackney.—The tender of the Private Telephone Co., Ltd., at £57 15s. has been accepted for an installation of telephones in the "A" and "B" pavilions at the High Street, Homerton, Infirmary.

Southend.—The tender of the Lancashire Dynamo & Motor Co., Ltd., has been accepted at £1,696 for a battery booster plant.

Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained the contract to supply Tantalum lamps for 12 months for the Royal Mail Steam Packet Company for ship lighting.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 10s. to £58 per ton (last week, £58 to £58 10s.).

Business for Sale.—An electrical installation business is for sale on exceedingly moderate terms. (See an advertisement on another page.)

Western Electric Co.'s Branch Offices.—The Western Electric Co., Ltd., have opened branch offices at 115 Colmore Row, Birmingham; Standard Buildings, City Square, Leeds; and 2 Bank Buildings, Cardiff, where representatives will give personal attention to inquiries for cables, telephones, and electrical supplies in the surrounding districts.

Canada.—Inquiries have been received at the office of the High Commissioner for Canada (17 Victoria Street, S.W.) from a correspondent in New Brunswick for the names of electrical manufacturers in Great Britain using amber mica. We are also informed that a London firm wishes to act for Canadian shippers of mica and asbestos, desiring to develop trade in Switzerland, Germany, Austria, and other Continental countries. Particulars from 73 Basinghall Street, E.C.

APPOINTMENTS AND PERSONAL NOTES

Mr. H. M. Hobart, the well-known consulting engineer and expert in dynamo design, and the author of many widely read treatises on electrical engineering, is leaving England on March 7th to join the permanent staff of the General Electric Co. of America as a consulting engineer. On Saturday last, some 75 friends assembled at a farewell dinner in London under the chairmanship of Mr. H. F. Parshall, and a presentation was made to Mr. Hobart of a silver cup on which the names of the donors were engraved. Mr. Hobart first came to England in 1895 to join the B.T.-H. Co., and in 1900 went to Berlin to the Union Elektricitäts Gesellschaft. Since 1903 he has practised in London, and was retained by several leading manufacturers of electrical machinery in a consultative capacity.

We are requested to announce that the engagement of Mr. M. F. Part, with the Hart Accumulator Co., Ltd., as traveller, terminates on December 31st.

Junior draughtsman required in London office of well-known firm of engineers (see an advertisement on another page).

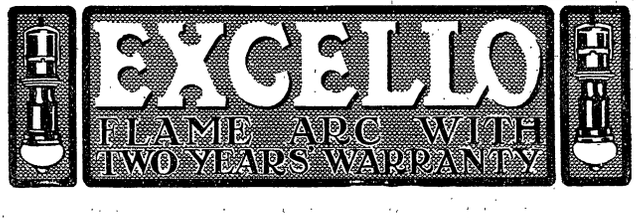
Mr. J. W. Dugdale, General Manager of the Ashton Corporation Tramways, has been appointed to succeed Mr. L. Slattery as General Manager at Oldham.

The salary of Mr. E. Lunn, Electrician-in-Charge of the Huddersfield electricity station, has been increased from £156 to £170.

Mr. A. F. Clement, Telegraph Engineer to the North British Railway Co., has retired under the age-limit. He is succeeded by Mr. David Wells, his assistant for many years past.

Mr. Lewis Slattery, General Manager of the Oldham Tramways, who has been appointed to the L.C.C. Tramways staff, has been presented with a case of cutlery by the tramway employees.

Palladium Stage Lift.—In our description of the electrical equipment of the Palladium Theatre on page 30 of last week's issue, the stage lift was, by an error, referred to as having "Eastman" control. The entire lift, with the push-button control gear, was installed by the Easton Lift Co., Ltd. (Express Works, Short Street, Southwark, S.E.).



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COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

East London Railway Co. The directors' report for the six months to October 31st states that the electrification of the line is still engaging the attention of the Board, and that a survey by a leading electrical company is in course of progress. When this survey is completed, a report will be made as to the approximate cost of reconstruction for electric traction. At the meeting on Tuesday, Lord Claud Hamilton said it had been decided that it was impossible to adopt the single phase system owing to the height of the tunnels. It really amounted to adopting the third rail system, as used upon the other underground railways in London, but the directors were not masters of the situation, either as regards their liberty of action, or the raising of capital. When the survey of the line is completed, the matter will be placed before the lessee companies, and he thought that the Metropolitan and possibly the District Railway Companies would be favourable to assisting in finding the necessary capital.

Metropolitan Railway Co.—The total receipts for the December half-year amounting to £403,169, show an increase of £12,413, whilst the expenditure of £200,147 has decreased by £5,505. A dividend at the rate of 1½ per cent. per annum is recommended upon the ordinary stock, carrying forward £9,498.

Lanarkshire Tramways Co.—After placing £8,500 to depreciation, a dividend at the rate of 6 per cent. per annum for the December half-year is declared upon the ordinary shares, with £1,499 carried forward.

City & South London Railway Co.—After transferring £1,500 to renewal fund, and meeting the 5 per cent. preference dividend, a dividend at the rate of 1¾ per cent. per annum is recommended on the ordinary stock for the December half-year, carrying forward £1,788.

Aron Electricity Meter.—Subscriptions are being invited for an issue of £100,000 five per cent. first mortgage convertable debentures at 97. The debentures will be repayable at 105 by means of a cumulative sinking fund of 3 per cent. beginning April 1st, 1914.

Minnesota & Ontario Power Co.—Subscriptions have been invited for $500,000 six per cent. first mortgage gold bonds. The company is a general trading concern, besides dealing with the supply of electrical power.

London, Brighton & South Coast Railway Co.—The report for the December half-year calls attention to the growth in receipts due to a revival of the third-class traffic, in which there has been an increase of nearly three millions in the number of passengers carried as compared with the corresponding period of last year, a result largely due to the inauguration of electric traction. The capital expenditure during the half-year amounted to £115,712, of which the most important item has been the expenditure upon converting the lines between London and the Crystal Palace to electric traction.

Wireless Telegraph Notes.—Professor Edouard Branly, the well-known wireless telegraph pioneer, has been appointed to the French Academy of Sciences. It will be remembered that there has been some considerable discussion as to whether Madame Curie should be elected.

According to the *Morning Post* Birmingham correspondent, the International Wireless Telegraph Conference, which was to have been held in London this summer, has been postponed until next year.

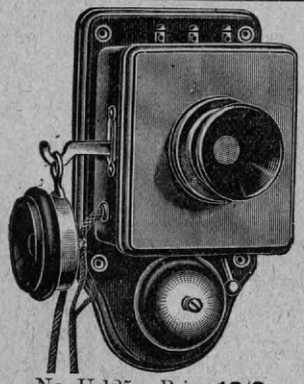
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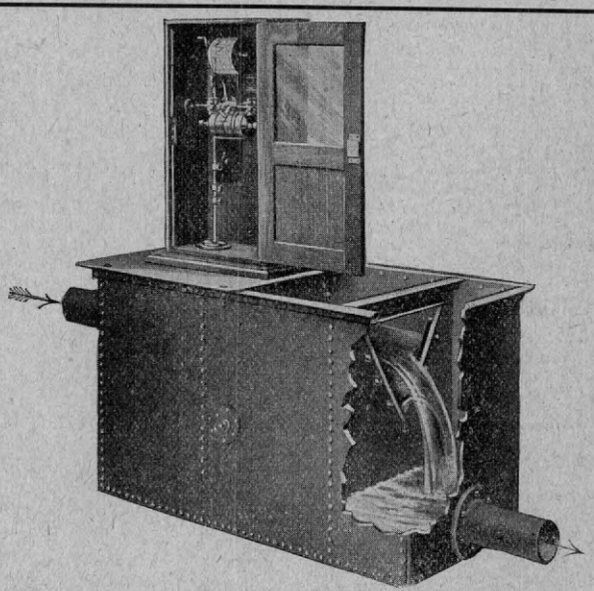
THREE-PHASE TRANSMISSION.
A Practical Treatise on the Economic Conditions governing the Transmission of Electric Energy by Underground and Overhead Conductors.
By WILLIAM BREW, M.I.E.E.,
late Chief Expert Assistant, Dublin Corporation Electricity Supply.
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7, Stationers' Hall Court, E.C., and 121a, Victoria Street, S.W.



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General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Tudor Accumulator Co. Ltd., 119, Victoria St., S.W.

AIR COMPRESSORS.
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AUCTIONEERS AND VALUERS.
Wheatley Kirk, Price & Co., 46, Watling St., E.C.

ALUMINIUM.
British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

ARC LAMPS AND ACCESSORIES.
British Thomson-Houston Co., Ltd., Rugby.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Jandus Arc Lamp and Electric Co., Ltd., Hartham Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Sloan Electrical Co., Ltd., 12, Golden Lane, E.C.

ARMATURE REPAIRS.
Higginbottom (J.) & Co., Blenheim St., Chelsea, S.W.
Marryat & Place, 28, Hatton Garden E.C.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
Concordia Electric Wire Co., Ltd., Cricklewood Lane, N.W.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CLUTCHES (Friction).
Bridge (David) & Co., Ltd., Castleton, Manchester.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Mirrlees Watson & Co., Ltd., Glasgow.
Willans & Robinson, Ltd., Rugby.

DYNAMOS, see Motors and Dynamos

EBONITE.
Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

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United Flexible Metallic Tubing Co., Ltd., 112. Queen Victoria St., E.C.

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Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.
Mirrlees, Bickerton, & Day, Ltd., Hazel Grove, Nr. Stockport.

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British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dowsing Radiant Heat Co., Ltd., 24, Budge Row, E.C.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.
Bertram Thomas, Worsley St., Hulme, Manchester.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.
Phillips (J. W. & C. J.), 23, College Hill, E.C.
Weston Electrical Instrument Co., Audrey House, Ely Pl., Holborn, E.C.

INSULATING MATERIAL.
Weidmann (H.), Rapperswil, Switzerland.

INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.
Ruberoid Co., Ltd., 81 & 83, Knightrider St., E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
The Fredk. Crane Chemical Co., 22 & 23, Newhall Hill, Birmingham.

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British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Horvath (S.), 51, Standen Rd., Southfields, S.W.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Philips Metallic Glowlampworks, Ltd., Eindhoven, Holland.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
Sunbeam Lamp Co., Ltd., Park Rd., Gateshead-on-Tyne.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

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Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

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Taylor & Challen, Ltd., Constitution Hill, Birmingham.

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Bastian Meter Co., Ltd., Kentish Town, N.W.
Bernhard Thormann, 25-26, Wassmannstr. Berlin
British Thomson-Houston Co., Ltd., Rugby.
Ferranti, Ltd., Hollinwood, Lancs.

MICA AND MICANITE.
Jaroslaw (D.), 5, George St., Tower Hill, E.C.

MINE EQUIPMENTS AND APPARATUS.
A. E. G. Electric Co., Ltd., 133-135, Oxford St., W.
British-Thomson Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Phœnix Dynamo Mnfg. Co., Ltd., Thornbury Works, Bradford.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Spagnoletti, Ltd., Goldhawk Rd., W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

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General Electric Co., Ltd., 67, Queen Victoria St., E.C.
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Peebles (Bruce) & Co., Ltd., Edinburgh.
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Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
Wilson-Wolf Engineering Co., Ltd., Bradford.
Wright & Wood, Ltd., Century Works, Halifax.

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Raworth (J. E.), 30, Broadway, Westminster.
Sokal (S.), 55, Chancery Lane, W.C.

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PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

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Krupka & Jacoby, 11, Queen Victoria St., London, E.C.

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Vickers, Sons & Maxim, Ltd., Sheffield.
Willans & Robinson, Ltd., Rugby

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Adams Watkin Co., Ltd., 36, Victoria St., S.W.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Apparatus Co., Ltd., Milford Works, Queen's Rd., Battersea, S.W.
Ellison (George), Warstone Lane, Birmingham.
Ferranti Ltd., Hollinwood, Lancs.
Reyrolle & Co., Ltd. Hebburn-on-Tyne.
Spagnoletti, Ltd., Goldhawk Rd., Shepherd's Bush, W.
Union Electric Co., Ltd., Park St., Southwark, S.E.

TECHNICAL BOOKS AND JOURNALS.
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Colonial Office Journal, Waterlow & Sons, Ltd., Gt. Winchester St., London.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W.
Electric Journal, 422, Mansion House Chambers, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.
Western Electric Co., Ltd., North Woolwich, E.

VENTILATION AND FANS.
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Wilson-Wolf Engineering Co., Ltd., Bradford.

VULCANISED FIBRE.
Mosses & Mitchell, 122-124, Golden Lane, E.C.

WATCHES (Non-Magnetic).
Batty (W.), & Sons, Ltd., Market St., Manchester.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

Our monthly supplement on Electrical Engineering in Mines is included in this issue. It opens with an abstract of a Paper on electric power in collieries by Mr. J. Miller, expressing a preference for three-phase working, and emphasising the advantages of the bar type of coal-cutter. A report is also given of a Paper recently read before the Institution of Mechanical Engineers describing the electrical coal hoists at Clydebank. Other articles include a description of the electrical equipments of an eastern tin mine and a New Zealand coal mine. A report of a Paper on mining switchgear is also given, and the electrical mining patents published during the month are reviewed.

Two interesting Papers on high-tension transmission were read at last Thursday's meeting of the Institution of Electrical Engineers. One by Mr. W. T. Taylor and the other by Messrs. R. Borlase Matthews and C. T. Wilkinson. In both Papers the latest practice in America, where voltages up to 110,000 are in use, was described. Special attention was drawn to the suspension type of insulator and the use of flexible steel towers. Mr. D. C. Jackson (President of the American Institute of Electrical Engineers) opened the discussion. (Page 57.)

A Paper was recently read by Mr. P. V. Hunter before the Newcastle Local Section of the Institution of Electrical Engineers on the design of sub-stations, especially as regards the arrangement of the buildings to contain the plant. (Page 68.)

A system of temperature measurement especially suitable for cold storage rooms consists of a galvanometer reading direct in degrees Fahrenheit, and connected with a source of E.M.F. and resistance coils in the different rooms. (Page 59.)

Among the specifications published by the Patent Office on Thursday last, was one by H. A. Mavor and H. M. Hobart for a variable-speed polyphase driving gear, in which variable pole motors are supplied with current of different phase-numbers and frequencies. Siemens-Schuckertwerke Ges. have patents for the ventilation of flame arc lamps, for cartridge fuses with main and long auxiliary fuses in parallel, and for a method of avoiding sparking when reversing three-phase induction motors. A patent by Mr. S. Z. de Ferranti covering the use of a gland round the spindle of mercury-motor meters expires to-morrow after the full life of fourteen years. (Page 60.)

A novel arc lamp on the principle of the Jablochkoff candle, only self-starting, is being brought out. (Page 61.)

A discussion on systems of wiring was held at the last meeting of the Dublin Section of the Institution of Electrical Engineers. Casing and lead-covered wire were, on the whole, generally preferred to conduit. (Page 61.)

The London County Council recommend the Board of Trade not to grant the Bermondsey Council an Electric Lighting Order in competition with two

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electric supply companies.—Newport Ratepayers' Association have threatened litigation in respect of the finances of the electricity undertaking.—Glasgow Tramways Committee recommend action being taken to secure that the tramways shall be assessed upon one-fourth of their rateable value.—Trolley 'buses are being suggested for parts of Dundee.—An action has been taken in Stoke-on-Trent in respect of alleged vibration from electrical machinery at a cold storage works. (Page 62.)

A 250 KW. motor generator is required at Barking; a number of telephone switchboards in Australia; tramway rails and fishplates in Birmingham; and electrical stores at Salford and Blackburn. Loans are proposed as follows: Dublin, £125,000; Bedford, £22,837; Doncaster, £12,000; Hastings, £2,803; and Stepney, £3,060. Glasgow Corporation have acquired land for the erection of a new generating station. (Page 62.)

A NEW arrangement has been entered into under which Edmundsons Electricity Corporation will manage the business of the Urban Electric Supply Co. The question of greater speed upon the City & South London Railway is under consideration. There was a deficiency of £3,903 upon the past half-year's working of the Great Northern & City Railway Company. A dividend of 10 per cent. is declared by the St. James & Pall Mall Electric Light Company, and 6 per cent. by the National Telephone Company. (Page 64.)

The G.B. System in the Mile End Road.—Before Lords Justices Vaughan Williams, Farwell, and Kennedy, in the Appeal Court last week, the appeal of Sir John Benn against the judgment for £12,000 damages in respect of certain statements made concerning the G.B. surface contact system in the Mile End Road was mentioned. Sir John Benn has consented to pay £250 into Court as security for costs of the appeal, and the Pay Office had refused to accept that sum without an Order of the Court. The Order was granted.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, FEBRUARY 2ND.

Institution of Electrical Engineers.

7 for 7.30 p.m. Annual dinner at Hotel Cecil.

MONDAY, FEBRUARY 6TH.

Society of Engineers.

7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment. Presidential address by Mr. D. A. Symons.

TUESDAY, FEBRUARY 7TH.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At Municipal School of Technology. "Wireless Telegraphy," by A. K. Bentley and B. Hoyle.

WEDNESDAY, FEBRUARY 8TH.

Institution of Electrical Engineers: Birmingham Section.

7.30 p.m. At the University. "The Electrical Undertaking of the Birmingham, Tame, and Rea District Drainage Board," by L. F. Mountfort.

Association of Mining Electrical Engineers: Newcastle Branch.

7.30 p.m. At Armstrong College. Discussion on Design of Induction Motors for Haulage, Pumping, and Coal-cutters, and, time permitting, "Electricity in New South Wales Collieries," by E. K. Scott.

THURSDAY, FEBRUARY 9TH.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. Adjourned discussion on "Long Distance Transmission of Electrical Energy," by W. T. Taylor, and "Extra High Pressure Transmission Lines," by R. Borlase Matthews and C. T. Wilkinson.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science.

FRIDAY, FEBRUARY 10TH.

Institution of Electrical Engineers: Yorkshire Section.

6.30 p.m. Annual dinner at Hotel Metropole, Leeds.

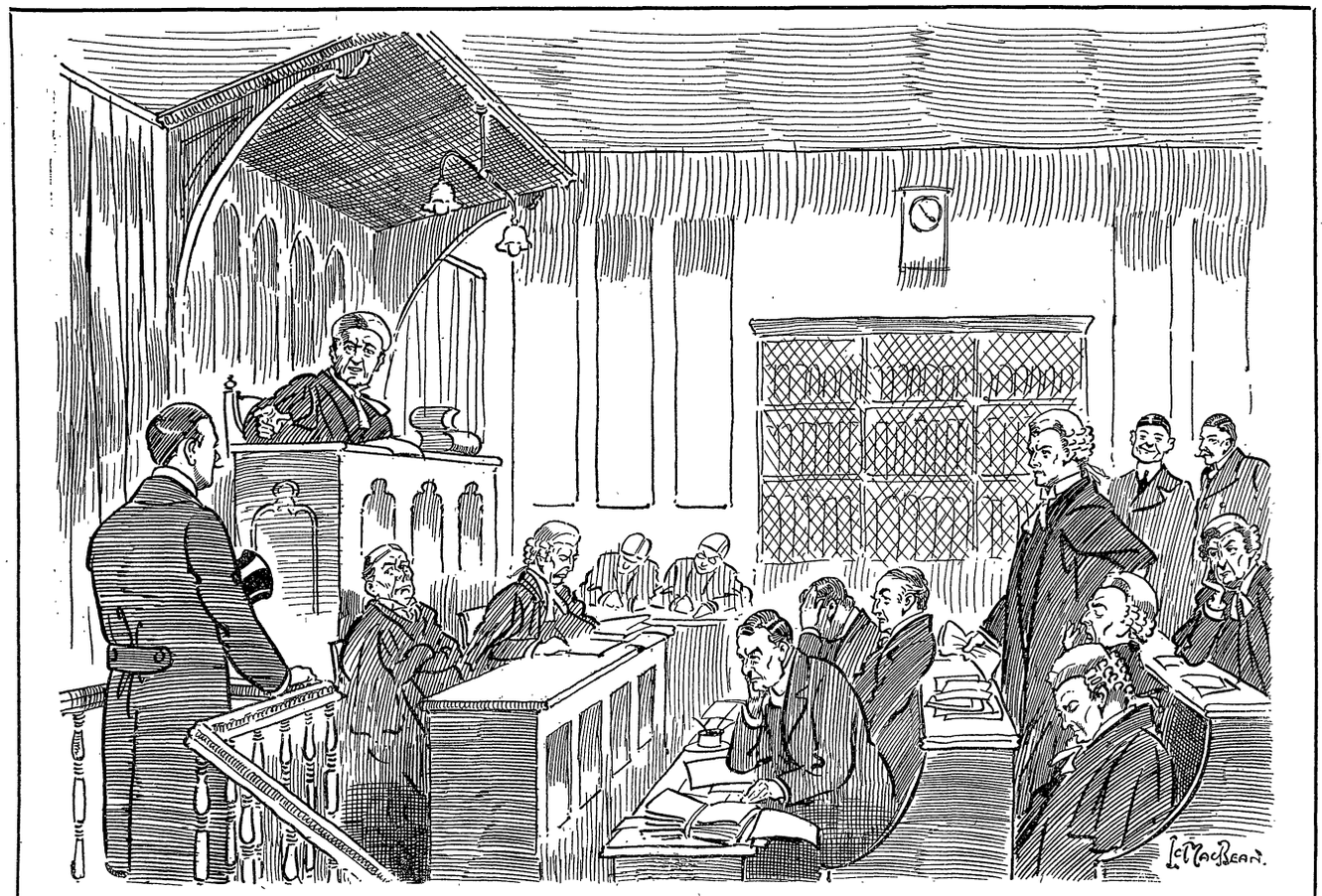
SATURDAY, FEBRUARY 11TH.

Institution of Electrical Engineers: Glasgow Section.

7 p.m. Annual Smoking Concert at the Grosvenor.

Junior Institution of Engineers.

6.30 for 7 p.m. Annual dinner at Hotel Cecil.



JUDGE (*to Witness in a Highly Technical Case*): We have been hearing a good deal during the last three days about the rating of motors. I am not sure that I have grasped the exact meaning of the term. Would you mind explaining to me what are the precise conditions which, in ordinary circumstances, would cause a motor to rate?

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

ELECTRIC POWER IN COLLIERIES

A PAPER with the above title was read before the Rugby Engineering Society by Mr. J. Miller on January 19th. In the author's opinion, it is generally more profitable to instal generating plant at the colliery, but if the load consists mainly of haulage, with little pumping and ventilation, the load factor may be very low indeed, and the plant be running at low efficiency, so that it may be cheaper to take power from a supply company. The author gave figures for a 250-kw. colliery set, which gave a total output of some 25,000 units per month. The capital charges amounted to 0·287d. per unit, and the running costs to 0·438d. per unit, giving a total of 0·725d. per unit. These figures refer to a period when the set was only about a quarter loaded. Power was originally taken from a local supply company at the price of one penny per unit.

The author thinks that only the alternating-current system will be used extensively in collieries in the future, giving as his reasons the greater attention required by D.-C. motors, the advantage of being able to use oil-switches with A.-C. apparatus, and the ease and economy of A.-C. transmission at high pressure. He favours generation of three-phase current at a pressure of 3,300 volts, at which pressure pump and haulage motors could be supplied, while motors near the coal-face would be worked at 500 volts. For the prime-mover, he advocates high-speed reciprocating engines, except where a large quantity of exhaust steam is available, in which case the installation of an exhaust steam turbine is advisable.

For distribution in the workings, the author favours armoured cables down the shaft, supplying a switchboard of the ironclad cellular pattern at or near the pit-bottom. The cables along the roads should also be armoured, and should be hung from wood props by pieces of cord, which will break if there is a fall of roof and allow the cable to fall. The armouring must be efficiently earthed and bonded throughout. Earthing at each individual machine by burying a copper plate in puddled clay has been found satisfactory, but earthing on the surface is probably the safest method. In connection with the question of earthed or insulated neutral, the author points out that the neutral must be earthed if the supply is from a company's mains without an intermediate transformer, as an earth on one phase in one colliery following on an earth on another phase elsewhere may have serious consequences. The possibility of an increase of pressure across the remaining two phases, if one goes to earth in an insulated system, is a serious element of danger, but many colliery engineers still prefer the insulated system. A leakage indicator should be used in all installations, and the leakage current should not exceed one milli-ampere per ampere of the supply. The author then briefly described the B.T.-H. Co.'s system of protection devised by Mr. E. B. Wedmore, and described in ELECTRICAL ENGINEERING, June 2nd, 1910, p. 356.

Pumping methods, continued the author, have undergone a radical change by the introduction of electric power. For underground work, reciprocating pumps of the three or four ram type are employed, as they can be constructed to pump against any head. Squirrel-cage motors can be used, as these pumps can be started light. Turbine pumps require less space and cost less, and are used where the head is constant and not too great. At the Cowie Colliery, Stirlingshire, turbine pumps aggregating 400 h.p. and arranged in three stages have recently been installed by Mather & Platt at a cost, including pipes, of about £1,000, to replace old reciprocating pumps operated with beams by a steam engine. The top lift pump discharges 900 gallons per min. against a head of 144 yards. Electrically-driven turbine pumps of the self-contained vertical spindle pattern are invaluable for sinking operations, one great gain being the elimination of steam losses due to leaky pipe-joints.

Turning to coal-cutters, the author referred to the possibility of working small seams with them without producing an excessive percentage of small coal. The disc machine, used chiefly in long-wall working, where the coal is strong, must be able to start up with more than full load torque, and therefore a wound rotor was essential for A.-C. machines. The bar machine is probably the best type for general use. It is less liable to be held up by coal falling on it, and has the great advantage that a squirrel-cage motor can be employed to drive it, thus obviating the sparking difficulty. It can also be more easily adjusted than the disc machine to follow irregularities in the coal seam. The chain type is extensively used with very soft and friable coal, but does not appear to possess any advantages over the bar type for this class of cutting. After referring to the necessity for interlocking arrangements for the plug connections of the trailing cable, the author emphasises the importance of effectively earthing the motor casing. The motors for coal-cutters vary between 20 and 40 h.p., and are of the totally enclosed flame-proof type. In the case of a certain 26-in. seam of hard steam coal, the underground cost of production per ton was reduced from 5s. 1½d. to 4s. 6½d. by the use of a coal-cutter, including capital charges and repairs. Thus a saving of 7d. per ton was effected, besides the increase in value due to the greater percentage of round coal.

With regard to haulage, Mr. Miller mentions that with main rope haulage (used where a single road is to be worked with gravity return) it is essential that the motor should be capable of starting up slowly, to avoid excessive strains on the tub couplings. For large gears, the maximum speed would be from 8 to 12 miles per hour. Main and tail haulage, used for level roads, also necessitates slow starting up of the motor with considerable torque. Liquid starters are frequently used with these. Endless-rope haulage, adopted extensively on long double roads, is arranged to run at 1¼ to 2½ miles per hour, and provides practically a steady load all day, so that a squirrel-cage motor, driving through a friction clutch, may be used. As an example of the economy of electric haulage, the author mentions the case of a 500-yard road with an endless-rope haulage running at 1⅓ miles per hour, and absorbing 33 h.p. The total output of coal is 300 tons per day, and the cost of working 0·39d. per ton. When worked by steam gear situated at the surface, the working cost was 1·77d. per ton, so that a saving of £500 per annum has been effected.

Electric locomotives, continued the author, require at least 6 ft. headway, and can only be used in intake roads near the down-cast shaft on account of the sparking at the trolley wire, and are not used much in this country. With regard to electric winding, the author thinks it probable that the heavy capital charges of main electric winding gear will neutralise any saving in efficiency over steam winding, except where a cheap supply of power is already available. Small winding gears of from 40 to 100 h.p. are employed in a number of cases to raise coal from one seam to another in order that the main winder may be run from one level only at the maximum speed. In a mine of average size, the power used for ventilation would probably amount to several hundred horse-power, and would tend to ensure a good load factor. Finally, the author referred to the use of the Tirrill regulator and the Holmes-Alderson fire-damp safety cut-out, described in ELECTRICAL ENGINEERING, Vol. VI., Mining Supplement, p. cxxvi.

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ELECTRICALLY-OPERATED COAL-HOISTS

At the meeting of the Institution of Mechanical Engineers on January 20th, a Paper by Mr. Walter Dixon and Mr. G. H. Baxter, entitled "Modern Electrical Dock Equipment, with special reference to electrically-operated Coal-hoists," was read. After running over some of the relative advantages of electrically- and hydraulically-worked dock appliances, a description was given of the electrical equipment of the Rothesay Dock of the Clyde Navigation Trustees, which includes the only electrically-driven coal-hoists in Great Britain, and in which the equivalent of the hydraulic accumulator has been provided in the shape of flywheel storage of power at the generating plant on a similar principle to the Ilgner winding system. The dock has its own steam-driven power station, and the electrical apparatus already at work consists of a pair of 32-ton coal-hoists, 18 four-ton cranes, 27 one-ton capstans, two tipping turntables, and two five-ton pierhead capstans. Further plant is in course of construction. A general description of the plant, including the flywheel generators, was given in ELECTRICAL ENGINEERING, Vol. I., May 2nd, 1907, page 749, further details of the cranes were given in Vol. II., page 730, and of the capstans in Vol. III., page 301.

The most interesting part of the Paper refers to the coal-hoists. These are of the high-level fixed type, arranged that the loaded wagons are run on the tipping platform at the quay-level, raised to the required height and tipped, after which the empty wagon is lowered to the high-level inclined viaduct, leaving the hoist at a height of about 17 ft. from the ground, and gravitating to the siding, the cradle then being lowered to the ground-level to receive the on-coming loaded wagon. One is designed for a lift of 60 ft. and the other for a lift of 50 ft., and each is capable of dealing with wagons containing 20 tons of coal. A mean hoisting speed of about 100 ft. per minute was adopted, corresponding to 30 seconds for the rise of 50 ft., and about 300 h.p. is required during this operation. About the same power is required for tipping the full wagons to an angle of 45° in six to nine seconds, so that the motors for the two motions are duplicates. The hoisting motor drives, by means of an elastic coupling and also an ordinary jaw-coupling, a pinion which engages with a spur-wheel upon the countershaft, this spur-wheel and pinion running in a cast-iron casing. At each end of the countershaft a pinion is fixed which engages with the spur-wheels firmly fixed to the hoisting-drums, the drums being so arranged that the ropes go directly to the cradle without the intervention of guide-pulleys. The whole of the gearing, with the exception of the motors, is erected upon a cast-iron bed-plate to obviate errors in erection, and both motors are mounted upon one base-plate, which is bolted to the gearing base-plate. For the purpose of taking up the slack of the tipping rope during the raising of the platform, a third drum, of barrel shape towards one end, is connected to one of the hoisting-drums. The tipping gearing generally is similar, excepting that only one drum is employed.

The brakes for both hoisting and tipping are of the friction clinch type, the brake-bands being kept tight during the hoisting, and the clinches revolving freely in the hoisting direction. By this means, the load is held in suspension immediately power is disconnected from the motor. In lowering, the brake-bands are released by electro-magnets in the usual way. Due to the fact that the hoisting and tipping motors are duplicates of each other, it has been possible to provide a simple arrangement by means of which one motor can work both motions in case of breakdown to either motor, thus enabling coaling to be proceeded with, and avoiding serious delay. The whole of the control is arranged from the attendant's cabin, situated near the top of the hoist. There is only one control-lever, which works in a quadrant or frame, and, by moving this lever in the various positions, the attendant has control of the hoisting, tipping and jib-crane, the only other controller being a small one for controlling the slueing of the jib-crane. Gearing is arranged in connection with this control-lever frame, which automatically renders it impossible for any of the motions to exceed their predetermined efforts, and it is also impossible for the attendant at starting to move the lever at such a rate as to accelerate at too great a speed, and consequently throw an undue load upon the generating station.

The official tests have shown an overall combined efficiency of 72 per cent., and further tests, after two years' actual work, have given a figure of 80 per cent. During twelve months the two hoists have dealt with 556,419 tons of coal in 70,604 wagons, with a consumption of 80,164 units. On the average, 6·94 tons of coal were handled per unit, but as much as 23 tons per unit was sometimes reached. Thirty wagons would be shipped in 31 min. 32 sec., which, with the largest wagons that the hoists will take, is equivalent to 1,140 tons per hour. The costing of working at 1d. per unit works out at 10s. 11d. per 1,000 tons. This compares with results of tests of hydraulic hoists with water at 9d. per 1,000 gallons, giving 18s. 11d. The result of two yeors' working shows that the cost of upkeep has not exceeded that required for the upkeep of coal-hoist plant operated by hydraulics or steam.

At the conclusion of the Paper, the authors submit that they have, by this entirely electrically-equipped dock, shown that, apart from the admitted advantages of electric power, the relative position of electric and hydraulic power is now as follows :—Electric and hydraulic systems are equally reliable; the cost of working with electric and hydraulic power is equal at full load, but under variable and low load conditions, electric power is cheaper; electric power has now the equivalent of the hydraulic accumulator; electric power can be applied to all dock appliances, and has greater flexibility than hydraulic power.

The discussion was opened by Mr. J. A. F. ASPINALL, who said that two gallons of water at a pressure of 1,000 lbs. per sq. in. was equivalent to 1·333 h.p., which, if used for one hour, was practically one Board of Trade unit. In the north of England water was supplied at this pressure at 1s. 6d. per 1,000 gallons, and on this basis the cost of the equivalent of a Board of Trade unit will be 2·16d., against electrical energy at 1d. per unit.

Colonel F. W. TANNETT WALKER complained that in this particular case, makers of hydraulic machinery had not been given a fair opportunity to show what they could do. He regarded the performance of the electric coal hoist of tipping 30 waggons in 30 minutes as nothing out of the ordinary, and suggested this was the longest time the hoist could keep up this rate of work, but the whole question was a traffic question, and being able to deal with any load according to the shipping which required to be dealt with. He thought that the method of braking employed was disadvantageous in that it necessitated a stop before the coal was actually tipped. A much smoother action was obtainable by hydraulic machinery, with a consequent saving in time. One of the hoists at Rothesay had shipped 278,000 tons of coal per annum, but he pointed out that the Taff Vale, Great Western, and North British companies were regularly doing 400,000 tons, and also mentioned instances in which many thousand tons of coal were tipped in a few hours. The price of 9d. per 1,000 gallons taken by the author for hydraulic power was quite beyond the actual figures that were being paid.

Mr. W. H. PATCHELL supported the previous speaker in favour of hydraulic coal hoists, and mentioned an instance in which he had installed one in an electric power station because it was cheaper.

Mr. E. B. ELLINGTON considered the authors were making a bold assertion in stating that electric and hydraulic coal hoists were equally reliable, but admitted that they had only two or three years' experience to go upon, against the 60 years' experience with hydraulic machinery. He agreed that at full load electric and hydraulic machinery were equally economical, but he was not yet convinced that this condition of equality was maintained at the lower loads or on a variable load. It seemed to him that in order to get their comparative figures of cost of power, the authors had about halved those for electricity, and doubled them for hydraulic power.

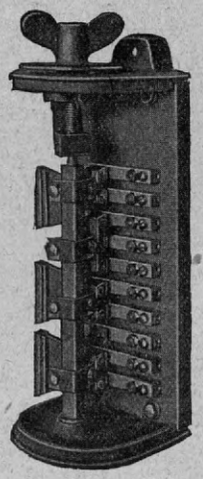
Mr. C. O. RIDLEY (Messrs. Armstrong, Whitworth & Co.) also made a few remarks in which he advocated the use of hydraulic machinery as opposed to electrical machinery for this purpose.

The discussion was then adjourned until February 17th.

The Pretoria Pit Explosion.—At the resumed inquest at Westhoughton, various startling allegations have been made by friends of the deceased miners and others who have worked in the Pretoria Pit with regard to the gaseous and heated state of the atmosphere, and the relighting of lamps in a return airway where there was sufficient gas to put them out. Sparking at the switch of the conveyor which was situated in a part of the mine which suffered from the explosion was again referred to, but no technical evidence was given. The general manager, Mr. A. Tonge, described the ventilation of the mine in some detail, and stated that he was not aware of the presence of a dangerous amount of gas. He was surprised to learn that a boy of 16 had been found to have a relighting key for the Wolf lamps in his pocket. He thought the explosion originated in the North Plodder mine in an area not including the coal face where the conveyor referred to and a coal-cutter were used, but including another district where there was a second coal-cutter. The explosion must have been caused by the ignition of gas or coal-dust which, if present, could be ignited even by sparking from the brake of a jig pulley. The electrical apparatus, he said, was on the best possible system, and the miners' agent had recently inspected it and complimented him upon its condition.

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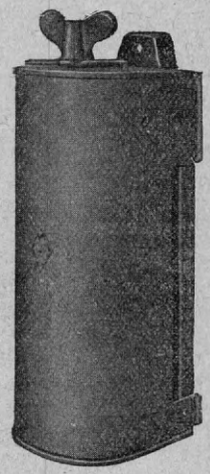
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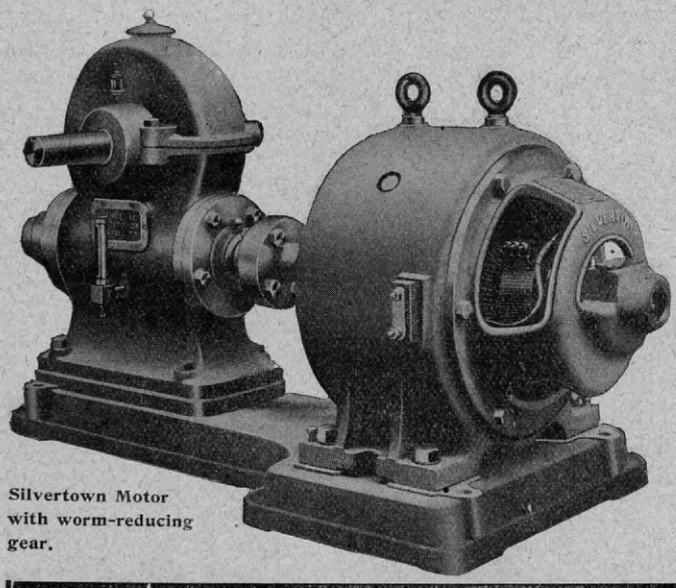
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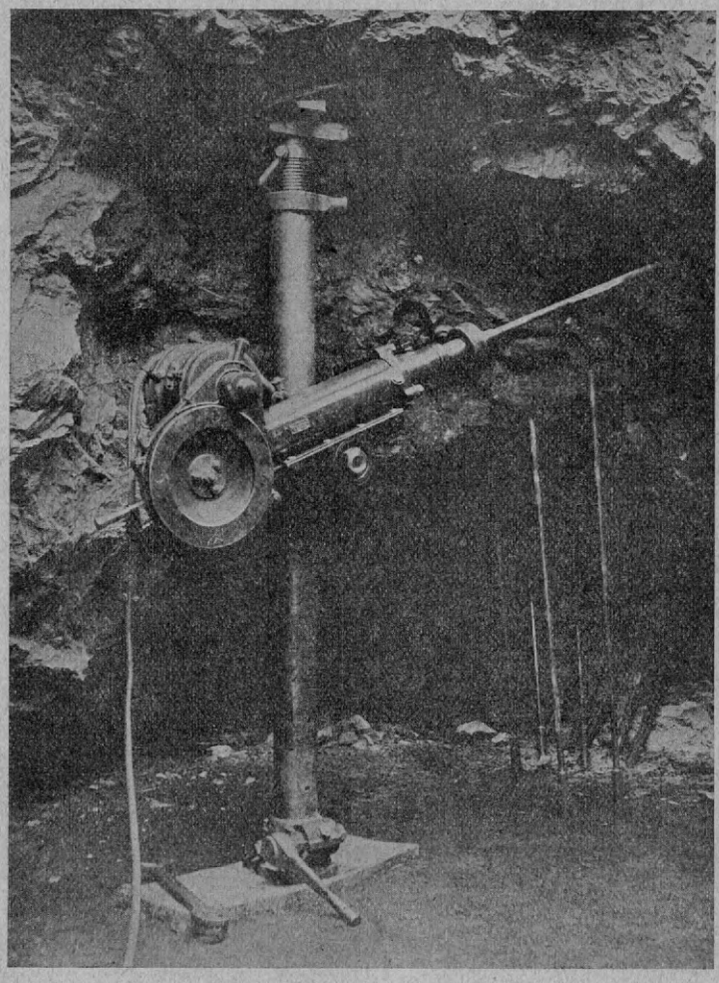
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ELECTRIC POWER AT A TIN MINE

THE properties of Pusing Bharu Tin Mines, Ltd., and the Siputeh Tin Mines, Ltd., are situated in the Malay Peninsula, district of Kinta, the nearest towns being Ipoh and Batu Gajah. The former company was registered in 1907 to acquire and work about 170 acres in this district, which is rich in low-grade tin, the value of the mineral won from the Pusing Bharu property in 1909, the first complete year of working, being £41,147. The latter company owns about 200 acres in the same district. The mines are worked electrically from a plant established conjointly by the companies. The order for the electrical machinery for this was placed with the British Westinghouse Electric & Manufacturing Co., Ltd., in 1907, through the Wilfley Mining Machinery Co., Ltd. Erection work was begun in January, 1908, and completed in the June following, when the mines started running.

The power-house, about half-way between the two mines, is equipped with three Babcock & Wilcox water-tube boilers, with mechanical stokers, three Bellis & Morcom non-condensing engines, direct coupled to British Westinghouse three-phase, 50-period, 150-kw., 220-volt alternators, with direct-coupled exciters. The sets run at 428 r.p.m. The control gear consists of a five-panel switchboard of black enamelled slate, embodying three generator panels with field rheostats, automatic oil switches, and the necessary instruments, one feeder-panel, fitted with two automtaic oil switches (one for each mine), and one panel fitted with a similar switch for a 60-kw., three-phase, 2,200/440-volt, oil-cooled transformer, which supplies current to the motors driving the power-house pumps, &c.

The transmission lines, which are each about one mile long, are of No. 4 hard-drawn copper wire on triple petticoat insulators, with a galvanised-iron earth wire stretched above for lightning protection. On each end of the line there is a horn-type lightning arrester. The mains feed into the the Pusing Bharu sub-station, which is equipped with six British Westinghouse, single-phase, 2,200/440-volt, oil-cooled transformers, connected in mesh and forming two groups of 150-kw. capacity each. There is one two-panel black enamelled-slate switchboard, consisting of one incoming high-tension panel fitted with one non-automatic oil switch and the necessary instruments, and one ordinary low-tension feeder-panel. From the sub-station there are two low-tension transmission lines of No. 5 hard-drawn copper wire, supplying a three-phase, 50-period, 15-h.p., 440-volt, slip-ring induction motor, fitted with a face-plate starter and a reversing switch, the latter having been made locally. This motor was supplied as a constant-running machine, but has been found to run equally well as a reversible motor for winch-driving. In the present case, it drives a double overburden winch for clearing away waste earth by means of endless haulage.

There are also two transmission lines feeding a 20-h.p., three-phase, 50-period, 440-volt, 945-r.p.m., squirrel-cage induction motor, direct-coupled to a Worthington 6 in. turbine pump which has an output of 660 gallons per minute with a 60 ft. head, a motor of the same type and output, but of a higher speed (1,400 r.p.m.), driving a Worthington 5 in. double-stage pump with an output of 375 gallons per minute against an 80 ft. head, and an overburden winch similar to the one already mentioned, but driven by an 8-h.p., three-phase, 50-period, 440-volt, slip-ring induction motor, with face-plate starter and locally-made reversing switch.

The tin-bearing earth is cut by coolies and loaded into trucks, and is then pulled up by an incline double-drum winch and endless haulage, driven by a 40-h.p. motor. This winch is fitted with a no-voltage brake solenoid direct into the puddler shed, and equipped with a reversing controller. The ore is then dumped into a chute, and monitored into the high-speed puddler, the water for monitoring being supplied by a Worthington 10 in. single-stage pump of 1,333 gallons per minute output, against a 30 ft. head, driven by a 25-h.p., three-phase, 50-period, 710-r.p.m., 440-volt, squirrel-cage induction motor, direct-coupled to it. The high-speed puddler consists of a shaft fitted with knives of forged steel, which chop up the large hard lumps of clay. This is belt-driven by a 25-h.p., squirrel-cage induction motor. The clay then has a natural feed into the low-speed puddlers, driven by a similar motor, which chops it up still finer. The overflow from the low-speed puddlers runs into the rifle races, which catch the tin as it escapes from the puddler and allow the tailing or useless material to flow away into the settling pond. There are 17 motors in use at Pusing Bharu, developing a total horse-power of 160. The Siputeh mine is of a similar character, but has only one incline to the puddling shed, and develops only 60 h.p. Both the mines have centrifugal pumps, driven by 15-h.p., squirrel-cage induction motors for auxiliary pumping.

An interesting fact about this installation is that the entire electrical plant was erected by unskilled native labour under the supervision of one electrical engineer. It has now been run for two years to the entire satisfaction of the company, in spite of very adverse conditions, the motors being at all times exposed to wet and dirt in the puddling sheds, and, in fact, in all parts of the mine where the tin-bearing earth is handled.

MINING SWITCHGEAR

A PAPER entitled "Recent Progress in Mining Switchgear," by Mr. G. Stevenson, was read on December 21st at a meeting of the Mining Institute of Scotland at Glasgow. After explaining the cause of arcing at switches and the effect of the self-induction of the circuit, the author described some typical forms of underground switchgear by the aid of lantern slides. The first requisite of such switchgear was the avoidance of all perishable or fragile materials. Oil switches had entirely superseded air break switches for the purpose. A special feature of underground switchgear should be the provision for solid bonding of the armouring of the cables by means of cable boxes bolted direct to the framework of the switch. The switches should also be well protected as regards accidental contact with live parts. Such contact was prevented in the type shown by a lock on the cover arranged so that the oil vessel cannot be removed until the lock is opened. The isolating links in another pattern shown were contained in a chamber, the door of which was interlocked with the switch. Various forms of automatic release were mentioned, such as those which trip when the voltage falls to 50 per cent. of its normal value, and prevent the switch being closed unless the voltage is over 50 per cent. of the normal. The author was not in favour of the present tendency to adopt a multiplicity of automatic features in mining switchgear. Two-coil trips were usually sufficient on three-phase systems, except where the neutral point was earthed. The great success of the oil switch he attributed mainly to its ability to open the circuit with great certainty and safety, and the fact that practically no rise of voltage occurs when the circuit is broken under oil. The effective action of the switch in breaking the circuit under oil is apparently due to the cooling action which the oil has on the resulting arc, which is extinguished promptly by the temperature being lowered below the value at which the arc can hold. Oscillograph records show that when an air-break switch is opened, the circuit is actually broken whenever the current falls to zero, but that the copper vapour does not have time to escape; consequently, as the potential rises again on the next cycle, the arc is re-formed. This process of rupturing and re-forming goes on until the blade has been drawn such a distance from the clip that the arc cannot re-form, and is apt to cause very serious strains on the insulation. This effect is not met with in oil-break switches, as, once the arc breaks, it is unable to re-form, owing to the oil washing in and cooling off the copper vapour and the surface of the contacts. Oscillograph records actually do show that the arc is broken when the current wave is passing through zero point.

Various types of controller were described, including the contactor system for large motors. This had been developed for alternating as well as continuous currents, and the magnetic blow-out arrangements were equally satisfactory in both cases.

With regard to surface switchgear, the author favoured enclosing each item of the equipment in a separate and self-contained fireproof cell of moulded stone, closed by iron doors interlocked with the isolating switches.

Colliery Supply.—The Staveley Coal & Iron Co., Ltd., have under construction at Devonshire a power station to supply electric power to their various collieries. The Hartington, Ireland, Seymour, and Markham pits will be connected first, and mains will subsequently be carried to the Barlborough, Warsop Main, Bonds Main, and Calow Main collieries. It is stated that the scheme will result in an economy of working to the extent of some £8,000 per annum.

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ELECTRICAL EQUIPMENT OF A NEW ZEALAND COAL MINE

THE following particulars of the electrical equipment of the Westport Stockton Coal Co.'s mine, which is important in view of the extent of the deposits and the high calorific value of the coal, are taken from a Paper read by C. J. Holroyde before the Engineering Association of New South Wales and abstracted in the *Australian Mining Standard*. The coal deposits lie at a height of from 2,500 ft. to 3,000 ft. above sea-level, and the coal has to be brought down. There are two main inclines, one above the other, with steel rope haulage, by which the trucks are handled, the loaded cars going down pulling the empties up, the rope speed being controlled by a hydraulic brake on each incline. From the head of the top incline to the mine, electric locomotives handle the trucks both ways, gathering loaded tubs from the various working faces in the mine proper, and distributing the empty tubs.

A tunnel leads from the coal-bins to the foot of the first incline, and at the head of the second incline the trucks run on to the level, where the main electric locomotives begin their run. These locomotives are supplied at 250 volts D.C. from an overhead trolley wire, and draw the loaded tubs from the mine to the head of the incline, and pull back the empty tubs. They weigh 20 tons each, and are equipped with master controllers to enable them to be worked as separate units, or coupled, as desired. Their draw-bar pull is 7,500 lb., at a speed of 8·2 miles per hour. To prevent them getting away on the steeper grades, a third (dead) rail is located in the middle of the track, projecting a few inches above the level of the two outside rails, and a powerful toggle brake on the locomotive engages both sides of the head of this centre rail. The smaller "gathering" locomotives weigh about 6½ tons each, and have a draw-bar pull of 2,500 lb., at a speed of 7·4 miles per hour. These locomotives are for pulling the full tubs to be made up into trains for the main locomotives to handle, and for breaking up the trains and distributing the empty tubs to the working faces. The coal tubs weigh 1,500 lb. each empty, and when loaded 4,500 lb.; in other words, each loaded tub carries 30 cwt. of coal. The "gathering" locomotives are equipped with a reel, automatically worked from the axle, containing 900 ft. of flexible twin cable, to enable the locomotive to have an operating range of this distance beyond the farthest point of overhead construction.

The track from the head of the top incline right into the mine is of 56 lb. rails. These are 40 ft. long, and at each joint are bonded with two No. 00 bonds, being cross-bonded every three rails. The gauge is 36 in. The track is single at present, and is provided with the necessary turn-outs to handle the traffic. The overhead construction comprises a G.E.Co. (U.S.A.) grooved No. 0000 (0·46 in. diam.) trolley wire in parallel with a bare stranded cable. The feeder cable is connected to the trolley wire on an average every 150 ft. The trolley wire is 7 ft. 8 in. above the level of the rail head.

The power house is some distance from the mine itself, and has generating plant installed aggregating 1,000 kw. This includes two A.-C. sets and one D.-C. set. Three sub-stations feed the overhead trolley network at the mine, and are served with three-phase current at 6,600 volts over a six-mile transmission line. Telephone lines connect the three sub-stations, power house, offices, &c., and each locomotive carries a portable telephone.

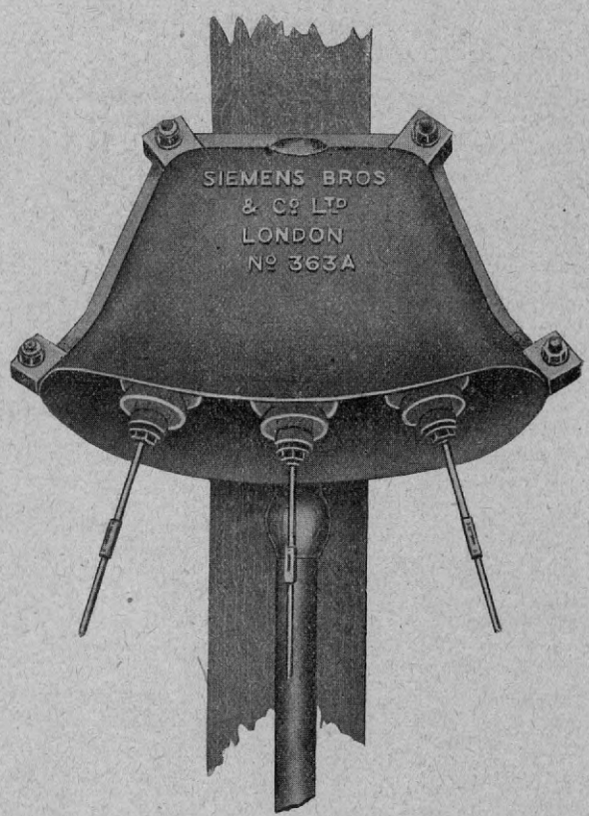
The mine is exceptionally fortunate in regard to ventilation, in that but small fan capacity is required. Two fans, each driven by a 30-h.p. B.T.H. three-phase 500-volt motor, are used in the tunnels. These motors are belted to centrifugal fans. The object in using 500-volt three-phase motors for driving the fans is that this service will be continuous, irrespective of any possible interruptions to the trolley overhead network. In addition to the above, there are six Sturtevant blowers, each belted to a 5-h.p. D.-C. 250-volt motor, which will be located as required at different parts of the workings; the motors taking the current from the overhead trolley. The natural drainage is so excellent that the only provision made is a small Worthington pump, direct geared to a 5-h.p. 250-volt D.-C. motor. This set is portable, and readily moved to any point of the mine where it is necessary to pump out any dips that occur in working.

Coal-cutting machines are employed in the mine, the company having started with two Sullivan board and pillar chain machines, with 6-ft. cutting bar, driven by a 30-h.p. motor. The company has already proved 30,000,000 tons of coal in sight, the coal averaging about 14,000 B.T.U. The seams vary from 6 ft. to 12 ft. in depth in the working already opened, and the coal is entirely free from slate and bands. The mine is fortunate in having a solid sandstone roof, which will necessitate the use of very little timber for its support.

The main storage bin at the base of the incline has a capacity of 5,000 tons. The loaded tubs run into the bin by gravity and automatically discharge the coal on to travelling elevators, which deliver it into the various compartments (screened and unscreened coal) of the bin. There are three elevators, operated respectively by two 10-h.p. and one 15-h.p. motors. The shakers are operated by three 5-h.p. motors. An electric hoist operated by by a 52 B.H.P. A.-C. motor, is used to haul the empty Government railway trucks out of a dip on to an incline, from which they are distributed by gravity into the various tracks under the bin. After the trucks are loaded they are sent to Westport (22 miles distant), on the west coast of New Zealand. Another electric hoist, worked by a 112 B.H.P. A.-C. motor, is used for hauling the mine tubs through the tunnel at the base of the incline.

A DIVIDING BOX FOR OVERHEAD LINES

Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster, S.W.), have introduced a special type of cast-iron dividing box, for use in exposed positions, such as on overhead transmission poles, &c. The illustration shows one of these boxes attached to a wooden post. The incoming cable enters through a brass wiping gland, and is connected to special angle fittings, from which bare copper rods are led out obliquely



DIVIDING BOX FOR CHANGE FROM CABLE TO OVERHEAD LINE.

through substantial insulators at the bottom of the box. The insulators are protected by a weather shed formation of the lower portion of the casting, which prevents the collection of snow or other conducting substances between the live terminals. The two halves of the casting are provided with a machined facing, to ensure watertightness, and after the connections are completed, the whole box is filled with hard insulating compound. These boxes are supplied both for high-tension and low-tension work.

Society of Engineers' "Status" Prize.—This prize may be awarded by the Council of the Society of Engineers (Incorporated) each year for the next three years (if papers of sufficient merit are received) for the best paper written by any person on the subject of "How to Improve the Status of Engineers and Engineering, with special reference to Consulting Engineers." Essays not exceeding 6,000 words must be sent to the Secretary, 17 Victoria Street, London, S.W., not later than May 31st.

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ELECTRICAL MINING PATENTS OF JANUARY

AMONG the patent specifications published during the past month, and of interest to electrical mining engineers, were three describing improved forms of coal conveyors. The first is No. 30,123 of 1909 by W. H. Barker, of Stoke-on-Trent, and relates to conveyors of the reciprocating type. It covers a method of mounting the trays in combination with Aitken gear in order to obtain a much quicker forward movement than the backward movement. No. 30,127 of 1909, by W. Wilson, of Armadale, describes a coal-face conveyor consisting of a long belt to which trays are attached. The belt is drawn along the coal-face to the end where the hatches are, where it passes over a hexagonal roller, causing the trays to discharge. The direction of motion of the belt is reversed when all the trays are empty. No. 30,361 of 1909, by J. Watson, of Motherwell, describes a conveyor comprising a number of trays which are drawn along the coal-face by means of an electric haulage gear. Stops are provided on the haulage rope to effect the reversal of the motor automatically when the trays reach the ends of the face. Means are also provided for reciprocating the trays and for shooting the coal into the hatches automatically.

A specification by E. E. Rogers, of Wimbledon, No. 4,066 of 1910, describes an electrically interlocked plug and socket connector for lamp and motor circuits, which cannot be disconnected while the circuit is alive. The socket is provided with a solenoid connected in series or parallel on the supply side, the plunger of which engages with a suitable projection on the plug so long as the solenoid is energised. In the case of the parallel connection, the plug can neither be inserted nor withdrawn if the circuit is alive.

Specification No. 4,357 of 1910, by F. A. Scott and D. Miller, of Glasgow, relates to coal-cutters of the disc pattern, in which the haulage drum is placed at one end of the machine, and describes an improved gear which reduces the height of the machine by avoiding the necessity of providing clearance below the machine for the passage of the haulage rope for forward travel. A vertically arranged drum is provided, and, for forward travel, the rope passes at the side of the machine.

A double bayonet joint for miners' lamps is described in Specification No. 4,451 of 1910, by P. Rennert, of Westphalia. Spring-locking pins on the oil-tank, withdrawable only by a magnet, snap into slots connecting two superposed bayonet slots of the oil tank, and lock the outlet for the bayonet projections of the upper lamp portion.

Specification No. 19,659 of 1910, by W. Aitken and British Insulated & Helsby Cables, Ltd., covers the various details of construction in a portable magneto shot-firing instrument.

Cumberland Branch of the Association of Mining Electrical Engineers.—A meeting of this branch was held on January 21st, when it was announced that the President, Mr. H. Maurice, would be present at the next meeting, on February 18th. A short discussion was held on the question of examinations, and it was mentioned that the first would be held on March 14th and 21st. The papers would be sent out by Prof. W. M. Thornton, and the actual examinations conducted by the President and Secretary of each branch. The paper by Mr. R. R. Smith, on "Inspection and Repair of Underground Plant" (see ELECTRICAL ENGINEERING IN MINES, January 5th, page vii.), was then discussed. Mr. Blair did not think that Mr. Smith's system of inspection would be practicable in any but very large mines. He thought that in future the mechanical and electrical engineering staffs would be amalgamated. The chief engineer should be both mechanical and electrical. Mr. J. Glynn Williams took up some points of detail in the paper, and in particular objected to the use of cast-iron slip rings on induction motors, as they were liable to become rusty when the motor is standing, and to cause sparking when starting up again.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during January.

Jan. 5th.—Monthly supplement on ELECTRICAL ENGINEERING IN MINES, opening with an abstract of a Paper on "Electricity in New South Wales Collieries," by Mr. E. K. Scott. Reports are given of discussions on electric winders before the Newcastle and Manchester Sections of the Institution of Electrical Engineers, at the latter of which a Paper by Dr. E. Rosenberg was read. A note is given on the possible cause of the explosion at Bolton, and discussions before two branches of the Association of Mining Electrical Engineers on a Paper by Mr. R. R. Smith on the care of underground plant are reported. Some notes are also given on mining patents published during December.

Jan. 12th.—Notes on the rotary converter. Illustrated descriptions of some new switches, &c. A Paper and discussion on the Merz-Price system of protection.

Jan. 19th.—Illustrations of a mixed-pressure turbo-alternator set. Special literary supplement, with reviews and list of recommended books on all branches of electrical engineering. Description of a telephone equipment for use on high-tension circuits.

Jan. 26th.—Illustrated description of a metal filament lamp factory. Further discussion on the Merz-Price system.

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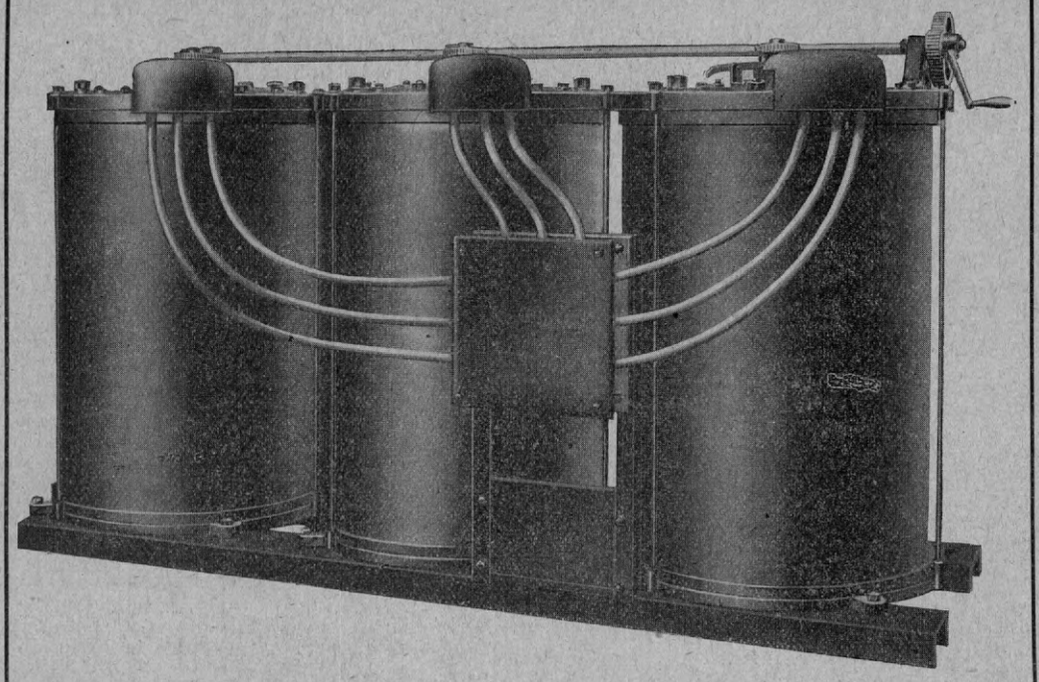
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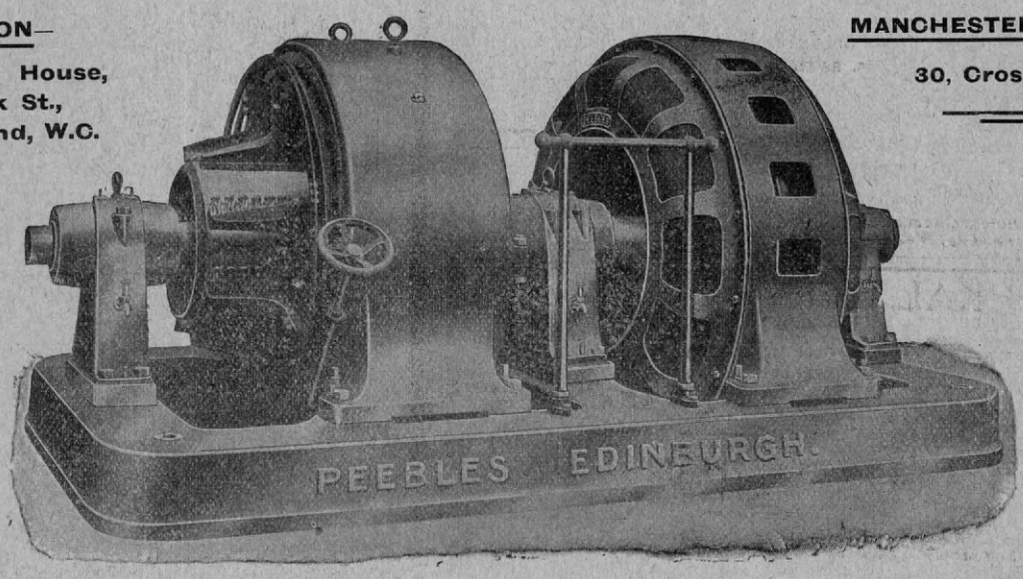
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30, Cross Street.



Peebles 750 Kw. Induction Motor Generator.

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HIGH TENSION TRANSMISSION LINES

TWO papers on this subject were discussed at last Thursday's meeting of the Institution of Electrical Engineers. One, by Mr. W. T. Taylor, was on "Modern Long-distance Transmission of Electrical Energy"; and the other, by Messrs. R. Borlase Matthews and C. T. Wilkinson, was entitled "Extra High-pressure Transmission Lines."

The first paper was read in abstract by Mr. J. F. C. Snell, in the absence of the author. After some general remarks, a *résumé* was given of some of the formulæ used in the calculation of the size of wire required, the self-induction, capacity, and the resistance and reactive drops due respectively to the power component of the current, the wattless component, and the charging current. The latter has, of course, a negative value, and sometimes causes the voltage at the far end to be higher than that at the station. The author was in favour of subdivision of the conductors forming each phase in large systems, with connecting switches at suitable points, as increasing the electrostatic capacity of the entire line, decreasing the inductive reactance and increasing the reliability and flexibility of the system.

Dealing then more particularly with generating stations, the author gave some diagrams of typical arrangements, and said that of late practice had been tending to outdoor installations of lightning arresters, entering buildings from the roof, and arranging high-voltage oil switches in steel tanks, operating them by primary relays and using the switch bushing as the primary for series transformers. With regard to the line itself, he followed out further the advantages of double circuits and simplicity in the arrangement of the sections and branches. Typical diagrams from actual systems were given. With the increase in price of wood and the decreasing price of steelwork, practice was, he said, steadily leaning towards steel towers and poles as substitutes for wooden poles. Spans from 300 to 750 feet are used, and towers 40 to 55 feet high. The overhead earthed steel cable now usual for lightning protection added greatly to the stability of the towers. Particulars were given of mechanical tests of steel towers, and illustrations of typical designs were shown. From the depreciation point of view, the life of steel towers should be not less than thirty-five years. That of wooden poles, however, averaged twelve years.

On the design of insulators it was remarked that size alone did not produce efficiency, but rather the surfaces in relation to the mass; 60,000 volts was about the limit for pin-type insulators, because a further lengthening of the pin increased the leverage and weakened the support, while the weight increased. For pressures from 60,000 to 100,000 volts the suspension insulator of four to eight parts in series was standard. It required, however, a higher tower, but allowed great flexibility to the line. The conductor should be anchored about every mile and at all corners. The maintenance of suspension insulators was said to have proved only ten per cent. of that for the pin type. Illustrations of designs in use were shown, and results of tests were mentioned. In these designs care is taken to get the maximum average length efficiency, that is, the ratio of the voltage at which the insulator flashes over to the breakdown voltage of an air-gap equivalent in length to the insulator.

The following general recommendations were given regarding line protection:—In large generating stations arresters should be installed on the generator busbars, or low-tension side of the power transformers to protect them against internal surges. On all outgoing and incoming transmission lines arresters should be placed on each line. They should be installed through a disconnecting switch preferably outside of the station, or as near as possible to the point of entry into the station. Arresters or lightning rods should be installed at high places where the lines are exposed to lightning, such as the top of a mountain where no ground wire is used. At least one ground wire should be installed along the top of the transmission line and grounded at every pole or tower. The aluminium type of arrester was favourably spoken of. The author did not express any very definite view on the relative merits of star and delta connections, but said that in the majority of cases delta connections were used but required larger apparatus and insulators. In conclusion, the author touched on the question of rates, and said that the present electric power rates on practically all hydro-electric systems of any importance and magnitude are based on a fixed charge per horse-power per month plus a definite amount per kilowatt-hour as recorded on the meter.

The second paper was read by Mr. Borlase Matthews. The author looked forward to the time when 200,000 volts would be considered practicable, and said that the lengths of lines were limited by financial and not by engineering considerations. Passing on to matters of detail, they dealt first with supporting systems, and pointed out the advantages of a line of flexible steel towers with a rigid anchor tower or a double-guyed tower at intervals. The strain was thus better distributed when a line broke. Curves were given of the comparative cost of flexible towers, rigid towers, and wooden poles. It is not practicable to build wooden pole lines for above 40,000 volts for two circuits, as the length of cross-arm becomes excessive; and, indeed, at about 50,000 volts the cost curve would cross that for flexible towers. The use of clamps designed to release the wire when a certain pull is reached was considered, and successful results in this direction were recorded.

With regard to insulators, the disc or suspension type were stated to be both easier to construct and less fragile than the pin type. Illustrations were given of the types most frequently used, which are designed for a working pressure of from 18,000 to 30,000 volts per disc, and have a net flash over voltage about $2\frac{1}{4}$ times this value. It is interesting to note that when testing a string of suspension insulators dry, the voltage will divide in accordance with capacity effects, and when tested wet, in accordance with resistance effect. The losses from corona effects were only dealt with briefly, but some interesting illustrations were shown, and the great protection of the insulators from lightning effect by an earthed metal ring surrounding them, and of the line by an overhead earthed wire was mentioned. Damage caused to lines by wind and by the weight of ice collected on the wires was referred to, and it was mentioned that in the United States, where the weather conditions are more severe than here, it was usual to allow in designing for $\frac{1}{2}$in. thickness of ice all round the wire with a 65-mile per hour actual wind velocity occurring at the same time, or $\frac{1}{4}$in. ice with an actual wind velocity of 77 miles per hour.

The following are among the general recommendations made regarding line construction:—

Districts subject to lightning should be avoided, and valleys chosen in preference to routes over hills. Duplicate lines should be kept as much as a mile apart if possible. Two ground wires are preferable to one; they should be earthed to every steel tower or at every third wooden pole. Lightning rods with sharp points projecting at least 6 feet should be provided at every tower. Insulators must be tested under dry and rainfall conditions, and the flash over voltage should be considerably greater than twice the line voltage. The line should work at a voltage slightly below the critical corona voltage. All towers must be efficiently earthed. Line wires should be 1 foot apart for every 10,000 volts.

Specifications for steel transmission line towers and suspension insulators are appended, and also a list of 28 typical transmission systems of over 50,000 volts.

DISCUSSION.

Mr. D. C. JACKSON (President, American Institute of Electrical Engineers), after pointing out that the interest of Americans in this subject was due to the larger amount of water-power in the United States, and also to the fact that many of their coal mines were far removed from large centres of utilisation, said there was undoubtedly a tendency to develop schemes for supplying large areas from few centres, with very large power houses, and although power stations with a hundred thousand kilowatts were not yet the rule, yet he thought eventually there would be many, especially in connection with railways. The extension of the limit of voltage for generation and transmission would play an important part in this movement, and if a limit of, say, 300,000, or even 500,000 volts could be reached, this would make it possible to couple almost any power station in the United States with any other. At present, however, there were difficulties if they went above 120,000 volts. The losses between wires due to corona, &c., were really marvellous, especially in the higher altitudes, and something more had to be learned before they would be able to go much further. He had ample confidence, however, in the ability of the engineers of the world to make the necessary discoveries and inventions.

Mr. B. WELBOURN (British Insulated & Helsby Cables, Ltd.) said both authors seemed to suggest that power transmission could only be by overhead lines, and that underground transmission was out of the question. But there were cable-makers on this side of the Atlantic who were prepared to manufacture cables of 30,000 volts A.C. three-phase, or up to 100,000 volts continuous current. There was a considerable amount of pole line work being carried out in Newcastle, Durham, Yorkshire,

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and Scotland, almost all by means of creosoted wood poles. The authors' estimate of 12 years for the life of wooden poles must surely refer to untreated wood. With creosoted poles he thought the life would be nearer 25 years. The longest span in this country was one which he hoped to put up in a few months, viz., 368 ft., this being necessary in order to get over wayleaves, but 80 yards was a common length. Neither of the Papers dealt with the automatic protection of the line nor aluminium wires. There was a good deal of the latter being used in this country, including a line at Aldershot, which was being put up by the War Office. The sizes used varied from No. 12 gauge to 1·4 sq. inches. The early troubles described by Sir John Gavey with aluminium had now been quite got over. A controversial point raised in both Papers was the use of a longitudinal earth wire. During a trip from the Atlantic to the Pacific, he had spoken to many engineers on the subject. There seemed to be great diversity of opinion on the point, and some of the most recent lines put up did not have any continuous earth wire. Some engineers condemned them root and branch. He agreed with the earth wire for mechanical reasons, and also for earthing purposes for the prevention of shock, but unless they were of the same material as the live wire, and therefore had the same life, it was very questionable indeed whether they ought to put up, because this might come down without it being known.

The discussion was adjourned until February 9th.

TRANSFORMER SUB-STATIONS

MR. P. V. HUNTER read a Paper on January 16th before the Newcastle Local Section of the Institution of Electrical Engineers on the design of sub-stations on power supply systems. He confined his remarks chiefly to the arrangement of buildings and plant, and dealt more particularly with the conditions met with on the north-east coast. It was most important, he said, to consider the sub-stations in relation to the whole supply system, and to design the switchgear not solely to suit the sub-station plant, but to meet the conditions imposed by the magnitude of the system and future developments.

With regard to cost, he remarked that the minimum cost per k.v.a. of naturally-cooled transformers is reached when

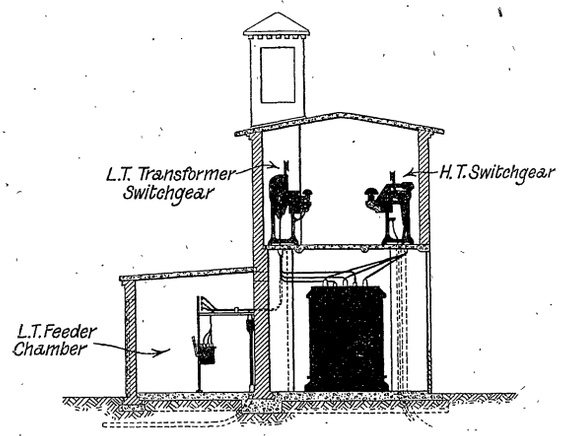


FIG. 1.—SUB-STATION WITH SEPARATE CHAMBER FOR L. T. FEEDER BOARD.

the size approaches 1,000 k.v.a., but up to this size, there is a reduction in cost per k.v.a. the larger the transformer. The cost of H.T. switch panels, on the other hand, was practically proportionate to the voltage, and more or less independent of the full-load current within working limits. A number of drawings of typical arrangements of sub-stations were given. The simplest arrangement, with all the apparatus in one chamber—transformers in the middle and L.T. and H.T. switchgear on either side, is suited only to very small stations, and is objectionable from the fire risk point of view, as well as large ground space occupied. A design, two-storied, such as in Fig. 1, with the transformers in separate cubicles, with special ventilating series, is preferable, although in some cases, where not more than two transformers will be required, a one-storey arrangement, with a pair of transformer chambers opening to the air at the ends and walled off from the switchgear, may be employed. The figure shows the low-tension feeder switchgear in a separate chamber, which, especially in cases of sub-stations on consumers' premises, is often found convenient. The dimensions of such a building depend on the maximum size of transformer to be accommodated, but, as a rule, there is no economy in employing units larger than 1,000 k.v.a. Extensions are easy with this type of sub-station. Further chambers can be added, side by side to any extent permitted by the site.

With voltages over 10,000 volts, where serious voltage surges are possible, special protective apparatus has to be provided for. In case of overhead lines, horn arresters may be placed in an additional chamber above that containing the H.T. switchgear. It is also sometimes advisable to provide surge arresters to each feeder panel; these, if of the roller

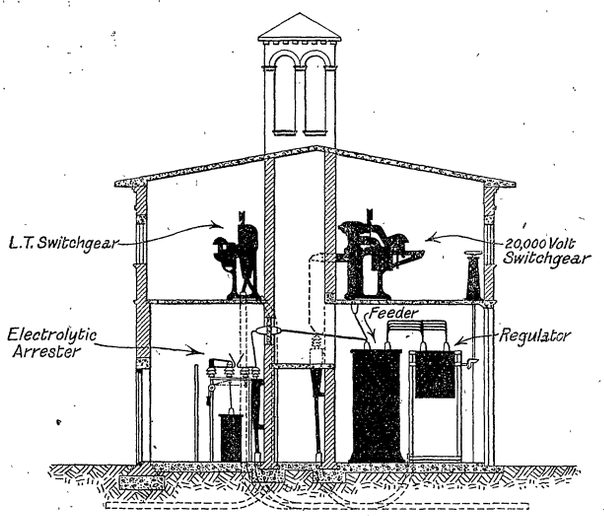


FIG. 2.—SUB-STATION WITH ELECTROLYTIC ARRESTERS AND FEEDER REGULATORS.

type, can be accommodated in small chambers alongside those containing the transformers. An arrangement where electrolytic arresters are provided for is shown in Fig. 2. In this design, space is also available for a feeder regulator. Where artificially-cooled transformers are required, special ventilation ducts are not required, and the oil- or water-cooling apparatus may be placed in a lean-to shed parallel to the row of transformer cubicles. In sub-stations for very large transformers, provision is sometimes necessary for lifting the transformers, as in Fig. 3, which represents the arrangement adopted at the junction points of the trunk mains on a 20,000-volt system where the energy is transformed to 6,000 volts for general distribution. They have, therefore, extremely important duties, and it is impossible to estimate the ultimate maximum load. In these circumstances, the sub-stations are designed with each section

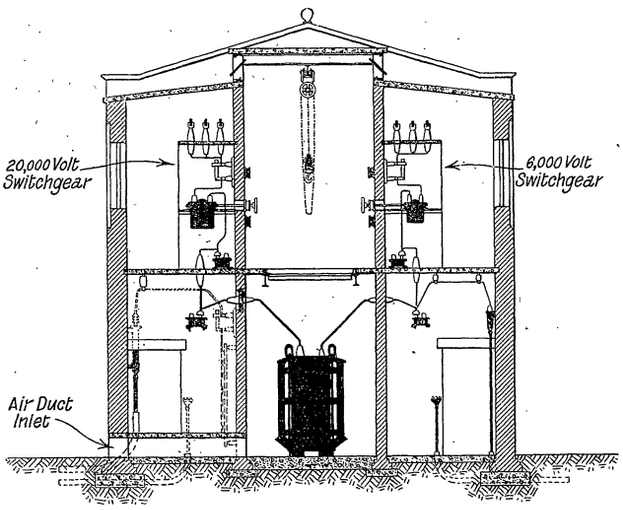


FIG. 3.—SPECIAL 20,000/6,000 VOLT SUB-STATION.

suitable for naturally-cooled transformers up to sizes of 1,000 k.v.a., but may be arranged to accommodate artificially-cooled units up to 3,000 k.v.a. each.

It is arguable, continued the author, that the same reasons which make lifting apparatus necessary for the artificially-cooled transformers also apply to the naturally-cooled apparatus. The question is somewhat involved, and is governed by the use likely to be made of the lifting apparatus. This is almost entirely a matter of individual experience, depending on the amount of trouble met with.

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In any case, repairs requiring more than one or two days should be carried out at a central repair shop, where proper apparatus is available for repairing, drying out, and testing the transformers. On the other hand, it is objectionable to have to transport a transformer some distance to the repair shop for the sake of inspection and adjustment only, although, of course, this is to be preferred to lifting it out of the case in the open air.

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to the Editor, ELECTRICAL ENGINEERING, *203-6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.*

J. A. HOPKINS.—Two-and-a-half brake horse-power.

L.—The first address you require is Finsbury Pavement House, E.C. The electric supply of Sydney is in the hands of the municipality, and the tramways are owned by the Government. The greater part of the new tramway contracts are now carried out by Australian firms who have no office in London.

E. H.—(1) The fee on application for a patent accompanied by provisional specification is £1; and on subsequently filing complete specification, £3. If the complete specification is filed within six months from the date of application and is accepted, a further "sealing fee" of £1 has to be paid. Renewal fees commence at the end of the fourth year, being £5 for the fifth year, £6 for the sixth, &c. (2) You can apply by post, by filling in a form obtainable from the Patent Office. (3) There is no need to employ a patent agent, but it is a course which we recommend, at any rate, when filing the complete specification, and, if you are not an adept at drafting patent specifications, we should recommend the employment of an agent from the start. If you are making application yourself, you had better obtain a copy of "The Patents Rules," price 7d. post free, and, in any case, you would also find "The Patents and Designs Act, 1907," by J. Roberts and H. F. Moulton (price 4s.) useful. Shall we send you these?

Wireless Telegraph Notes.—According to the *Money Market Review*, Brazil will have the largest wireless telegraph system in the world by the end of 1911, no less than fifteen new wireless stations being now under erection along the Amazon and Paraguay by the United States Wireless Telegraph Co.

According to a British Consular report dealing with the trade of Uruguay for 1909, a small power Marconi wireless telegraph station has been established at Punta del Este, near Maldonado, which has a radius of 310 miles. Mr. Marconi is said to have under consideration the establishment of a large power station for communicating direct with Italy. The Ministry of the Interior have decided to accept the offer of a German wireless telegraph company, which is represented in Monte Video, for the erection of wireless telegraph stations in Uruguay. There are to be five land stations, three stations on battleships, two military transportable stations, and four flying transportable stations for army use. The prices are said to be as follows:—Land stations, with a range of 800 km., £3,810; 500 km. range, £2,350; vessel stations, 400 km. range, £950; 100 km. range, £537; transportable military stations, 200 km. range, £1,600; 60 km. range, £478. The total value of the contract is £16,397.

The action of the Australian Postmaster-General in giving a contract to the Australian representatives of the Telefunken system for wireless stations at Sydney and Fremantle has been considerably criticised in the Australian Parliament. It is now stated that the Australian Wireless, Ltd., have not signed the contract, and that the guarantors for the Company have not signed the guarantee. According to the *Australian Mining Standard* there is a strong feeling that the Marconi Co. should have been given the contract, in spite of a considerable difference in price, this argument being mainly based upon the question of patent rights in connection with which the Marconi Co. is fully protected in every country except Germany, whilst the Telefunken Company were said to have no patent rights outside Germany. Whilst on the one hand it was suggested that the Australian representatives of the Telefunken Co. are not financially strong enough to carry out the contract, the chairman of that Company, which was specially formed in connection with the Australian contract, has written a letter stating that the Company is anxious to proceed with the contract, but that some indecision on the part of the Government as to the exact site is the cause of the delay.

According to the *Board of Trade Journal*, the South African Government have entered into a contract with Marconi's Wireless Telegraph Company for the erection of a wireless telegraph station at Slanakop, near Kommetje, on the coast of the Cape Peninsula, which is to have a day range of 400 miles and a night range of from 600 to 1,000 miles. The capacity of the station is 5 kw.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

DEPRECIATION.—We have received a copy of the second edition of a useful booklet, entitled "Depreciation of Works and Machinery: its Causes, Effects, and Treatment," by Mr. H. Sherley-Price, senior partner in the firm of Wheatley, Kirk, Price & Co., engineering valuers (46 Watling Street, E.C.). The depreciation of works or factory buildings as well as machinery are clearly dealt with, and the necessity for dealing with every case on its merits is emphasised. Complete revaluation is often preferable to the writing off of fixed arbitrary percentages.

CONDUITS.—A new and revised price list of steel conduits and conduit fittings, much more comprehensive than the old list which it supersedes, is to hand from Messrs. Siemens Brothers' Dynamo Works, Ltd. (Supplies Department, 39 Upper Thames Street, E.C.).

RESISTANCE MATERIALS.—A booklet on this subject is being issued by the Driver Harris Wire Co. (sole British agents, Messrs. Denman, Glover & Cooper, 429-431 Corn Exchange Buildings, Manchester). This contains well-arranged tables of particulars of a considerable number of resistance materials, including two special new alloys known as "Yankee Silver" and "Therlo," which the company have recently introduced.

ISOLATING SWITCHES.—A new leaflet from Messrs. A. Reyrolle & Co., Ltd. (Hebburn-on-Tyne), gives particulars, prices, and dimensions of a series of isolating switches for pressures up to 10,000 volts, arranged for operation by a hook on an insulating pole.

ARC LAMP LOWERING GEAR.—Messrs. J. & H. Grevener (Eldon Street House, E.C.) have sent us leaflets describing a new pattern of self-sustaining safety arc lamp winch and arc lamp coupling. The winch is simple in construction and is governed by an automatic brake, so that it remains locked in any position when the handle is taken out, and the coupling, which is quite weatherproof, locks itself automatically and takes all strain off the rope when the lamp is in place.

INSULATING VARNISH.—A leaflet from Chas. H. Blume (Western Road, Mitcham, Surrey, and The White Building, Sheffield) calls attention to a range of insulating varnishes which this firm have perfected as the result of considerable research and practical experience. These varnishes, which entirely prevent the absorption of water by the materials treated with them, are known respectively as "Megomac" and "Insulac." The former is a clear and the latter a black varnish, and both are made in three grades for stoving, air-drying, and finishing respectively.

CALENDARS, &c.—A clear, boldly printed office calendar with monthly tear-off sheet is being issued by the United Flexible Metallic Tubing Co., Ltd. (112 Queen Victoria Street, E.C.).

Messrs. Pooley & Austin (25 Victoria Street, S.W.) are sending to their friends with their New Year's wishes a convenient flexible office desk ruler, which will also serve as a reminder of the articles for which they are most anxious to receive inquiries.

THE TELETHERMOMETER

A SYSTEM for the electrical measurement of temperature at a number of different places from a central position, and especially designed to meet the requirements of cold stores and the refrigerating compartments of steamships, has been introduced by Nalder Bros. and Thompson, Ltd. (34 Queen Street, London, E.C.). Resistance coils enclosed in metal cylinders open to the atmosphere are mounted in the various compartments, and are connected by means of lead-covered cable to a multiple contact switch and an indicating instrument of the moving-coil pattern. To ascertain the temperature in any particular compartment, the corresponding resistance coil is connected by means of the switch to the indicator and a source of constant pressure. The temperature is read off direct on the dial of the instrument. For cold storage work, special attention is paid to the calibration of the scale between 29° and 40° Fahr., and accuracy is guaranteed to within half a degree with certain ranges. Either a potentiometer resistance connected across the lighting supply or a special form of magneto-generator is used for the source of current; a steady pressure of 30 volts D.C. is required.

This system has recently been installed at a large cold storage depôt in London. Resistance coils are placed at ten points and are all connected to an indicator in the manager's office. The source of current is a potentiometer coil connected across the 230-volt public lighting supply. The guaranteed accuracy of within half a degree has, it is stated, been substantiated by careful tests. The system enables accurate and regular records of the temperatures to be kept with the minimum of time and trouble.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published January 26th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

30,556/09. **Variable Speed Polyphase Driving Gear for Ships, &c.** H. A. MAVOR, H. M. HOBART and MAVOR & COULSON, LTD. This patent covers a system in which two or more motors with means for varying their pole numbers, are supplied with currents of different phase-numbers and frequencies from two or more generators. At maximum load all the machines and the different windings are used at their full capacity without interfering with each other. An important feature is that synchronising of the generators is avoided. Various windings and connections are described. Nineteen figures.

12,483/10. **Flame Arc Lamps.** SIEMENS-SCHUCKERTWERKE GES. In order to remove the fumes from the globe of a flame arc lamp, an annular passage with outlets in the upper part of its outer wall is provided above the globe. Screens or rotary cowls are fixed outside over these openings, so that wind striking the lamp may set up a suction effect. Six figures.

13,311/10. **Fuse Holder.** V. G. MIDDLETON and C. J. BAKER (London). A totally enclosed fuse holder of the handle pattern with contact blades at each end, consists of an insulating tube, in the ends of which are terminals for gripping the fuse wire without the aid of screws. Caps, which fit over the ends of the tube, serve both to grip the wire and to close the tube. Five figures.

18,528/10. **Fuse.** SIEMENS-SCHUCKERTWERKE GES. To prevent the setting-up of an arc in a cartridge fuse, in which a short main fuse wire is connected in parallel with a longer auxiliary wire to take the final arc, the two wires are arranged in the same casing, but are separated by a screen of insulating material, which divides the casing into two compartments. Four figures.

22,224/10. **Instrument for Indicating Equalising Currents of Alternators in Parallel.** SIEMENS BROS. & Co., LTD. (*Siemens and Halske A.-G.*). The primary coils of a current transformer are inserted in series between the common 'bus-bar and the circuit of similar phase of each generator, and the secondary coils are connected in series with one winding of the phase-difference indicator of that generator. The other winding of the phase instrument is traversed by the resultant current due to the sum of the separate currents flowing in these secondary coils. Four figures.

28,661/10. **Reversing of Polyphase Motors.** SIEMENS-SCHUCKERTWERKE GES. To avoid sparking at the switch contacts and heavy rushes of current when reversing three-phase induction motors of low frequency, the field is maintained near its full strength during reversing by first short-circuiting the two phases to be reversed at the instant when they are at equal potential. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: SAUVAGE [Projectors] 378/10; SIEMENS-SCHUCKERTWERKE GES., 5,452/10; SIEMENS BROS. DYNAMO WORKS and NEBEL [Search-light projector lamps] 15,018/10.

Distributing Systems, Cables & Wires, Insulating Materials, &c.: BERRY [Transmission and distribution systems] 23,179/09; BURGESS and CLARK [Apparatus for cleaning wire] 9,673/10.

Dynamos, Motors, & Transformers: LYNDON [Variable-speed dynamo (train-lighting) distribution system] 649/10; A.-G. BROWN, BOVERI & CIE. [Compensating winding for polyphase commutator machines] 1,768/10; HEATHER [Control of slip-ring induction motors] 9,304/10; MARKS (*Felten & Guilleaume-Lahmeyerwerke A.-G.*) [Motor control] 10,370/10; SIEMENS BROS. & Co. (*Siemens & Halske A.-G.*) [Current transformers] 25,732/10.

Electric Ignition: HOSCH and MORREL [Sparking-plug] 2,186/10; SUSSEX, 23,241/10.

Electrometallurgy & Electrochemistry: REID [Electric furnaces] 1,189/10; SMITH and DEAKIN [Electrodeposition of metals] 7,224/10; RUTHENBURG [Electric furnaces] 20,404/10.

Incandescent Lamps: BENNETT [Lamp sockets] 5,926/10; KRAUSE [Metal-filament lamps] 11,107/10; SCHRÖTER [Metal-filament lamps] 15,879/10.

Instruments & Meters: MACALISTER [Apparatus for determining position of faults on mains] 7,574/10.

Storage Batteries: STERN, 11,781/10.

Switchgear, Fuses, and Fittings: WINTERBOTTOM [Lamp-holders] 472/10; PARKINSON and WOODALL [Conduit joints] 658/10; SYKES & SUGDEN, LTD. [Double-break switches] 8,460/10; SMITH [Battery connectors] 9,617/10; THOMPSON (*Porter*) [Motor controllers] 15,548/10.

Telephony and Telegraphy: THOMPSON (*Morse Code Signal Co.*) [Electromagnets for signalling apparatus] 671/10; AITKEN and BRITISH INSULATED & HELSBY CABLES, LTD. [Telephone switchboards] 1,050/10; THOMPSON (*Deutsche Telephonwerke Ges.*) [Automatic telephone exchanges] 12,248/10.

Traction: HAMILTON [Suspended railways] 886/10; MOORE and CROMPTON [Safety devices for trolley-wires] 903/10; OWEN [Ventilation of tramcars, &c.] 2,538/10; SPENCER [Vacuum brakes] 3,503/10; WOODYER [Route indicator] 10,333/10; MONARD [Control of points and signals] 15,292/10; ALLGEMEINE ELEKTRICITÄTS GES. [Selenium cell signalling apparatus] 17,156/10; SIEMENS BROS. & Co. (*Siemens & Halske A.-G.*) [Signalling circuits] 20,326/10.

Miscellaneous: BRENNAN [Gyroscopic stability mechanism] 26,034/09; HARVEY PNEUMATIC CLEANERS Co. [Vacuum cleaners] 1,058/10; STOTHERT & PITT, LTD. [Electric cranes and winches] 3,462/10; SERRELL [Vacuum cleaners] 4,966/10; GAUCHER [Air-compressors adapted to work as vacuum pumps] 9,591/10; ALLGEMEINE ELEKTRICITÄTS GES. [Emergency braking devices] 25,589/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electrochemistry, &c.: HEIL [Galvanic batteries] 207/11.

Incandescent Lamps: ATWOOD, 23,535/10.

Miscellaneous: MERSHON [Formation of dielectric films] 28,352/10; FISKER [Portable electric vacuum cleaner and blower] 30,058/10; BECKER [Reducing loss of energy in lines with variable electro-magnetic equalising] 65/11; MERSHON [Insulating devices] 239/11; ALLGEMEINE ELEKTRICITÄTS GES. [Centrifugal pumps] 431/11.

Application for Restoration of Patent

530/07. **Copper Refining.** L. JUMAU. Application has been made for the restoration of this patent, which expired last June owing to the non-payment of renewal fees. It covers a chemical process for obtaining a copper precipitate from a copper salt solution. The precipitate is then compressed into briquettes, which are used as anodes in ordinary electrolytic refining vats to eliminate the precious metals.

Surrender of Patent

18,328/09. **Flame Arc Lamp.** SIEMENS-SCHUCKERTWERKE GES. This patent was revoked on Jan. 17th, as the result of an offer to surrender by the patentees. It covers a lamp with three carbons, two of which support each other and contain the salts, the third being a plain carbon.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

2,818 of Feb. 3rd, 1897. **Mercury Meter.** S. Z. DE FERRANTI. This patent covers the use of a gland in mercury motor meters to enable them to be transported with the mercury in them. The first claim is:—"In an electricity meter using mercury, retaining the mercury in position by the use of a gland through which the spindle passes freely during work, and which gland is capable of being closed when desired."

2,904 of Feb. 3rd, 1897. **Telegraphy.** F. L. MUIRHEAD. This relates to perforators for automatic tape transmitters, and covers a construction in which the punches and cutting plates are mounted on a removable base-plate for facilitating sharpening or adjustment.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: F. M. LEWIS [Converging-carbon lamp mechanism] 20,609/05.

Distribution Systems, &c.: G. WILKINSON [Cable junction boxes] 20,497/01.

Dynamos, &c.: W. E. BURNAND [Air-cooled transformer] 20,423/01; R. VON LIEBEN and E. REISZ [Electric variable-speed transmission gear] 21,795/04; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [High-speed rotor field magnets] 22,157/04; V. A. FYNN [Combined series and repulsion A.C. commutator motor] 20,368/05.

Incandescent Lamps: W. NERNST [Heating wire and automatic cut-out for Nernst filament] 23,470/97.

Switchgear, &c.: G. C. MARKS (*J. Roberts, Durban*) [Limit switch for dimming lamps] 20,666/05.

Telephony, &c.: V. POULSEN [Variable-capacity condenser for wireless systems] 20,068/05; I. KITSEE [Twisted conductors of telegraph and telephone systems] 20,547/05.

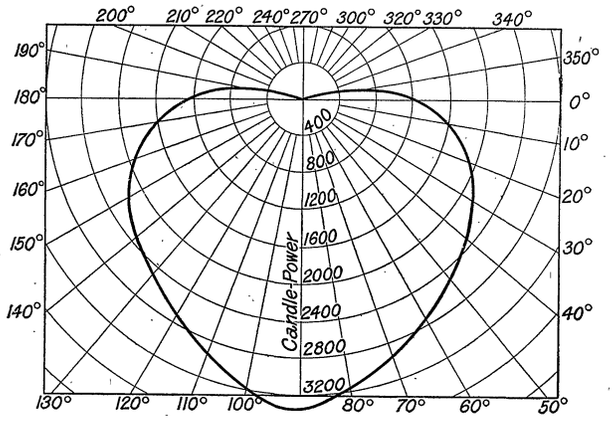
Traction: F. R. JOYCE [Brake blocks] 20,584/99; A. B. UPHAM [Trolley poles, &c.] 22,097/03; H. JAMES [Trolley wheels] 21,648/04.

Miscellaneous: J. TINSLEY [Coal-cutters] 22,042/02; T. BAMFORTH [Smoke consumption] 20,652/05.

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A NOVEL ARC LAMP

An arc lamp of extreme simplicity, looking at first sight like a resuscitation of the Jablochkoff candle, but with an important new feature rendering it always self-starting, is shortly to be placed on the market in this country. We were permitted to be present at a demonstration of the apparatus by the inventor, Dr. Ruhling. As in the Jablochkoff candle, the two carbons are parallel, and are separated by a strip of non-conducting plaster, and a metallic bridge is provided for starting the arc. In the original lamp, if the current is interrupted, the arc cannot restart without restriking by hand; but in this invention, a certain amount of powdered copper is incorporated in the plaster, and when the arc goes out, a film of copper is deposited across the plaster, and forms the necessary bridge for restarting the arc. The reducing effect of the carbon in the arc prevents the copper



Polar Curve of Candle-power Distribution.

from oxidising. The lamp can be used in any position—vertically upwards like a true candle, horizontally, or with suitable carbons pointing vertically downwards in an economiser, with a blow-out coil, as a flame lamp. In the first two cases, absolutely no mechanism is required, and in the flame lamp the very simplest device is sufficient to permit the carbon to feed against a stop as burnt away. The sizes of the two carbons in the continuous-current lamps are proportioned so as to burn away at an equal rate, and we are informed that a steady light can be obtained with a current as low as 2·5 to 3 amperes.

The appended candle-power curve shows that the candle-power is a maximum in the axial direction, which would indicate that, with the carbons nearly horizontal, a distribution of light not unsuitable for street lighting can be obtained.

SYSTEMS OF WIRING

A DISCUSSION on Wiring Systems was held at a meeting of the Dublin Section of the Institution of Electrical Engineers, on Thursday, January 12th. Mr. T. Tomlinson was of opinon that no one system was applicable to all situations. Casing and capping had advantages where the materials, workmanship, and supervision were not of the best, because the wires were well separated from each other. It did not, however, make a cheap job if properly done. He considered close joint tubing was absolutely the worst system to employ under bad conditions. The wires were all bunched together, and might actually get burnt on to the tubing, there was great difficulty in jointing up the tubing, and wires were often left exposed at junctions, probably resting on a sharp edge. The use of screwed junctions was a distinct improvement, but was rather expensive. In that system, however, it was essential that the conduits be laid first and jointed up complete, the wires to be drawn in *after*. For this it was necessary to provide ample room, easy bends and proper draw boxes. Screwed tubing should be laid during the construction of buildings; it made a bad and unsightly job if done on the surface. He thought there were possibilities in the Stannos system, but it was very much handicapped because at present all supply authorities refused to connect it to their mains unless a transformer intervened. (Mr. Tomlinson evidently had in mind the form of the Stannos system where the sheathing is used for the return; there is, of course, no objection to the ordinary two-wire Stannos system.) Twin wire insulated with vulcanised rubber and lead-covered, made a neat and safe job under certain conditions. Paper insulation could also be used if care was taken in sealing up the ends; he believed, however, that this class of wire could now be obtained in which the insulation was not of so hygroscopic a character. He thought that lead covering was preferable to cheap and badly enamelled tubing.

Mr. Mark Ruddle (City Eectrical Engineer, Dublin) thought the most important requirement was absolute reliability. Wood casing systems put in some 16 or 18 years ago were still doing good service. Systems employing an "earthed" outer were quite unsuitable for connection to public supply systems.

Mr. Wainwright (Messrs. Meldon & Co.) mentioned that in his experience very few faults occurred on wires in wood-casing systems; he could not, however, say the same regarding close conduit; the trouble was usually due to water entering and collecting at the switches. More trouble, however, occurred with flexible cords than the main wires. The lead-covered system was good. Slip-tubing was the cheapest system, casing some 10 to 15 per cent. higher, while screwed tubing was too expensive for ordinary work.

Mr. S. W. Martyn described at considerable length his M. P. system (see Electrical Engineering, September 8th, 1910, page 574). He knew whole streets of houses in London which had been wired at 4s. 6d.—5s. per point.

Mr. J. Tierney (Dublin United Tramways Co.) drew attention to cheap wiring systems which he had seen very largely used on the Continent.

Mr. R. U. Eaton said that the cost of erecting casing was considerable as, in order to do a good job, it was necessary to employ carpenters. Slip tubing was cheaper, but damp plaster acted on it very rapidly. He had found 4—22 wires in a $\frac{5}{8}$ in. tube. Screwed tubing and 2,500 megohm wire made the best job, but 2,500 megohm wire was dear—especially if it wore the C.M.A. label. It was possible to buy wire apparently as good without the magic label some 40 per cent. cheaper. He considered that consulting engineers should specify the size of junction boxes to be put in. He had found lead-covered and paper-insulated wires unsatisfactory.

Mr. Wm. J. U. Sowter (Chief Electrical Engineer, Bray) mentioned that where paper-insulated wires were used it was quite common to see wall-paper saturated in oil which had escaped from the wires. Stannos wiring was only suitable for connection to public supply systems where a special transformer was used. He believed that in some cases two wires were used, each surrounded by the metal envelope, which was earthed. Such a system might do for direct-current supply, but was unsuited for alternating supply, owing to eddy currents being set up in the metallic casings.

Mr. A. E. Porte, in closing the discussion, thought it significant that a recent congress of Fire Brigade Officers unanimously decided that casing and capping was the safest system. He knew of a large job in a brewery on the slip-tube system, which had all been pulled out after a few months' working, the trouble arising from damp necessarily present. He considered that consulting engineers should specify the weight of tubing per foot run. He would suggest 14 B.W.G. as a standard gauge, but 15 B.W.G. was the thickest obtainable at present. Mr. Porte did not favour lead-covered wires on account of the necessary presence of mortar, which had a corrosive action on lead.

Coronation Illuminations.—The Associated Municipal Electrical Engineers, Greater London, have passed the following recommendation:—"That this Association recommend that the charge for current for Coronation illumination be on the basis of one penny per unit, with a minimum connecting and disconnecting fee of 5s., and, where the existing service is insufficient, the cost of additional service."

Institution of Electrical Engineers.—The following is the result of the ballot for new members on Thursday.—*Members:* H. A. Couves, S. B. Donkin. *Associate Members:* J. Alsing, F. Briggs, T. K. Evans, F. W. Francis, W. H. Freemantle, J. W. Heaney, D. F. McIntosh, F. McMorrough, E. E. Moore, E. W. Newton, P. A. Paris, T. D. Parry, G. Richman, G. Rogers, W. R. Rothenberg, W. V. Ryder, R. P. Stewart, J. D. White, W. N. Wilson. *Associate:* R. L. Goold. *Students:* J. V. Buckley, R. Cowell, D. H. Green, D. Harrop, F. C. Heayberd, S. Holmes, L. Hugo, P. S. Jackson, E. G. James, L. S. King, M. Kshirasagar, B. S. Lion, R. Nandi, A. Neilson, J. F. Perrin, C. E. Robertson, H. D. Shaw, H. C. Simmons, D. H. Smith, N. Steel, K. A. Ward, W. Woodrow.

Liverpool Tramways.—Mr. C. W. Mallins, General Manager, Liverpool Corporation Tramways, read a Paper on Friday evening last before a large audience in Liverpool on the Liverpool tramway system. He mentioned the pioneering experiments of G. F. Train at Birkenhead in 1860, and traced the history of the Liverpool undertaking from the incorporation of the company in 1865. After various vicissitudes, the lines were finally taken over by the Corporation in 1897, and their electrification was completed in June, 1901. Since then the increase in traffic has been enormous. Looking into the future, he expressed strong preference for tramways over tube railways for dealing with the traffic problem, and pointed out that the substitution generally of mechanical for horse traction was doing much to better the conditions, and he looked forward to a great future for the trackless trolley system.

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LOCAL NOTES

Dundee: *Trolley Omnibus.*—Mr. Peter Fisher, the Tramway Manager, gave a lecture last week upon trolley omnibuses, which he considers could be adopted on certain routes in the neighbourhood of Dundee.

Falkirk: *Bulk Supply.*—The Council have decided to inform the Scottish Central Electric Supply Co. that, after the expiry of the present agreement for bulk supply on July 1st, no electrical energy will be required from the company.

Glasgow: *Tramways Assessment.*—The Tramways Committee's recommendation to appeal against the assessment has been referred back. The Committee claim that the law in Scotland is that a tramway should be rated as a railway, viz., upon the basis of 25 per cent. of the valuation. For two years an increased assessment has been levied, but the Committee think it is time they asserted what they are advised is their legal position. The object of referring the recommendation back was to give the City Assessor an opportunity to explain his reasons for the increased assessment.

L.C.C.: *Petitions against Bills.*—The Highways Committee recommend that petitions should be lodged against the following electrical bills in the coming Parliamentary session:—Central London Railway, London Electric Railway, Metropolitan District and Metropolitan Railways.

Electric Supply.—An agreement between the Poplar and Stepney Borough Councils for a mutual supply of electricity in times of emergency has been reported upon favourably by the L.C.C.

Bermondsey: Electric Supply Competition.—The Highways Committee of the L.C.C. have communicated with the Board of Trade concerning the application of the Bermondsey Council for an electric lighting provisional order in the portion of their area now supplied both by the London Electric Supply Corporation, Ltd., and the County of London Electric Supply Co. The County Council ask that the order should not be granted on the ground that it is very unusual to have three authorities supplying in the same area, that public inconvenience will be caused by the laying of a third set of mains, and that it would extend the area in which, after purchase of the companies, the L.C.C. will be in competition with the Borough Council. Should the order be granted, the L.C.C. call attention to a section which would give the Borough Council authority to sell electric fittings to persons other than consumers or prospective consumers.

Newport: *Electricity Finances.*—The Ratepayers' Association having threatened litigation in respect of the finances of the municipal electricity undertaking, the Town Clerk has been instructed to take counsel's opinion on the position. The questions involved are similar to those which arose in the action by the India Rubber, Gutta Percha & Telegraph Works Co., Ltd., against the West Ham Corporation.

Plymouth: *Electricity Estimates.*—The estimated revenue for the electricity undertaking for the year to March, 1912, is £26,585, compared with £24,750 for the current year, leaving a gross profit of £11,295, against £10,120 in the current years. For street lighting the Committee anticipate an expenditure of £6,946 against £6,916 for the current year.

Stoke-on-Trent: *Vibration from Electrical Machinery.*—The Stoke-on-Trent Ice & Cold Storage Co. have been summoned in respect of alleged vibration from the electrical machinery, at their works, by a tradesman whose premises adjoin those of the company. The County Court judge was reluctant to grant an injunction, as it might lead to the abandonment of an important industry. Consequently, the proceedings were adjourned to see if the parties could come to an agreement.

Sutton: *Street Lighting.*—There has been a long fight between the gas and electric lighting companies as to a renewal of the contracts for street lighting, both companies at present having a certain portion of the district to deal with. After much debate the Council have decided not to give either company any additional portion of the district; but the keenness of the competition has been such that the ratepayers will benefit considerably under the new contracts. Thus, in those side streets which are at present lit by 64-c.p. lamps, 100-c.p. lamps will be substituted without any additional cost. In the same way, the gas company have had to give better value for money.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Barking.—The Electricity and Tramways Department require a 250-kw. motor generator or rotary converter. Particulars from Electrical Engineer and tenders by February 15th.

Bedford.—Application is to be made for a loan of £22,837 for electrical extensions.

Doncaster.—A loan of £12,000 is to be applied for in connection with extensions at the Electricity Works.

Dublin.—A loan of £125,000 is to be applied for in connection with the electricity undertaking.

East Indies.—According to the *Board of Trade Journal*, the Netherlands Government are to erect several large electric cranes for operation in connection with the Ombilin mines in the Netherlands East Indies. It is said that machines of German make have been offered, but are not regarded as suitable.

Glasgow.—The Corporation have acquired land at Dalmarnock, at an estimated cost of £22,000, for the purpose of a new generating station.

Hastings.—A Local Government Board inquiry was held last week concerning a loan of £2,803 for additional mains. There was strong opposition by the local gas companies. The inquiry was concluded.

London: *Stepney.*—The L.C.C. Finance Committee recommend sanction to a loan of £3,060 for electrical extensions.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Buildings on the southern side of Catford Hill, Lewisham. New Middlesex County Council Guildhall at Westminster.

Factory in Ryley Street, Bermondsey. Messrs. Grant and Co.

Ten houses, Melrose Avenue, Croydon. C. S. Banks.—Distillery and storeroom, Mitcham Road, Croydon.—Thirty houses, London Road. Alder & Wheeler.—Electric theatres, London Road and Brigstock Road. C. Spencer, 16 Camden Road, Croydon.

PROVINCES.

Barry.—Proposed new police station.

Bridlington.—Laundry at Infirmary. Architect's Office, Wellington Road.

Hull.—Tenders are invited by February 16th for the electric lighting of the Sidmouth Street Schools. Particulars from City Architect.—New Sanatorium. Hospital Sub-Committee.

Lancaster.—Elementary School on High Street Estate.

Manchester.—Extensions to Guardians' Schools, Swinton.

Merthyr Tydfil.—Infants' School at Lower Pentrebach.

Paisley.—New Post Office. H.M. Office of Works, Storey's Gate, London.

Perth.—Two large tenements in South Inch Terrace. Builder, M. Kerrigan.

Rochdale.—Alterations to Town Hall.

St. Albans.—Cinematograph theatre.

Sittingbourne.—New Post Office.

Swansea.—Cinematograph hall, High Street. W. Coutts.—Six houses, Waterloo Place. R. Lacy.—Eight houses, Monterey Street. James Taylor.—Seventeen houses, Beechwood Road. H. Jenkins.

Torquay.—New school.

Watford.—New Church and Institute in Whippendale Road.

MISCELLANEOUS

Birmingham.—The Tramways Committee require 1,700 tons of grooved steel girder tramway rails, and 3,000 pairs of fish-plates. Particulars from the Manager, and tenders by February 13th.

Blackburn.—Tenders are invited by the Electricity and Tramways Committee for stores, including insulating material, house service fuse-boxes, switches, &c., motors, motor starting switches and screwed tube for inside wiring. Particulars from Electrical Engineer and Tramways Manager and tenders by February 13th.

Salford.—Tenders are invited by February 13th for a year's supply of stores to the Electricity Department, including cables, cable accessories, bitumen, cable conduits, service fuse-boxes, meters, maximum demand indicators, gravity type

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ammeters, circuit breakers and ironclad switches, switches, fuses and arc lamp globes, carbon filament lamps, arc lamp carbons and motor carbon brushes, motors, and motor starters. Particulars from Borough Electrical Engineer.

TENDERS RECEIVED AND ACCEPTED

London: *L.C.C.*—The following were received for the electric lighting of the Fire Brigade Headquarters extension :—Pinching & Walton, £460 17s.; G. Weston & Sons, Ltd., £525; Foote & Milne, Ltd., £528 10s.; E. Newbald & Co., £545 10s.; Lund Bros. & Co., £621 10s. The first-named tender has been accepted.

For the supply of workshop motors at the chief station of the Fire Brigade, the following have been received :—Verity's, Ltd. (recommended), £158 18s.; Lancashire Dynamo and Motor Co., Ltd., £182 4s.; General Electric Co., Ltd., £193 5s.; Mavor & Coulson, Ltd., £195 10s.; Electromotors, Ltd., £197.

The tender of Messrs. Stanley Bros. for 500,000 stoneware cable ducts for the Tramways Department, at £4,487 10s., is recommended for acceptance.

A contract is to be entered into with the British Thomson-Houston Co., Ltd., for the provision of 40 pairs of mercury-type ampere-hour meters for tramcars, at £200, and for the maintenance of same at 5s. per meter per annum

The tender of the Edison & Swan United Electric Light Co., Ltd., accepted by the L.C.C., and mentioned in our last issue, was for wiring material only, and not for fixing.

The Diesel Engine Co., Ltd., has recently received the following orders :—Hoffman Manufacturing Co., Ltd., Chelmsford, one 330 B.H.P. engine, with 220 kw. generator. Athlone Wool Mills, Ireland, one 240 B.H.P. engine. The Smithfield Markets Electric Supply Co., Ltd., three 270 B.H.P. engines, with 180 kw. generators. Barking Urban District Council, one 600 B.H.P. engine, with 400 kw. generator. Linoleum Manufacturing Co., Ltd., Staines, two 200 B.H.P. engines, with 135 kw. generators. Colombo Tramway Co., Colombo, one 525 B.H.P. engine, and 375 kw. generator. Canadian Government for pavilion at "Festival of Empire" Pageant at the Crystal Palace, one 200 B.H.P. engine, with 135 kw. generator, and one 120 B.H.P. engine, with 80 kw. generator.

London Electric Supply Companies' Dispute.—What promises to be an interesting action was mentioned before Mr. Justice Joyce in the Chancery Division on Friday, when the London Electric Supply Corporation, Ltd., sought to restrain the Westminster Electric Supply Corporation from soliciting or attempting to entice away the former's customers. In ELECTRICAL ENGINEERING for October 21, 1909, we gave particulars of an agreement between the two companies, under which the London company placed the management and working of the portion of their undertaking in Westminster in the hands of the Westminster company, upon certain terms. It is now alleged that the Westminster company have violated the terms of this agreement, although it was not made clear in what way. Both sides agree that it is a case which must be tried by the Courts, but the object of the motion was to secure that the Westminster company should not solicit the customers of the London company in the meantime. It was agreed that no further circulars should be sent out by the former pending the trial.

Tantalum Lamps for Tramcar Lighting.—An investigation has been carried out by the Chicago Railways Company in regard to "Tantalum" lamps, the object being to ascertain the proper allowance for renewals, energy economy, and correct voltage rating of lamps for street-car service. It was shown that in the case of a car burning twenty-five 16-c.p. "Tantalum" lamps, as compared with a similar equipment of carbon lamps, there was a saving of 1,301-kw. hours in energy on the basis of 1,800 hours lamp-burning a year, while a test extending over 600 car-months showed the renewals of carbon lamps to be 4·269 per car-month, and of "Tantalum" lamps 2·21 per car-month. The *Electric Railway Journal*, in analysing the results, shows that there was an average saving of 2·5d. per car-day on the basis of 1,800 hours of illumination per car-year, and that when "Tantalum" lamps have been installed in all the cars operated by the company there will be a saving of about £5,000 a year. The higher cost of "Tantalum" lamps over carbon lamps is claimed to be balanced at the end of the first year by the longer life of the metal filament. The saving in the current consumption is important in the case of the Chicago Railways, as the company purchase the power and pay a premium on peak loads.

APPOINTMENTS AND PERSONAL NOTES

Mr. C. A. Park, late carriage superintendent of the London and North Western Railway, has been appointed managing director of the British Westinghouse Electric & Manufacturing Company's works at Old Trafford, Manchester.

Mr. Arthur Wright has given six months' notice terminating his engagement as Consulting Electrical Engineer to the Brighton Corporation. Mr. Wright is now giving much attention to the undertaking of the Victoria Falls and Transvaal Power Co., to which concern he is Joint Consulting Electrical Engineer. His connection with Brighton extends over some twenty years, first with the old Hammond Co., and later with the Corporation. He designed the first power station, viz., North Road (now a sub-station), and also the Southwick Works, which were opened in 1906.

The Bradford Electricity Committee recommend that the salary of the City Electrical Engineer, Mr. T. Roles, shall be increased from £600 to £700 per annum as from April 1st, with two annual increases of £50 each, making a maximum of £800 per annum.

One hundred and twenty applications were received for the post of Burgh Electrical Engineer at Falkirk, rendered vacant by the resignation of Mr. John McMillan, who is going abroad. The salary is £200 per annum.

Mr. A. J. Newman has been appointed Mains Superintendent in the Bristol Electricity Works, at a salary of £180, rising to £200 per annum.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 5s. to £57 15s. per ton (last week, £57 10s. to £58).

Bankruptcies.—A scheme of arrangement in the bankruptcy of Mr. Robert Brown, Parliament Chambers, Great Smith Street, Westminster, by which 7s. 6d. in the £1 will be paid on liabilities of £2,164, has been sanctioned. The debtor for four years acted as manager to the Traction Corporation, Ltd., and his insolvency is attributed to his liability for costs on an action brought by himself and the company in connection with an alleged infringement of an electrical patent.

A. J. Dale, electrician, 15 New Oxford Street, London, has been adjudicated bankrupt. The first meeting of creditors took place at Bankruptcy Buildings, Carey Street, London, on January 30th, and the public examination will take place on March 1st.

Siemens' New Telephone Numbers.—Messrs. Siemens Bros. Dynamo Works, Ltd., Incandescent Lamp and Fittings Department, Tyssen Street, Dalston, N.E., advise us that in future their "Dalston 4" line will be cancelled, this line having been replaced by three lines on the Dalston Exchange. With the three Central lines, there will be a range of six lines, the numbers being as follows :—Central 8387, 8388, and 8389; and Dalston 2440 (three lines).

Change of Address.—The offices of the Horsfall Destructor Co., Ltd., have been removed from No. 15 to more commodious premises at No. 17, Victoria Street, Westminster, S.W.

Reyrolle's Foremen's Dinner.—The foremen and deputy-foremen of Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, held their annual dinner at the Ellison Hotel, Hebburn, on Saturday. Mr. W. A. Harrison, works manager, occupied the chair, and a very pleasant evening was enjoyed.

Theft.—At the Exeter Assizes on Monday, Arthur Wall, an electrical fitter at the Devonport Dockyard, was sentenced to six months' imprisonment for embezzling the funds of the Electrical Workers' Help Club at Devonport. The sum of £81 was involved out of a total of £144 which were received.

Train Telephony.—The "Railophone" system of train telephony by magnetic induction, devised by Mr. H. von Kramer, and described in ELECTRICAL ENGINEERING, Vol. VI., pp. 513 and 590, is to be given a trial on a ten-mile section of the Stratford-on-Avon and Midland Junction Railway.

OSRAM·LAMPS

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COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

British Columbia Electric Railway Co.—Interim dividend at the rate of 5 per cent. per annum on non-cumulative preferred ordinary stock for December half-year, together with a bonus of 1 per cent.

Siemens-Schuckert Co.—The *Times* states that this company is receiving an advance of £1,500,000 from Messrs. Siemens & Halske, and from Messrs. Schuckert & Co.

Blackpool & Fleetwood Tramroad Co.—Dividend at the rate of 9 per cent. per annum, placing £3,500 to depreciation, £750 to reserve, and carrying forward £2,642.

St. James & Pall Mall Electric Light Co.—Final dividend on the ordinary shares, making 10 per cent. per annum for 1910.

Cuban Telephone Co.—Subscriptions are invited for an issue of £300,000 five per cent. first mortgage gold bonds at 89.

Urban Electric Supply Co.—An extraordinary general meeting was held last week to consider a new agreement with Messrs. Edmundsons Electricity Corporation, Ltd. Mr. P. D. Tuckett, who presided, said that the agreement under which Messrs. Edmundsons managed the business of the Urban Electric Supply Co. had expired, and a new agreement was proposed for them to continue the management at an annual fee of £2,000. They were also to carry out all new construction work at cost price plus 10 per cent., and to finance the Urban Co. to the extent of a further £100,000. The agreement was approved.

Liverpool Overhead Railway Co.—Dividend at rate of 1½ per cent. per annum on ordinary shares for the December half-year, carrying forward £4,246.

London Electric Railways Co.—Dividend at rate of ¾ per cent. per annum upon ordinary stock for December half-year.

National Telephone Co.—Dividend at the rate of 6 per cent. per annum on the deferred stock for the December half-year, carrying £200,000 to reserve, and about £12,000 forward.

Metropolitan Railway Co.—At the meeting last week special attention was called to the fact that £10,000 had been transferred out of the half-year's revenue to the electrical renewal and depreciation fund, as against £5,000 twelve months ago. Automatic electric signalling has now been installed as far as Willesden Green.

Great Northern & City Railway Co.—The net revenue for the December half-year was insufficient by £3,903 to meet the fixed charges, and this sum has been provided from outside sources. The number of passengers carried was 5,856,829, against 5,652,556 in the corresponding period of 1909.

Anglo-American Telegraph Co.—A balance of £2,609 is carried forward from 1910, after meeting dividends of 3¾ per cent. on the ordinary stock, 6 per cent. on the preferred stock, and 1½ per cent. on the deferred stock.

City & South London Railway Co.—Mr. C. B. Stuart Wortley presided at the annual meeting on Tuesday. Although more passengers have been carried, the revenue per passenger was less for the half-year, owing to an increase in the through traffic with other railway companies. He referred to the speeding up of the trains to the average of 17 miles, which is now the speed on many of the other underground railways. On the City & South London, the average is only 13½ miles per hour, and an increase to 17 miles would necessitate great changes and additions to their rolling stock, and also considerable increase in siding accommodation. Nevertheless the public seemed to expect the increase in speed to become general, and it might be possible to save some portion of the expense of the new stock by ceasing to run five-coach trains in the less busy parts of the day, which at present they were obliged to do owing to the lack of siding accommodation and difficulties connected with the coupling and uncoupling of the coaches. The company had received representations from the municipal bodies in favour of extending the line beyond the present terminus at Clapham Common.

NEW COMPANIES

T. H. BROOKER, St. Michael's House, St. Michael's Alley, London, E.C. Capital £5,000. Electrical engineers.

MONTREAL TRAMWAYS & POWER CO., 4 St. Mary Axe, London, E.C. Capital, £4,000,110. To construct, purchase, lease or acquire tramways and street railways in Canada; to supply electricity, and to adopt an agreement with the Imperial Trust Company of Montreal.

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ELECTRICAL POWER USERS ASSOCIATION.—This company has been registered with 100 members, each liable for £1 in the event of winding up. For insuring users of electric power against fire and other risks. The subscribers include O. Huxley, consulting engineer, 120 Coldershaw Road, Ealing, London.

Faraday House.—Mr. R. J. Wallis-Jones commences next week a course of demonstration lectures on electric welding to the senior students at the Standardising Testing and Training Institution, Faraday House.

Telegraph Traffic and Movements of Cable Ships.—The Compagnie Française des Cables Télégraphique has its West India system in order again, the last repair having been effected on December 27th, between Cape Haiti and Puerto Plata. On January 24th the cable between Dakar and Honakry was placed in working order again, but the following day the El Arich route was down. The lines of the Indo-European Telegraph Co. between Kertch and Soukhoum were down on January 26th for a short while. On January 28th the *Via* Hanekin route was interrupted between Bagdad and Hanekin, but was restored to working order on the following day. The *Via* Batoum route was interrupted between Trebizond and Batoum on that day also. The Indo-European Telegraph Co. again suffered derangement of the line between Kertch and Soukhoum-Kale on January 30th. The c.s. *Mackay-Bennett*, after having finished work in connection with the Havre-Waterville cable, is now in home waters, and expects soon to leave for her station, Halifax, N.S.

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ELECTRICAL ENGINEERING

No. 215 [Vol. VII., No. 6] THURSDAY, FEBRUARY 9, 1911. [Price One Penny.
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BINDING "ELECTRICAL ENGINEERING." — Vol. VI. of "Electrical Engineering" (Jan.—Dec. 1910) closed with our issue of December 29th, 1910. An index for the volume is now ready, and copies may be ordered from any newsagent or bookseller at the price of 1d. each (or post free, 2d.). Binding Cases, including index, price 2s. each, post free 2s. 4d. (Abroad 2s. 6d.) Readers can have their volumes bound by their own bookbinder; or, they may send their numbers to us, carriage paid (with the reader's name and address), and a remittance of 4s. 6d. under separate cover. The volumes will then be bound and returned carriage paid to any address in the United Kingdom, or carriage forward to the Colonies or abroad.

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SUMMARY

A comparison of the estimated costs of manufacture of aluminium and copper low-tension, paper-insulated, lead-covered cables shows that aluminium cables should be cheaper than copper cables, and should effect a very considerable saving on the larger sizes. (Page 67.)

The Papers on high-tension transmission read recently at the London meeting of the Institution of Electrical Engineers, and to be discussed again to-night, have also been discussed in Newcastle and Manchester. (Page 68.)

Our monthly article on new electrical supplies and accessories contains announcements regarding some new sizes of metal filament lamps, and descriptions of several novelties, including an electrically heated towel-rail, a three-pin plug with an earthing contact for cooking apparatus, electric hair brushes and massage outfits, and an electric humidifier. (Page 69.)

A report of the discussion on Mr. P. V. Hunter's Paper on sub-station design, read recently before the Newcastle Local Section of the Institution of Electrical Engineers, is given. (Page 72.)

Some particulars are given of a new design of three-phase goods locomotive, forty of which are being constructed for use on the electrified main line sections of the Italian State Railways. The two motors are rated at 1,000 h.p. each, and two running speeds of 14 and 28 miles per hour are provided. (Page 71.)

At the annual dinner of the Institution of Electrical Engineers on Thursday, Mr. S. Z. de Ferranti said that the Council were considering whether the Institution could not be of greater utility to its members. He also spoke strongly against the "municipal idea" that no one should be allowed to make a profit out of the industry. (Page 73.)

The discussion upon library lighting, which has been taking place at the Illuminating Engineering Society was concluded on Tuesday last week. A feature of the discussion was the desire of librarians to have prepared for them a specification showing the proper illumination for different purposes. There was some difference of opinion as to whether there should be local lighting of tables, in addition to general lighting of the rooms, and suggestions were made with the object of avoiding certain difficulties now encountered in the wiring of new buildings. (Page 73.)

Among the Specifications published by the Patent Office on Thursday was one describing the stability mechanism of the Brennan mono-rail car. Two specifications covering details in the manufacture of metal filament lamps by O. Krause and K. Schröter respectively, are abstracted. R. A. Macalister describes a method of determining the position of faults on mains by means of a voltmeter and a wire brush in contact with the earth above the cable. A device for switching off traction motors automatically on the application of the emergency brakes, is covered by the Allgemeine Elektricitäts Ges. (Page 74.)

We give some figures relative to the dispute in Manchester regarding the smaller amount paid in relief of rates by the Electricity Department compared with the Gas Department. The Electricity Committee had to pay interest on nearly £1,000,000 more capital than the Gas Department, whilst in the case of about £1,000,000 expended in respect of the tramways no profit is made. (Page 75.)

The L.C.C. Highways Committee recommend that

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the horse tramway lines in Liverpool Road, Islington, should be pulled up. There is much opposition.—£800 damages have been awarded against the Dublin United Tramways Co. in respect of a street accident.—The Manchester tramway employees have agreed to arbitration provided there is no question of reducing wages with the reduced hours.—Newcastle ratepayers are opposed to the running of trolley omnibuses.—The tramway extension from Paignton to Torquay, and the completion of the overhead lines in Torquay, will be completed in a few months.—In spite of the tender for electric street lighting at Holborn being the cheaper, it is proposed to adopt gas. (Page 75.)

EXTENSIONS to generating machinery are contemplated as follows: Aberdeen, £12,500; Bedford, £22,837; Heywood, £4,355; St. Pancras, £2,582; St. Helens, £10,800; Worthing, £7,000; and York, £15,000. —Two 100 kw. Diesel engine sets are required at Reigate; V.B. cable at Belfast; mains at Hackney; switchboard at Sale; and extension at the power station of Messrs. Bayliss, Jones & Bayliss, Wolverhampton.—Electrical and tramway stores are required at Belfast, Grimsby, and Leeds.—It is proposed to spend £1,000 at Bexley upon new tramcar brakes, and large expenditures upon tramway track reconstruction are contemplated at Nottingham and Burnley. (Page 75.)

ARRANGEMENTS have been made upon the Central London Railway for the separate lighting of the carriages in case of a failure at the power station.—Dividends have been announced as follows: St. James' & Pall Mall Electric Light Co., 10 per cent.; Central Electric Supply Co., 5 per cent.; Chelsea Electricity Supply Co., 5 per cent.; Westminster Electric Supply Co., 10 per cent.; Liverpool Overhead Railway Co., 1½ per cent.; South London Electric Supply Co., 5 per cent.; London Electric Railways Co., ¾ per cent. (Page 77.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, FEBRUARY 9TH.

Institution of Electrical Engineers.

8 p.m. Adjourned discussion on Long Distance Transmission Lines.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science.

Paint and Varnish Society.

8 p.m. At St. Bride's Institute, Bride Lane, Fleet Street, E.C. "The Application of Electrolytic Methods to Materials used in the Paint and Varnish Industry," by Dr. F. Mollwo Perkin.

FRIDAY, FEBRUARY 10TH.

Institution of Electrical Engineers: Yorkshire Section.

6.30 p.m. Annual dinner at Hotel Metropole, Leeds.

SATURDAY, FEBRUARY 11TH.

Institution of Electrical Engineers: Glasgow Section.

7.30 p.m. Annual Smoking Concert at the Grosvenor.

Junior Institution of Engineers.

6.30 for 7 p.m. Annual dinner at Hotel Cecil.

Birmingham and District Electric Club.

7 p.m. At Colonnade Hotel, New Street, Birmingham. "The Electric Incandescent Lamp," by J. Findlay.

MONDAY, FEBRUARY 13TH.

Institution of Civil Engineers.

8 p.m. At Great George Street, Westminster. Lecture on "Wireless Telegraphy," by Capt. H. Riall Sankey.

TUESDAY, FEBRUARY 14TH.

National Electrical Manufacturers' Association.

2.30 p.m. Committee meeting at Balfour House, Finsbury Pavement, London.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "Chemical Action in the Windings of High-Voltage Machines," by A. P. M. Fleming and R. Johnson.

Institution of Electrical Engineers: Glasgow Section.

8 p.m. At 207 Bath Street. "Some Considerations Relating to the Parallel Working of Alternators," by the late Mr. J. R. Barr, introduced by Prof. F. G. Baily.

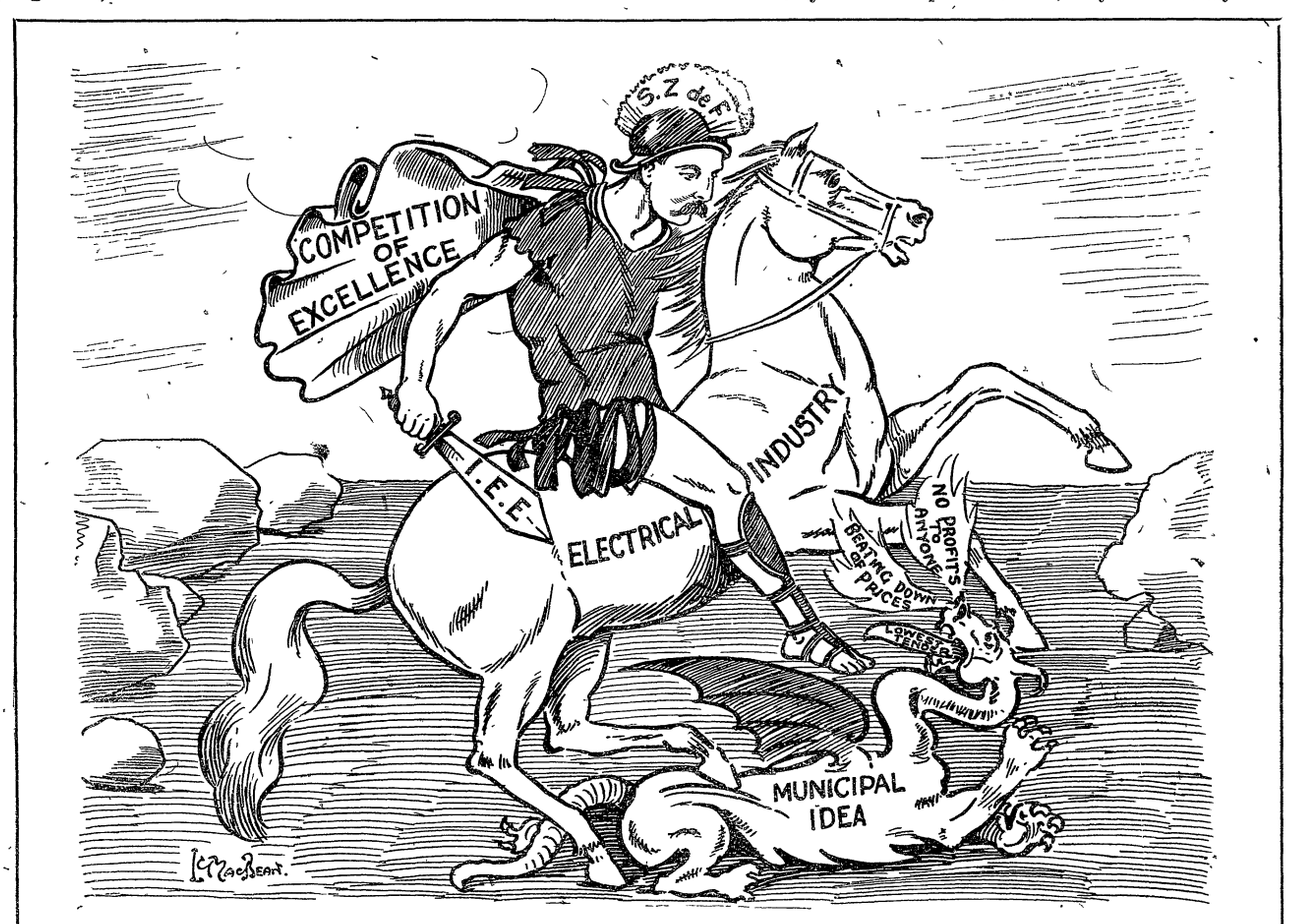
WEDNESDAY, FEBRUARY 15TH.

Institution of Electrical Engineers: Yorkshire Section.

7 p.m. At Leeds University. "Modern Long Distance Transmission of Electrical Energy," by W. T. Taylor, to be read by Mr. J. F. C. Snell.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At Victoria Embankment. "The Manufacture of Dry Core Telephone Cables," by H. C. May.



See Mr. Ferranti's definition of the "Municipal Idea" at the Institution Dinner (page 73).

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ALUMINIUM v. COPPER CABLES

In Electrical Engineering of November 24th, 1910, an article by F. C. Raphael and J. B. Sparks compared the relative costs of aluminium and copper cables for low-tension feeders on underground networks. It was pointed out that it should be possible, at the present prices of aluminium and copper, to buy single-core aluminium cables at a cheaper price than copper cables, of the same conductance, but the authors considered it unwise to quote actual prices for paper-insulated, lead-covered cable, owing to the present state of the cable market. Relative prices were, however, given for bitumen cables of various sizes.

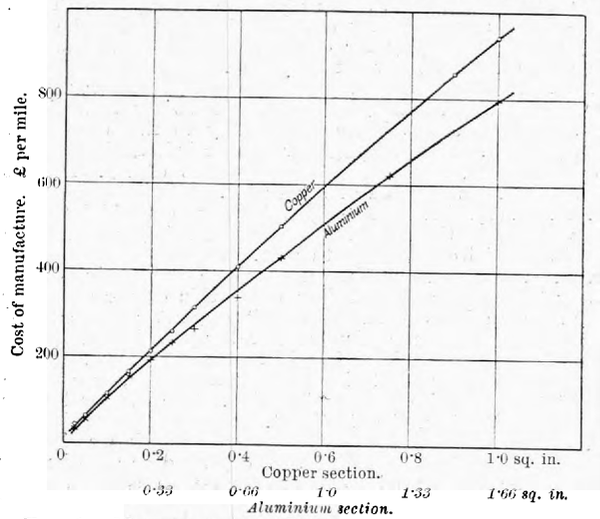


Fig. 1.—Manufacturing Cost of Copper and Aluminium Single-core, Paper Insulated Cables.

The authors have been urged to make this statement with regard to paper-insulated cables more complete, and although they are still loth to quote actual selling prices of cable, which are affected by so many considerations other than prime cost, they have made an approximate estimate of the manufacturing costs for both copper and aluminium cables on an identical basis. The table above gives some of the standard sizes of copper cable with aluminium equivalents, the overall diameters, approximate weights per mile, and estimated manufacturing costs. Copper is taken as costing £60 per ton (electrolytic wire bars c.i.f. port of arrival),

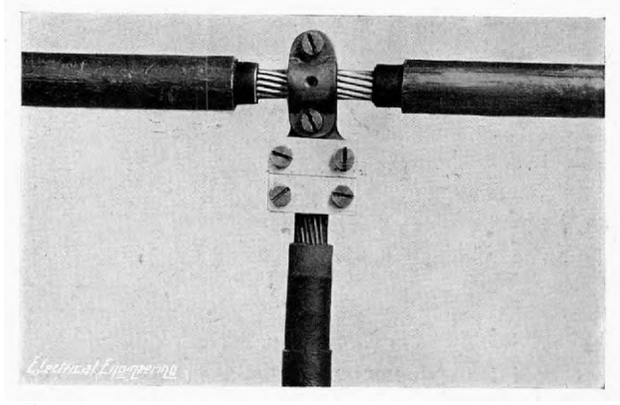


Fig. 3.—Aluminium Cable "Teed" off Copper Cable.

equivalent to drawn copper wire at 7¾d. per lb., and aluminium wire at 10d. per lb. at the cable works, which prices are approximately those at which the two metals are now obtainable. The radial thicknesses of dielectric and lead are assumed to be those specified by the Engineering Standards Committee for the diameters of conductor in question. Thus, for instance, in the case of 1 sq. in. aluminium equivalent to 0·6 sq. in. copper, the radial thicknesses that are employed for 1 sq. in. copper are assumed.

Standard Low Tension Paper-insulated Lead-covered Cables.
Copper v. Aluminium.

Copper Section. (Sq. in.)	Equivalent Aluminium Section. (Sq. in.)	Number and Diameter of Wires. (In.)		Dielectric Thickness. (In.)		Thickness of Lead. (In.)		Overall Diameter. (In.)		Approximate Weight. (Lbs. per mile.)		Approx. Manufacturing Cost. (£ per mile.)	
		Copper.	Aluminium.	Copper.	Aluminium.	Copper.	Aluminium.	Copper.	Aluminium.	Copper.	Aluminium.	Copper.	Aluminium.
0·025	0·041	7/·068	7/·087	0·08	0·08	0·06	0·06	0·48	0·54	2,700	2,800	41	38
0·050	0·083	7/·097	19/·074	0·08	0·09	0.06	0·07	0·57	0·69	3,780	4,350	66	63
0·100	0·166	19/·083	19/·105	0·09	0·09	0·07	0·08	0·74	0·86	6,260	6,560	120	105
0·150	0·250	19/·101	37/·092	0 09	0·10	0·08	0·09	0·84	1·02	8,740	8,960	168	152
0·200	0·333	37/·083	37/·107	0·09	0·10	0·08	0·09	0·92	1·13	10,200	10,300	211	188
0·250	0·415	37/·092	61/·093	0·10	0·10	0·09	0·10	1·02	1·24	12,450	12,600	254	229
0·300	0·500	37/·104	61/·102	0·10	0·10	0·09	0·10	1·11	1·32	14,550	13,800	320	264
0·400	0·666	37/·118	91/·096	0·10	0·11	0·10	0·11	1·23	1·59	18,250	17,600	406	338
0·500	0·830	61/·104	91/·108	0·10	0·12	0·10	0·12	1·34	1·67	21,600	21,600	504	431
0·750	1·250	91/·101	127/·112	0·11	0·13	0·11	0·13	1·55	1·98	29,100	29,100	696	618
1·000	1·660	91/·118	127/·129	0·13	0·14	0·12	0·14	1·80	2·24	38,500	36,300	946	798

It is seen that for all sections, aluminium cable is cheaper to manufacture than copper cable, and that for the larger sizes the difference is very considerable. Thus, while the manufacturing costs for a 1 sq. in. copper cable amount to some £946, the corresponding figure for the equivalent aluminium cable is only £798, namely, £148 or over 15 per cent. less.

In Fig. 1 the same manufacturing costs are plotted in a pair of curves, which show very clearly how the saving due to the use of aluminium increases with the size of the cable.

It must be understood that the costs given are not those at which cable can be bought. They represent the bare manufacturing costs, including material, labour, &c., and no allowance is made for establishment charges, profit, or transport and other general charges.

The various methods of jointing were dealt with in the previous article. The accompanying photographs of copper to aluminium joints have been taken by the British Aluminium Co. Fig. 2 represents a straight-through joint. A three-part stepped clamp is used on

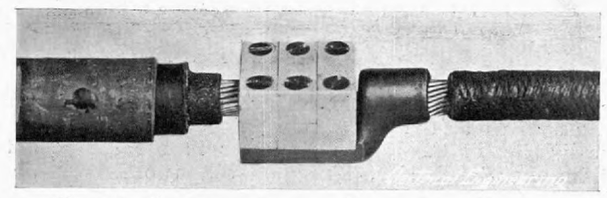


Fig. 2.—Straight-through Joint with Stepped Clamp on Aluminium Cable.

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the aluminium cable, the clamping pieces being screwed down on to the flat lug of a thimble, into which the copper cable is sweated. A simple T-joint of an aluminium cable tapped off a copper cable is shown in Fig. 3. As before, the aluminium cable has a stepped clamp, which is screwed to the usual form of clamp on

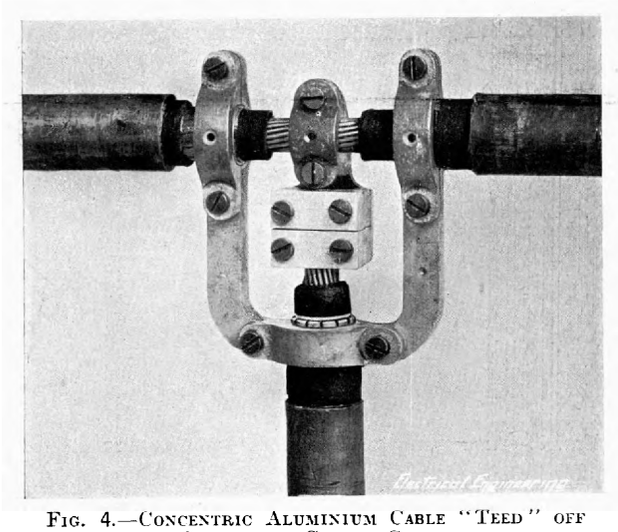


FIG. 4.—CONCENTRIC ALUMINIUM CABLE "TEED" OFF CONCENTRIC COPPER CABLE.

the copper cable. Fig. 4 illustrates a T-joint with concentric cables. A stepped clamp is placed over the inner of the aluminium cable, while a sleeve of aluminium is inserted between the outer strips and the paper insulation to protect the latter from the cutting action of the strips.

HIGH TENSION TRANSMISSION LINES

THE Papers on this subject by Mr. W. T. Taylor and by Messrs. R. Borlase Matthews and C. T. Wilkinson, read on January 26th, have been further discussed by the Local Sections of the Institution at Newcastle and Manchester.

The Newcastle discussion on Monday was opened by Mr. C. VERNIER (Newcastle-on-Tyne Electric Supply Co.) with a few remarks in favour of the Thury system. He also gave some figures of comparative costs for steel towers and wood poles, including first cost, erection, maintenance, and wayleaves, for a period of 36 years, assuming this to be the life of the steel tower, and 18 years that of the wooden pole. The cost per steel tower for 720 ft. span was £62, and for the equivalent number of wood poles for 240 ft. span, £63 18s. The necessity for voltages over 20,000 had not arisen in this country, but above 30,000 the suspension insulator was essential, and as it could swing, it lessened the stress on the towers. The shackle type of insulator had been abandoned by his company in favour of the pin type. He explained the action of the much criticised overhead earth wire, which to some extent counterbalanced the electrostatic charges induced by thunder clouds in the live wires. He thought that it was resonance that would probably limit the distance of transmission by A.-C. currents. The natural period for a line was approximately the speed of light in miles per second divided by four times the length of the line in miles. Thus a 400-mile line would resonate with the third harmonic at 40 cycles. With the high voltage, however, corona effects would greatly relieve the line from surges. The surge voltage when a current of C amperes was broken was independent of the length of the line, and could not exceed $200\sqrt{2}$ C. volts. In this respect the lower voltages and heavier currents had a less factor of safety. The authors of the second paper had stated that in long spans, the wires were prevented from touching by swinging in synchronism, but his own experience did not confirm this.

Mr. B. WELBOURNE (British Insulated & Helsby Cables, Ltd.) criticised some of the designs of towers shown, and held that the principal function of the earth wire was to earth all the metal-work on the poles. Flexible poles had been used for some years in the Midlands with success. He also referred to the advantages of aluminium for line conductors, and said that they were less liable to become coated with ice than copper.

Some discussion then ensued on the life of creosoted wooden poles. Mr. A. G. E. DRUMMOND (National Telephone Co.) mentioned 40 years, and both Mr. ROBB (G.P.O.) and Mr. J. PIGG (N.E. Railway) had experience of poles lasting over 30 years. Mr. REDMAN (Messrs. Merz & McLellan) said that it was certainly too much to expect steel poles to last 36 years, and instanced steel-work which had only lasted seven years. Wooden poles were not suitable for conductors larger than 0·15 sq. in. in voltages above 20,000.

Mr. P. V. HUNTER (Messrs. Merz & McLellan) criticised the complications of some of the diagrams of connections, and Mr. J. ANDERSON (Newcastle-on-Tyne Electric Supply Co.) thought that on many such systems the relays would have to be tied up to enable the system to work at all. Messrs. Porter, Robinson, and Laws also spoke.

The discussion at Manchester was opened by Mr. J. S. PECK (British Westinghouse Co.). He did not quite agree with Mr. Taylor's ideas as to capacity and inductive effects, and called attention to the necessity for careful transposition in the case of the split conductors advocated by him.

Mr. W. CRAMP (Manchester Municipal School of Technology) wished to know whether the limit of 200,000 volts mentioned as now practicable was intended to apply to this country or only to America. He also asked for further information regarding corona losses, and made some criticisms of Mr. Taylor's presentation of his methods of calculation.

Mr. A. P. M. FLEMING suggested the use on high-tension systems of one of the three line conductors suitably earthed in place of a special overhead earth wire.

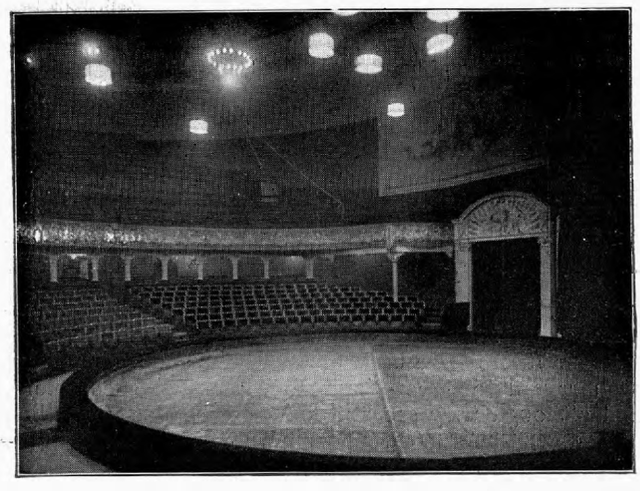
Mr. A. E. MALPAS referred to experiments on lessening corona losses by the use of a cable built up of a thin copper conductor wound round a hemp core. The split conductor method had been employed on the Lucar-Madrid transmission, where 20,000 h.p. was transmitted 300 km. at 60,000 volts, but he preferred complete duplicate lines on separate poles, as a breakdown of one line might affect the other. The overhead earth wire was not usual on the Continent.

Mr. J. LUSTGARTEN spoke of the way in which the limiting voltage from the corona point of view depended on the diameter of the wire, and referred to experiments with spheres. The explanation of the different voltage gradients necessary for breakdown of the air with different diameters was not clear. Again, when an actual brush discharge appeared, a larger voltage was required to maintain the ionisation. The humidity of the atmosphere had not appeared from his experiments to make any difference. He did not quite agree with Mr. Taylor's view that a flat disc insulator had a greater capacity than one with petticoats.

Mr. J. FOSTER thought that there was a great field in this country for long-distance transmission in connection with cheap power from surplus blast furnace and coke-oven gas.

METAL FILAMENT LAMPS AT A CIRCUS

FOLLOWING the lead of the majority of theatres and music halls which are now electrically lighted, an electrical installation has now been put in at Hengler's Circus, Glasgow, and full advantage has been taken of the excellent effect combined with economy that can be obtained with



OSRAM LAMPS AT HENGLER'S CIRCUS, GLASGOW.

Osram lamps. The accompanying illustration, which has been sent us by the General Electric Co., gives an idea of the lighting of the ring. The lamps in use comprise ten of the 1,000-watt size, nine 400-watt, two 100-watt, and 140 32-watt Osram lamps.

Tramways & Light Railways Association.—The annual general meeting will be held at the Gaiety Restaurant, Strand, London, on Friday, February 17th, at 7 p.m., and will be followed at 7.45 p.m. by the annual dinner and smoking concert.

The Special Committee on Speed Indicators submitted their final report on January 20th, and it will be published in the March issue of the Association Journal, the price of which will be increased to 2s. 6d.

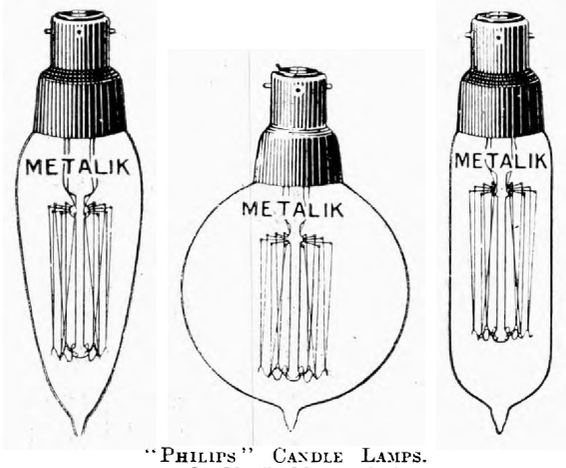
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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Incandescent Lamps.

Siemens Brothers Dynamo Works, Ltd. (Incandescent Lamp and Fittings Department, Tyssen Street, Dalston, N.E.) announce that they are extending the range of their now well-known "One-watt" lamps by putting on the market a 400-c.p. size in a bulb 12 in. long by 8 in. diameter. These lamps have an efficiency of approximately one-watt per c.p., and are generally similar to the 100 and 200-c.p. "One-watt" lamps already on the market, with filaments of wire-drawn tungsten wound on spiders, such as employed in tantalum lamps. They will be supplied with "Goliath" Edison screw caps, and a special brass and porcelain holder has been introduced for use with them. The price at which these lamps are being put on the market compares very favourably with that of other high c.p. metal filament lamps. As in the case of the 100 c.p. and 200 c.p. lamps, they are made for 100–130 and 200–250 volts, and with their robust filaments they should prove of great utility for shop and street lighting. They are, of course, equally suitable for continuous and alternating currents.

The latest technical development in the lamps sold in this country by G. M. Boddy & Co. (15 Gray's Inn Road) hitherto under the name of the "Metalik" lamp, but now to be known as "Philips" lamps, in view of new arrangements with the manufacturers (Philips Metallic Glow Lamp Works, Ltd., Eindhoven, Holland), is the production of a series of candle lamps, such as are illustrated here. These are made in various bulbs in the 10- and 16-c.p. sizes, for

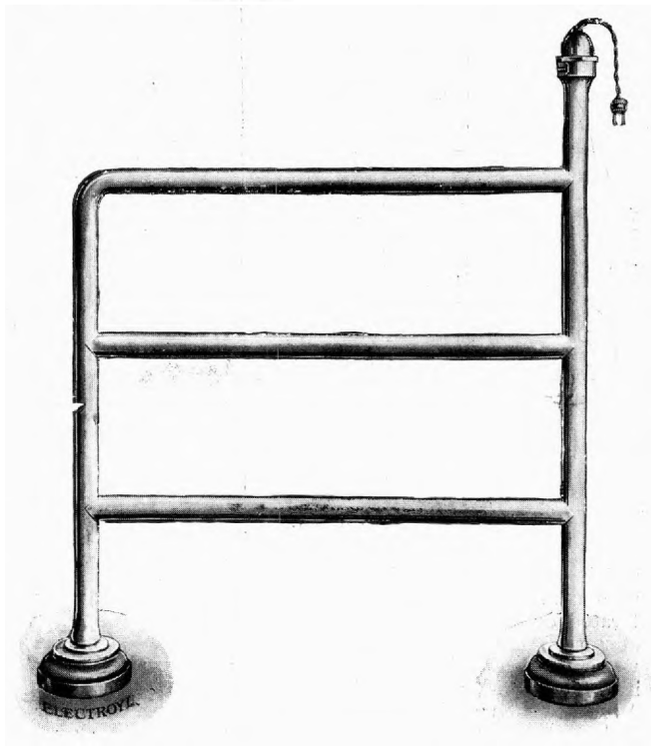


"PHILIPS" CANDLE LAMPS.
(G. M. Boddy & Co.)

25 to 55 volts, and in the 16-c.p. size for 66 to 135 volts, so that lamps are available by suitable grouping in series where required for the conversion to metal filament lighting of existing two or three light candle fittings on all ordinary supply voltages. Messrs. Boddy are now in a position to offer exceptionally favourable discounts to factors and the trade. The firm were one of the first in the English market with a metal filament lamp, and, in spite of the altered name, it is important to realise that all the time the lamps have been supplied from the same factory, and now represent the result of years of accumulated experience.

Heating and Cooking Apparatus.

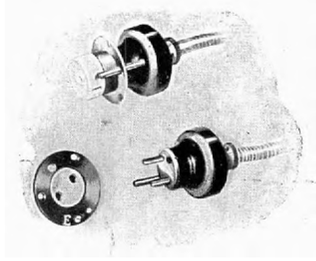
An electrically-heated towel rail is being introduced by Messrs. Purcell & Nobbs (87 Cleveland Street, Fitzroy Square, London, W.), the makers of the well-known "Electroyl" radiators, in which the resistance wire heating elements are immersed in oil. The oil, by being set in a natural state of circulation, ensures a uniform temperature of the whole device and protects the resistance from oxidation. The towel rail consists of three or four horizontal brass tubes of oval section, with or without a double rail at the top connected by two vertical tubes, and provided either with feet for fixture to the floor, as illustrated, or neat brackets for suspension from the wall. The latter arrangement is preferable, as it leaves the floor unencumbered for cleaning. The heating element, which is inserted in the tubes in such a position as to secure a good circulation of the oil, consumes only 150 watts for a 30 in. rail or 250 watts for a 36 in. rail, and maintains the whole at a uniform temperature of from 150 to 180° Fahr., according to the temperature of the room. The running cost of the larger size is thus ¼d. per hour with a 1d. per unit heating rate. The heavily nickel-plated tubes are easy to clean, and have flush joints with no projecting points. An adapter is provided, but, if desired, an indicating switch



"ELECTROYL" TOWEL RAIL.

can be fixed in place of the cord cap. A regulating switch with "full," "medium," or "low" positions, can also be supplied. To ensure that the tubes shall not leak, they are tested to an internal pressure of 50 lbs. per sq. in. Important features of this device are the entire elimination of fire risk and of liability of scorching the towels.

The accompanying illustration shows a new form of plug which the Berry Construction Co., Ltd. (29A Charing Cross Road, W.C.), have introduced for use with their single and extension "Tricity" cookers. Two pins of the plug are for the electrical circuit, and the third is connected permanently to the flexible metallic armouring of the cooker cable, and makes contact with the flange of the socket before the elec-



NEW THREE-PIN WALL PLUG FOR "TRICITY" COOKERS.

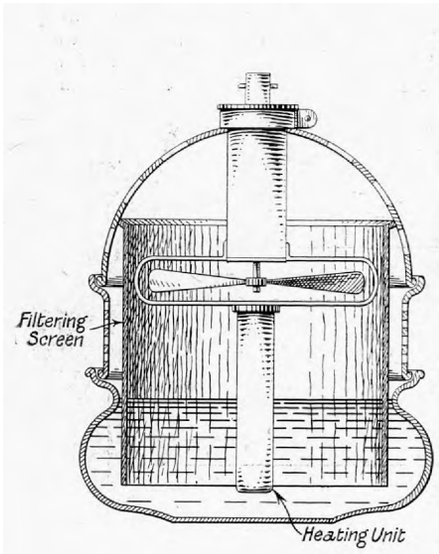
trical circuit is completed. An earth terminal is provided on the socket flange, so that insertion of the plug earths the cooker case. A similar socket, but without the earth terminal, is used on the duplex cooker case, so that a single or extension cooker can be connected up without additional wiring. The earth terminal is not necessary in such instance, as the flange of the socket is in metallic contact with the duplex cooker case and earthed through its own cable armouring.

Miscellaneous.

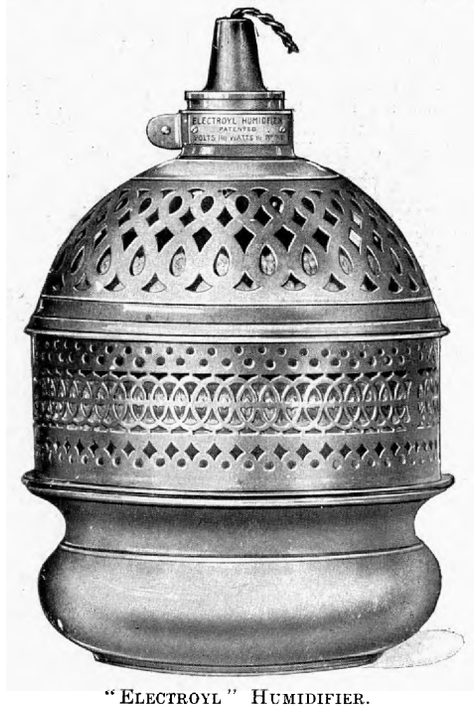
A novel device for improving the condition of air in living rooms, railway carriages, &c., has been introduced by

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Messrs. Purcell & Nobbs (87 Cleveland Street, Fitzroy Square, London, W.), under the name of the "Electroyl" humidifier. This consists of a small portable apparatus, which sucks in the dry air and expels it through a screen which purifies and moistens it. As can be seen from the accompanying illustrations, the air enters through the perforated dome at the top of the device, and is expelled by a small electric fan through a cylindrical asbestos screen which is partly immersed in the water, perfume or disinfectant liquid, contained in the lower portion of the device. As this screen soaks up the liquid, the air passing through it becomes thoroughly saturated, as well as being filtered and purified. An electric heating unit is suspended in the liquid to increase the rate of production of vapour, and to heat the vapour produced. In the drawing, the device is shown with an adapter connection for suspension from a bracket; larger sizes are made for use in halls and other large buildings. The apparatus is made for all voltages up to 250 volts, and for both D.C. and A.C. circuits. The consumption is about 10 watts only. The dimensions of the size illustrated are 12 in. by 8 in. diam. The apparatus is particularly suitable for use with radiators and other heating devices, as it prevents the air getting into the hot, dry state so detrimental to health.



"ELECTROYL" HUMIDIFIER.



"ELECTROYL" HUMIDIFIER.

Two novelties recently introduced by Simplex Conduits, Ltd., 116 Charing Cross Road, W.C., are illustrated here. One is a self-contained electric motor hair-brush with the motor concealed within the brush. A switch is carried on the handle, and an adapter is fitted for connection to a counterweight pendant lampholder. The other illustration shows an electric vibro-massage set, also intended principally for hairdressers' establishments, where it proves a very remunerative adjunct. A fan for hair-drying can also be fitted to the motor.



"SIMPLEX" ELECTRIC HAIRBRUSH.



"SIMPLEX" VIBRO-MASSAGE OUTFIT.

As we go to press we have received information of a new patent standard ammeter which Messrs. Elliott Bros. (Century Works, Lewisham, S.E.), are introducing. The instrument is constructed on the dynamometer principle with air damping. It can be used on both D.C. and A.C. circuits, and is claimed to be free from wave-form, frequency, and temperature errors. A special three-way switch is provided for enabling the current in the different phases of a three-phase circuit to be quickly determined without opening the secondary circuits of the current transformers. The instrument has a wide open scale, and is particularly suitable for laboratory use. A travelling clip guards the movement from injury in transit, while a front flap protects the glass and scale.

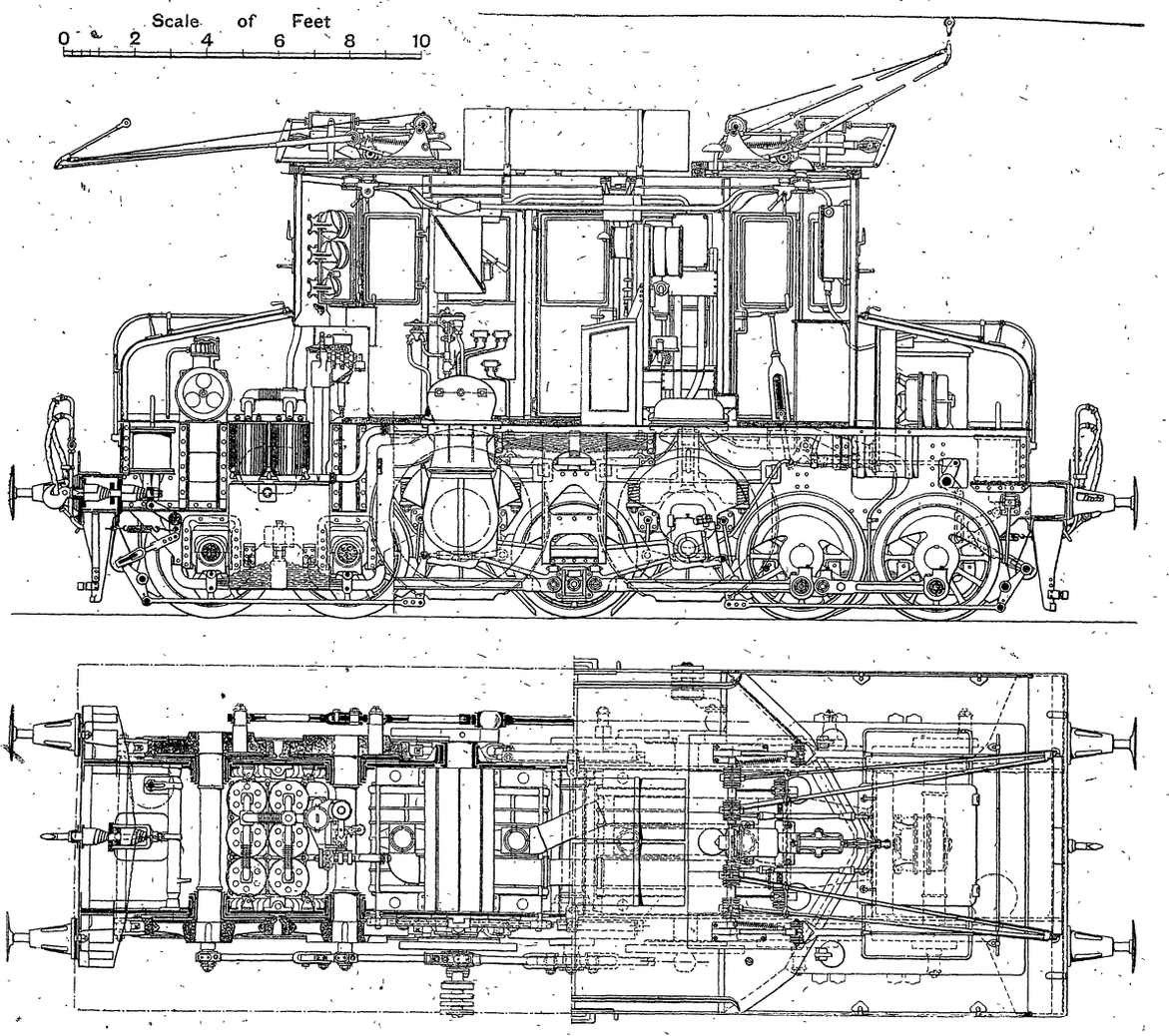
University College.—The introductory lecture by Mr. Archibald R. Low, to his course on "The Design and Calculation of Aeroplanes," was delivered at University College on Friday, Feb 3rd, at 5.30 p.m. Dr. H. S. Hele-Shaw, F.R.S., took the chair.

Telephone Rates.—The Glasgow Corporation have decided to hold a conference in London on the 27th inst., to consider the question of telephone rates, with a view to their revision immediately the Post Office acquires the National Telephone Co.'s undertaking. The Postmaster-General recently stated that this question cannot be considered until the valuation of the National Co.'s property has been considered. It is proposed to ask the Postmaster-General to receive a deputation.

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A THREE-PHASE GOODS LOCOMOTIVE

IN an article in the *Zeitschrift des Vereins Deutscher Ingenieure*, Mr. K. von Kando, of the Italian Westinghouse Co., describes a new design of three-phase locomotive, forty of which are now being constructed for use on the electrified main line sections of the Italian State railways. As shown in the accompanying illustration, there are five coupled driving axles, and the two three-phase motors are mounted between the second and third and third and fourth axles. They are 8-pole motors, each rated at 1,000 h.p. on the one-hour rating, and drive through cranks and connecting rods. Two running speeds of 14 and 28 miles per hour, obtained by cascade and parallel connection of the motors respectively, are provided for. The speeds of the motors in the two cases are 112·5 and 225 r.p.m. The driving wheels have a diameter of 3·5 feet. For accelerating, water resistances are used; and the control is effected on the Westinghouse multiple unit pneumatic system, so that two or three locomotives can be simultaneously controlled from the cabin of one of them. The disadvantage of three-phase motors, that equal loading of two or more motors is dependent on exactly equal speeds and therefore equal diameters of the driving wheels, is overcome by an ingenious arrangement whereby the current supplied to the individual motors of two or more locomotives can be regulated at will. Current is returned to the line on down-gradients. Bow collectors, raised and lowered by compressed air, and provided with glycerine dashpots, and similar to those in use on the Valtellina locomotives (see ELECTRICAL ENGINEERING, Vol. I., page 1006), are employed. The total weight of the locomotive, all of which is useful adhesion weight, is 60·2 tons, but this can be increased to 75 tons, if required, by ballast. The total length over the buffers is 31 ft. Current is supplied to the locomotive at 3,000 volts from two overhead lines and the rails. The frequency of the supply is 15 cycles. No transformer is employed on the locomotive, the primaries of the motors being fed direct at 3,000 volts. These locomotives will be used on the Pontedecimo-Busalla section and on the Giovi tunnel section of the main line railways.



2,000-H.P. THREE-PHASE GOODS LOCOMOTIVE FOR THE ITALIAN STATE RAILWAYS.

The Hulton Colliery Disaster.—The following letter has been sent from the Hon. Secretary of the Lancashire branch of the Association of Mining Electrical Engineers to Mr. A. J. Tonge, manager of the Hulton Colliery:—"DEAR SIR,—I have been instructed by my committee to inform you that, at the meeting of our association held at Manchester on Saturday, January 28th, a vote of sympathy with yourself and all who have suffered by the unfortunate disaster which occurred at the Hulton Colliery was passed. May I ask you, on behalf of all who were present at the meeting, to accept the expression of our sympathy?"

Station Lighting on Tube Railways.—In a recent issue we referred to the use of Tantalum lamps for station lighting; and in this connection it is of interest to note that "Onewatt" high c.p. lamps, in conjunction with special holophane fittings, have been approved for use on all stations of the Great Northern and City Railway, to replace the ordinary arc lamps now in use. One of these stations has already been converted, and the others are to be proceeded with immediately. "Tantalum" traction lamps have been used for some time with considerable success in the cars of this railway, and a number of traction companies and corporations are also taking up these lamps for use in their cars.

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TRANSFORMER SUB-STATIONS

WE give below a short report of the discussion on Mr. P. V. Hunter's Paper, read before the Newcastle Section of the Institution of Electrical Engineers on January 11th. An abstract of the Paper itself appeared on page 58 of our last issue.

DISCUSSION.

Mr. J. ANDERSON, who opened the discussion, criticised the use of oil-coolers in one of the types of substation described, and thought that as an alternative to the expense of coolers, pipes, pumps, &c., larger transformers were a better way of spending the money. There was also great risk of cooling water leaking into the oil, with disastrous results.

Mr. H. L. RISELY (Newcastle-on-Tyne Electric Supply Co.) pointed out the extreme difficulty in getting at the transformers in some substations, and thought that the more extensive provision of lifting tackle was desirable. He did not like the design of flat roof shown, and agreed with the last speaker regarding the danger of oil leakage.

Mr. A. TURNBULL (Chief Electrical Engineer, North Shields) was much struck with the cost of these elaborate substation arrangements, and questioned whether, after all, the heavy distribution cost did not take away much of the advantage of supply on a large scale.

Mr. FAWSETT spoke of the effec of changes of wind on the efficiency of the ventilating flues, and defended horn arrestors in place of the roller pattern.

Mr. VERNIER (Newcastle-on-Tyne Electricity Supply Co.) wanted to know how the voltage affected the economical limit of the size of the transformers, and Mr. SHEARER (Newcastle-on-Tyne Electricity Supply Co.) spoke in favour of groups of single-phase transformers instead of three-phase transformers. Mr. HUNT and Mr. PORTER made some further remarks on the nature of the action of horn arrestors.

Mr. H. W. CLOTHIER (Messrs. A. Reyrolle & Co.) looked forward to the time when substation switchgear would be put anywhere, such as in a field, and substation buildings would not exist, and suggested the arrangement of transformer connections so that the whole transformer could be plugged in the same way as is done with his firm's design of switchgear.

After a few remarks by Mr. Wood, Mr. Viall, and Mr. Butcher,

MR. HUNTER said, in reply, that naturally-cooled transformers cost about double the price of water-cooled transformers. He did not think that the danger of water getting into the oil was appreciable. The provision of permanent lifting tackle was, in his opinion, generally a needless expense. Flat roofs were preferable on account of ease of extension. He did not think that the provision of three single-phase transformers with one spare was a sufficient standby, as it would necessitate shutting down to change over. Transformers were not yet available for the open-air service favoured by Mr. Clothier.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

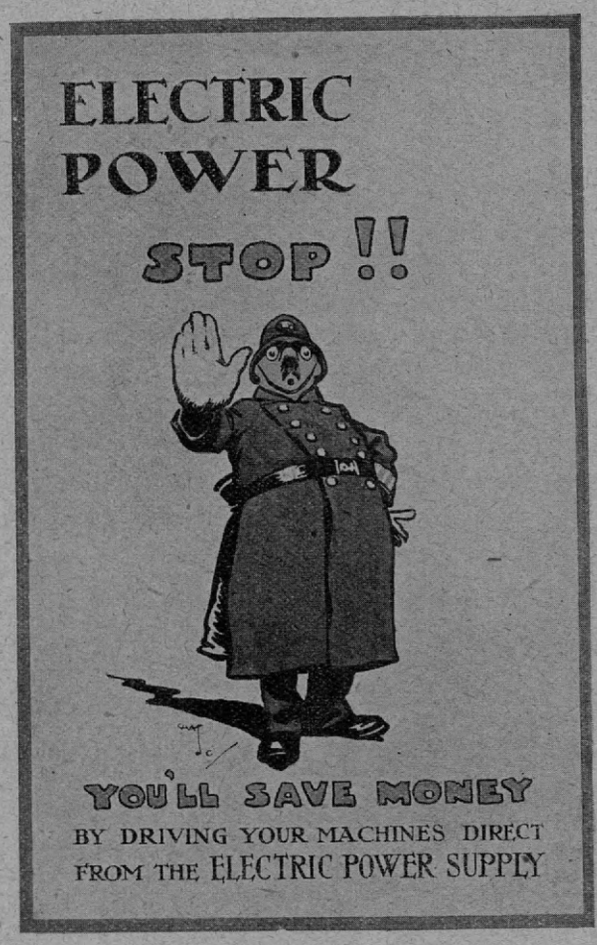
ENGINEERS' STANDARDISED PUBLICATIONS ASSOCIATION.—In view of the desire expressed by some members of this association to have a means of indicating to manufacturers the fact of their membership, the association have prepared a small adhesive label for attachment to correspondence, reading as follows:—"Price lists, leaflets, &c., sent to us through the Engineers' Standardised Publications Association, of Craven House, Kingsway, London, are assured of our notice, and are filed and retained for reference." These may be obtained on application. Among the latest lists, &c., issued by the association are the following:—Leaflet describing the "Flexalite" candle fitting of the Sun Electrical Co. (see ELECTRICAL ENGINEERING, Jan. 12th, page 16); particulars of the new electrically-heated towel rail and humidifier of Messrs. Purcell & Nobbs (see page 70 of this issue); a series of lists of traction specialities, lightning arresters, &c., from Laing Wharton, Ltd., 7 Great Newport Street, W.C., including the V.P. patent link insulator; and particulars of ladders, trucks, &c., supplied by H. C. Slingsby, 142 Old Street, E.C.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

DYNAMOS, MOTORS, &c.—Siemens Brothers' Dynamo Works, Ltd. (Caxton House, Westminster), have issued a list of electrical machines in book form, with convenient thumb index, uniform with the list issued by their supplies department. Full particulars are given of continuous-current, single, two- and three-phase generators, and motors of all sizes and speeds, as well as fans and a very complete range of regulators, starters, and other special switchgear. Spare parts and accessories are also included, and a full series of dimensional outline drawings is given. The whole is wonderfully complete and well arranged, and at the same time conveniently compact.

ELECTRICAL ACCESSORIES FOR MOTOR-CARS, &c.—Messrs. J. C. Fuller & Son (Woodland Works, Wick Lane, Old Ford Road, Bow, E.), have brought out a new catalogue of electrical and automobile accessories, which appears very complete. The ignition appliances include a number of patterns of coils, secondary cells, and accessories, as well as the Fuller magnetos, including their complete dual ignition system. A special feature of the list is the Fuller system of electric car lighting by a small dynamo worked in conjunction with accumulators, and provided with automatic switches to cut the dynamo out of circuit when the speed or the voltage falls. Numerous patterns of side, back, head, and roof lamps are included. The list also deals with charging outfits, primary batteries for all purposes, electric heating and cooking apparatus, and other matters.

SUPPLY ADVERTISING.—The Electric Supply Publicity Committee are continuing their activities in the issue of leaflets. The front of one of the new publications, with a sketch by Mr. C. Crombie, is illustrated here, and the wording is as vigorous and effective as the design. The possibilities opened up by electric radiators are indicated on a new series of postcards and



adhesive labels and a leaflet specially devoted to the use of radiators in bedrooms. Another new illustrated leaflet directs householders' attention to certain aspects of spring cleaning, and in further publications the ways in which electricity can minister to the needs of grocers, florists, drapers, butchers, and hotel-keepers. Several new circulars are directed against gas competition, and other subjects dealt with are "Electric Light and the Eyesight," the cost of wiring, and electric cooking.

"ONE-WATT" LAMPS.—A new price list is being issued by Siemens Brothers Dynamo Works, Ltd., of their "One-watt" lamps, including the new 400-c.p. size, which is described in our article this week on new electrical supplies and accessories. Ten and 16-c.p. lamps for 20 to 50 volts are also included.

SUCTION GAS PLANTS.—The new catalogue dealing with suction gas plants just issued by Crossley Brothers, Ltd. (Openshaw, Manchester), is a fine production, and contains a wealth of illustrations and technical detail concerning the latest forms of suction gas producer plants which are the outcome of the firm's long and extensive experience. Not only are particulars given of the details and the functions explained of each portion of the apparatus, but letters from users are reproduced, from which valuable information as to costs of working and maintenance under actual working conditions can be gathered. An important feature is the special suction producer, which is now available for bituminous fuel and the modification suitable for wood, tan, and other refuse, cotton seed, and other vegetable products. Ammonia recovery plants are also dealt with.

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LIBRARY LIGHTING

ON Tuesday, Jan. 31st, the discussion on library lighting, which was commenced on Jan. 16th (see ELECTRICAL ENGINEERING, Jan. 26th, page 45) by the Illuminating Engineering Society, in conjunction with the Library Association, was concluded.

Mr. P. Blagg considered arc lamps too unsteady for general lighting. Difficulties sometimes arose from the impossibility of getting accurate information beforehand as to the arrangement of the furniture, and Mr. V. C. Middleton, as a contractor, agreed, and urged architects and engineers to be more precise in their requirements. In connection with the arrangement of furniture, Mr. J. Duff Brown suggested that in all new buildings the wires should be brought only to the corners of the rooms, and thus give the lighting engineer an opportunity to experiment as to the best positions for the lights. He further suggested the appointment of a committee to draw up a set of conditions which would avoid difficulties of this character.

The lighting of the Patent Office library was again discussed by Mr. V. H. Mackinney (Holophane Co.) and Mr. H. V. Hopwood (Patent Office Library). During the past week or two the Holophane Co. have submitted a scheme for improving the lighting of the alcoves at the Patent Office. Originally the illumination on the tables in these alcoves was from 2 ft.-candles to something under ½ ft.-candle, whilst at the lower end of the bookshelves it was as low as one-third ft.-candle. By a rearrangement of the lamps, the Holophane Co.'s engineers succeeded in improving this to 4 ft.-candles down the centre of the table and 4·4 ft.-candles on the edges. The illumination on the bookshelves had been increased six times. It was found at first that the lamps were too close to the tables, and by the next rearrangement that they were too close to the bookshelves, and that the bottom and least used books were best lighted. The lamps were then lowered a little towards the tables, with the result that they now got about 0·6 ft.-candle at the corners of the bookshelves, which, whilst not bad for the purpose merely of finding a book, was not sufficient for the old bindings in the Patent Office.

The question of indirect lighting was dealt with by Mr. T. F. Ritchie, who mentioned an instance in which the gangways between rows of cases for filing documents were lighted by two 8-ampere inverted arc lamps. The gangways were 6 ft. long by 2 ft. 6 in. wide, and 8 ft. high, and the illumination on the floor in the corners was 2·38 ft.-candles. The illumination on the tables was from 6 to 10 ft.-candles. On the bookshelves the illumination varied only 0·85 ft.-candle over a height of 83 inches from the floor. Mr. Justus Eck was also an advocate of this method of lighting, which he thought was less fatiguing to the eyes.

Another speaker mentioned a room 45 ft. by 30 ft. and 14 ft. high at the Croydon Library that was lighted by metal filament lamps, the light from which was reflected from white ceilings. Several speakers, however, objected to this method of lighting.

There was some difference of opinion on the point of making the general lighting satisfy all requirements, and eliminating local lighting of tables. Mr. Haydn T. Harrison was in favour of local lighting, and mentioned a case which he had in hand where 8-c.p. 25-volt lamps were used upon the tables. Mr. Mackinney suggested that they should aim at getting 10 ft.-candles on the tables and 1/10th ft.-candle for general illumination. Mr. Darch thought that 0·75 ft.-candle was sufficient for general lighting as an average figure.

Some interesting figures were given by Mr. J. H. Quinn of the cost of lighting Chelsea libraries by metal filament lamps, which had superseded arc and Nernst lamps. In 1906 the cost for current was £194, but this has gradually come down, and in 1910 with metal filament lamps the cost was £135, whilst the candle-power had been doubled. Similarly, in 1909, £20 were paid for lamp renewals, whilst in 1910 with metal filament lamps the cost of renewals was only £4 18s. 8d.

THE INSTITUTION DINNER

THE annual dinner of the Institution of Electrical Engineers was held at the Hotel Cecil on Thursday last. Mr. S. Z. de Ferranti, the President, was in the chair, and there was a large attendance, including many distinguished guests. The toast of the evening was proposed by Lord Justice Fletcher Moulton, who referred to the fact that he was a past member of Council of the Institution of Electrical Engineers. The speaker then gave an interesting retrospect of the development of electrical engineering from the time at which, in his last year at Cambridge, he had read the work of Clerk Maxwell with "feverish haste." From being the nerves of the social world, electricity had now become its muscles. The last occasion on which he had had to exercise his judgment on electrical matters was a case in which this delicate electricity had been applied to the brutal work of driving 16,000-h.p. rolling mills. He looked forward to British time being shouted next year from the Eiffel Tower in Paris—unless, indeed, Parliament should by then have passed the marvellous Bill which proclaimed to civilisation that the moral courage of an Englishman is such that he could not get up at six unless he had been told it was seven.

Mr. S. Z. de Ferranti, replying to the toast, said that there were four hundred members present at the dinner as against three hundred last year. Now the Institution was duly installed in its new building, the Council were considering whether it could not be of greater utility to its members. It had been argued that the Institution should be a purely scientific society, but in the Articles of Association the object of the Institution was defined generally as being "to further electrical interests." Members of Council and former Presidents had been afraid of divergent interests, but this was not his view, for the one thing to be considered was the progress and prosperity of the industry. Much good work could be done, and should be done. The present position was not at all satisfactory. We were the nation that first made railways practical, and built railways for the world. We started the great textile industry in this country, and became the textile producers to the world; and as other countries took up textile manufacture themselves, we furnished them with the machinery. In the motor industry we built the first steam road vehicle, which ran from Paddington to the Bank in 1834, but vested interests and other forces had killed this mechanical traction industry; we had to buy millions of material from France whilst unemployed walked our streets. This country had produced the pioneers of electricity. They had had to face a well-established and prosperous gas industry, but this was fair competition, although certainly it meant a disadvantage when compared with countries like America or Switzerland. What they had chiefly to fight against, however, was the "municipal idea" that no one should make a profit out of the industry—that individuals must not make a profit out of the people. This had been largely responsible for electricity not having made the advances in this country which it should have. He did not belittle what we had done, but we should have done much more if we had had a fair chance. There must be a cessation of the idea that no profit or a mere livelihood should be derived from electricity. An impoverished electrical industry meant that no money could be spent on experiments towards improvements, as this could not be done if the industry were starved. He would like to see a competition of excellence rather than a beating down of prices.

Mr. Sam Mavor, Chairman of the Glasgow Local Section of the Institution, proposed the toast of the guests, which was responded to by Mr. Leonard Stokes, President of the Royal Institute of British Architects.

A feature of the evening's entertainment was that there were only four speeches, so that the formal part of the proceedings terminated at about 10.30, and was followed by an informal *réunion* in the adjoining hall, where members could meet their friends and conversation could be carried on uninterruptedly.

Telegraph Traffic and Movements of Cable Ships.—The Indo-European Telegraph Co. succeeded in restoring its lines on the 1st inst., and on the 2nd inst. the El Arich route was restored. The Indo-European lines between Kertch and Soukhoum suffered another derangement on the 5th inst. The *via* Batoum route was restored on that day. New telegraph offices have been opened at Prinzenbucht, in German South West Africa, and at Chinsenda, Elisabethville, Mikola, and Sakania, in the Belgian Congo. The West India system of the Compagnie Française des Cables Télégraphique still gives trouble. The Cape Haiti—Puerto Plata section recently put into working order has again given out, thus cutting off French and Dutch Guianas, Guadeloupe, and Martinique by the *via* Hayti route. Telegrams will be conveyed by special means between the two towns in Hayti unless they are sent *via* Brazil or *via* Key West—Jamaica—Puerto Rico. The c.s. *Mackay Bennett* has again left for Havre, to complete work on the Havre—Waterville cable.—The British Columbia Telephone Co. of Vancouver is about to build a cable ship.

Systems of Wiring.—With reference to the discussion on wiring systems. which was held at a meeting of the Dublin Section of the Institution of Electrical Engineers on Thursday, January 12th (as reported on page 61 of ELECTRICAL ENGINEERING of February 2nd), Messrs. Siemens Brothers & Co., Ltd., point out to us that some of the speakers appear to have been under some misconception regarding the uses to which "Stannos" wires can be put. In the first place, the idea seems to have been in the minds of some of the speakers that "Stannos" wires could only be used in connection with an alternating current supply, and then on the concentric system only; that is to say, with the sheathing forming the earthed return; also that a double-wound transformer is absolutely necessary in such cases. Now, "Stannos" wires are used most extensively on the 2-wire system, in both continuous and alternating current districts, and Messrs. Siemens hold that the suggestion that two wires are unsuitable for an alternating supply, owing to eddy currents being set up in the metallic casings, is quite fallacious. Further, in certain districts where there is an alternating current supply, amongst which Hindhead and Haslemere may be mentioned, the Board of Trade has allowed concentric "Stannos" installations without the interposition of a double-wound transformer.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published February 2nd, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

26,034/09. **Monorail Car.** L. BRENNAN. This specification covers the stability mechanism of the Brennan monorail car described in ELECTRICAL ENGINEERING, Vol. V., 1909, p. 977. The compressed-air gear for accelerating the precession of the gyrostats is described and illustrated. Fifteen figures.

7,574/10. **Determining Position of Faults.** R. A. M. MACALISTER (Greenock). A trolley with a wire brush bearing on the road surface, and connected to one terminal of a voltmeter, is pushed along the road in the path of the cable. The other terminal of the voltmeter is connected to earth at the starting point by means of a wire which is paid out off a reel as the trolley is moved along. Two figures.

9,304/10. **Control of Induction Motors.** H. J. S. HEATHER (Johannesburg). In order to guide the attendant, an ammeter with a mark at the point corresponding to maximum torque at normal voltage is placed in the stator or rotor circuit.

10,370/10. **Ward-Leonard Control.** E. C. MARKS (*Felten and Guilleaume-Lahmeyerwerke A.-G.*). In order to make the variation in speed of the motor exactly proportional to the regulation of the shunt field of the generator and independent of residual magnetism and the C.R. drop in resistances, the generator is compound wound, and its shunt field is controlled automatically by an auxiliary generator coupled to the motor. Five figures.

11,107/10. **Metal Filament Lamps.** O. KRAUSE (Deutsche Gasglühlicht Ges., Auergesellschaft). It has been found that the lamp foot containing the platinum leading-in wires is liable to burst when the binding materials of the tungsten filament are volatilised by raising it to a high temperature. To avoid this, the leading-in wires are temporarily shunted by thicker wires outside the foot, or connection is made above the foot. Two figures.

15,879/10. **Metal Filament Lamps.** K. SCHRÖTER (Berlin). When filaments are drawn from a mixture or alloy of tungsten with a soft metal, the latter is expelled by raising the filament to incandescence after it has been wound on the supports. A deposit of the volatilised metal may be formed on the supports, and, to make its removal easy, these are covered with a film of collodion or wax, which is dissolved afterwards in a solution, and carries the deposit away with it. Two figures.

25,589/10. **Emergency Brakes.** ALLGEMEINE ELEKTRICITÄTS-GES. To open the motor circuit of a locomotive or motor-coach automatically on the application of the emergency air-brake, a contactor in the circuit is forced open against the magnetic pull holding it closed by a piston under air-pressure. A resistance is inserted automatically in the contactor coil circuit to prevent the switch closing on the release of the emergency brake. Three figures.

25,732/10. **Current Transformers.** SIEMENS BROS. & Co., LTD. (*Siemens & Halske A.-G.*). Current transformers consisting of a wound iron ring round E.H.-T. conductors are insulated from them by a series of concentric insulating cylinders of decreasing length. Concentric metal cylinders are placed between the insulating cylinders and are connected to tappings on a transformer or a resistance to equalise the potential gradient. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad. Summaries of some of the more important of these patents will appear in our next issue.

Dynamos, Motors, and Transformers: POLKEY [Clutch for train-lighting dynamo] 936/10; BURNS [Rotary commutator for obtaining A.-C. impulses from D.-C. supply] 1,475/10; SIEMENS BROS. DYNAMO WORKS and PARKER [Rotary transformer] 4,262/10; SIEMENS BROS. DYNAMO WORKS, KIEFFER and KLOSS [Ventilation of machines] 5,118/10; HILL and TRIER & MARTIN, LTD. [Constant-current dynamo] 5,652/10; ALLGEMEINE ELEKTRICITÄTS-GES. [Cooling of machines] 14,863/10.

Electric Ignition: SCHÜLZKE [Ignition of gas lanterns from a distance] 991/10; KUHN [Sparking-plugs] 27,574/10.

Electrometallurgy and Electrochemistry: HENRI, HELBRONNER and VON RECKLINGHAUSEN [Sterilising of water supply] 2,424/10; THOMPSON (*Mix & Genest Telephon und Telegraphenwerke*] [Process for pickling aluminium and its alloys prior to coating] 13,012/10.

Incandescent Lamps: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Treatment of tungsten to facilitate working] 23,499/09.

Storage Batteries: NAYLOR [Process for regenerating plates] 1,558/10; HAZLEHURST and LONGSTRETHS, LTD [Method of determining when battery is fully charged] 1,677/10.

Switchgear, Fuses, and Fittings: ESKRIGGE [Attachment of shades and reflectors to lamp-holders] 415/10; EVANS [Lamp-holders, ceiling-roses, &c.] 1,164/10; LUCAS [Electro-magnetic relays] 1,167/10; DEWSE and DEWSE [Shade-carrier for lamp-holders] 1,465/10; WHITE [Control of electrically-operated switches] 4,811/10; PARKES [Bells] 5,014/10; PIZZUTI and FERRARI [Safety apparatus for discharge of high potentials] 6,865/10; HIRST and RECORD [Automatic control gear] 10,530/10; TRIN [Safety lamp] 12,368/10; SIEMENS BROS. & Co., and IRELAND [Elbow joints for wiring conduit] 20,427/10; DICKS [Seamless conduit] 32/11.

Telephony and Telegraphy: MARKS (*Electro-mechanical Works*) [Telephone switch apparatus] 1,281/10; DICKER (*Automatic Electric Co.*) [Telephony] 1,298/10; MELLINGER [Telephony] 1,418/10; MARTIN [Telephony] 1,419/10; SIEMENS BROS. & Co. and RIBER [Telephone receivers] 1,598/10; STERLING TELEPHONE & ELECTRIC Co. and BELL [Intercommunication telephone systems] 1,631/10; BETULANDER [Automatic telephone exchanges] 1,946/10; GOLDSTEIN and POOL [Central energy signalling system] 16,334/10; EISENSTEIN [Oscillation generator for wireless telegraphy] 16,371/10; CARPENTIER [Perforated tape telegraphic transmitter] 19,102/10; DICKER (*Automatic Electric Co.*) [Telephone receiver] 29,182/10.

Traction: PIEPER [Vehicle propulsion and control] 1,434/10; PECKHAM and ANDREWS [Railway and tramway trucks] 1,850/10; JONES [Entrance devices for tramcars] 3,717/10; JACKSON and FOURNISS [Current Collectors] 5,098/10; RAVEN [Signalling] 6,859/10; GAUNT [Permanent way] 11,815/10; BATTAILLE [Operating points and switches] 19,619/10.

Miscellaneous: BRANDENBURG [Automatic electrically-driven pumps for domestic water supply] 29,383/09; COWPER-COLES [Non-dazzling lamps] 1,101/10; MURDAY and REASON MANUFACTURING Co. [Electric clocks] 1,326/10; MAVOR & COULSON, LTD., and DEMPSTER [Coal-cutters] 1,383/10; BIGGE and BUTT [Mercury breaks and interrupters] 3,209/10; SCHWARZSCHILD [Electrically-driven cutting-out machine] 5,900/10; NEILL [Electric clocks] 11,379/10; ELIA [Submarine mines] 14,511/10; MYERS [X-ray shield] 17,782/10; SIEMENS BROS. & Co. [*Siemens & Halske A.-G.*) [Electro-medical electrode holders] 21,389/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: FRIED. KRUPP. A.-G., 25,167/10.
Electric Ignition: SAUERBREY [Distributer] 790/11.
Heating: TRÜMPLER [Regulating apparatus] 30,201/10.
Traction: CAMPANA [Automatic switch] 1,020/11.
Miscellaneous: SIEMENS SCHUCKERTWERKE GES. [Percussion tools] 19,540/10; LINDER [Ozonisers] 447/11.

The following amended Specifications can now be obtained.

G. BELLUZZO [Steam turbines] 2,215/09; G. OKILL [Storage battery plates] 8,875/09; STOTHERT & PITT and W. PITT [Electric cranes] 14,318/09.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

4,120 of Feb. 16th, 1897. **Electrolytic Apparatus.** W. HALL. Metal articles, such as pins, tubes, handles, &c., are tapered by being drawn through an electrolytic bath of which they form the anode. The articles are rotated to preserve a uniform section, and the shape is determined by their rate of axial movement or by the current density.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: BRITISH THOMSON-HOUSTON Co. (*W. S. Moody, U.S.A.*) [Air-cooled H.-T. transformers] 24,129/97; K. A. LINDSTRÖM [Elimination of harmonics in alternator E.M.F. waves] 21,889/04; SIEMENS BROS. & Co. (*Siemens-Schuckertwerke Ges.*) [Improving commutation of A.-C. and D.-C. commutator motors] 22,653/04; A.-G. BROWN, BOVERI & Co. [Stators of A.-C. repulsion motors] 20,772/05.

Electrometallurgy, &c.: S. O. COWPER-COLES [Rotation of cathode in baths for electrodeposition of metals] 21,974/98; C. N. RÜBER [Electrolysis] 20,898/05.

Incandescent Lamps: V. I. FEENY (*Allgemeine Elektricitäts-Ges.*) [Resistance for Nernst and other lamps consisting of iron wire in bulb of hydrogen] 20,720/99.

Switchgear, &c.: R. H. KNIGHT and L. NAGEL [Wiring conduit] 21,071/05.

Telephony, &c.: H. T. CEDERGREN [Central battery telephone system] 6,484/02.

Traction: E. PECKHAM [Axle-trucks and brake-rigging for railway and tramway vehicles] 23,907–8/97; W. C. KIRWAN and K. QUANEY [Prevention of falling of trolley-wires broken at the ears] 22,404/04; SIEMENS BROS. & Co. and F. LYDALL [Multiple-unit control system with single-phase motors] 21,068/05.

Miscellaneous: G. B. BOWELL and PEARSON FIRE ALARM, LTD. [Fire alarm system] 22,456/03.

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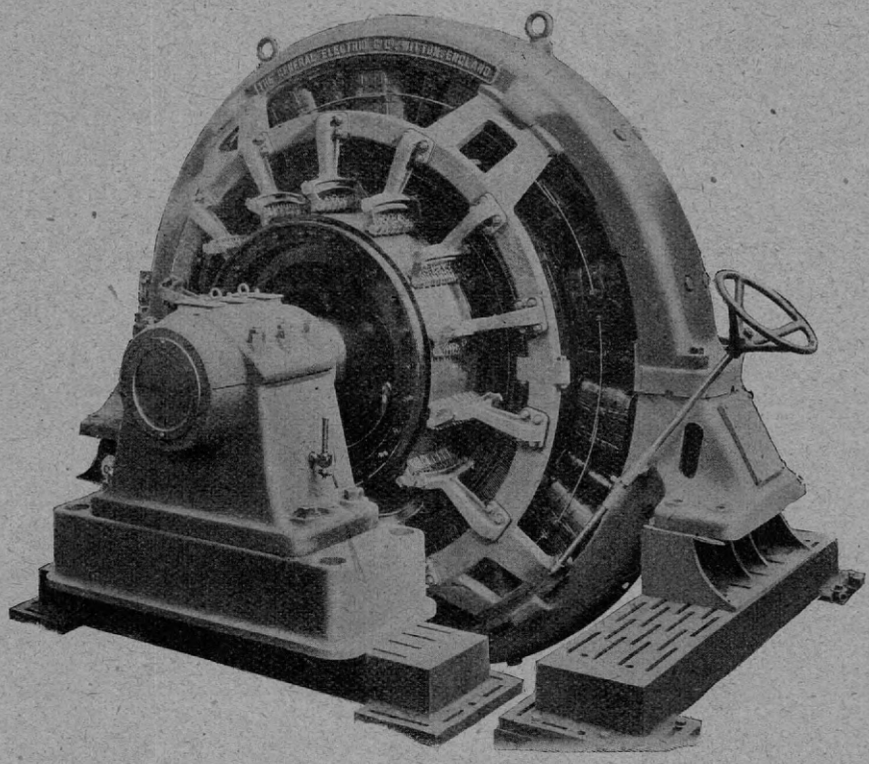
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THE MANCHESTER ELECTRICITY AND GAS DEPARTMENTS

AS we have pointed out in recent issues, the question of the relative sums which the Manchester Corporation Electricity and Gas Departments should pay towards the relief of rates is under consideration, and the views of the Electricity Committee regarding this will soon be made public. The dispute, if it can be called such, arises out of a discussion which has been developing for some time past as to what extent there should be competition between two municipal departments supplying power. In some quarters the opinion has been expressed that a Joint Committee should be formed to deal with all applications for power supply and lighting, whether electricity or gas, and that there should not be active competition between the two. It appears probable that this policy may be adopted in the case of new districts which are developed from time to time. This, however, may be a matter for the future; the present controversy is to settle a common basis upon which contributions in aid of rates should be made out of profits. It has been claimed that the Electricity Committee does not contribute to the relief of rates to the same extent as the Gas Committee, but, so far as public discussion has gone at present, the real point seems to have been missed. A simple inquiry will show that the Gas Committee, by reason of it having been established many years longer than the Electricity Committee, has to pay interest on nearly £1,000,000 less capital than does the latter, as a large proportion of the early capital expenditure has been already repaid by the usual statutory allocations to sinking fund out of past revenue. The Gas Committee have repaid £1,678,721 out of a total of £2,851,184, whereas of the capital expenditure upon the electricity undertaking, viz., £2,678,629, only £677,199 have been repaid. It has been calculated that the Gas Department pays £27,297 less in interest charges than the Electricity Department. If allowance is made for this, the percentage of rate aid to capital of both departments will not show that startling difference which appears to be agitating the minds of some of the Manchester councillors, and the local and municipal Press. Of considerable importance, too, is the fact that the Electricity Committee supply the Tramways Committee with energy at cost price, without taking any profit, and the capital invested for this purpose is approximately £1,000,000.

We think it will be found to be a somewhat striking fact that whereas the charge has been made that the Electricity Committee are unduly cutting prices, the officials of the two committees are agreed that the charges made by the two departments have been fixed on recognised principles, and that no arbitrary ruling can be laid down. This being so, it may yet be necessary for some of the participants in the controversy to modify their views.

LOCAL NOTES

Dawlish: *Street Lighting.*—The local Electric Light Co. have offered to install 250-c.p. lamps, and maintain them, the Council merely paying a charge of 3d. per unit for current consumed. The offer has been referred to the Lighting Committee.

Dublin: *Heavy Tramway Damages.*—A verdict of £800 was given against the Dublin United Tramways Co. last week in an action brought by Mr. E. N. Richardson for damages through a horse which he was driving stumbling on the tram lines and throwing him out of a trap, fracturing his collar-bone. It was alleged that the tram line where the accident occurred was in a defective condition.

Electricity Extensions.—The Electricity Committee, as announced in our last issue, recommend the Council to apply to the Local Government Board for a loan of £128,129 for further extensions to the electricity undertaking. The progress of the electricity department was, the committee say, brought almost to a standstill by the introduction of metal filament lamps, which inquiries made by the electricity officials show were more rapidly availed of in Dublin than in almost any other city, but the stoppage of the progress was more quickly got over than elsewhere. Mr. Ruddle, the City Electrical Engineer, estimates that the demand for next winter can be met by an additional expenditure of £55,000, the greater proportion (£33,000) of that sum being on a further installation of plant at the Pigeon House station, which is immediately necessary. As a safeguard, the committee consider that any application made to the Board should cover the probable capital requirements for the next three years, and these requirements are estimated to work out as follows:—Expenditure (already incurred) in excess of amount applied for in 1909 on short extensions, house services, motors, &c., £10,129; extensions of plant in 1911, £40,000; new high-pressure feeder mains from Pigeon House to Fleet Street (1912), £9,000; short extensions, house services, and alterations to distribution system (1911), £15,000; ditto (1912), £15,000; ditto (1913), £15,000; second additional set of plant probably required by 1912, £24,000; total, £128,129.

Dundee: *Tramway Policy.*—A deputation from the Tramway Passengers' Association waited upon the Council last week in regard to certain matters relating to the management of the tramway system. They complained of the tramway department being charged a higher rate for energy than is being charged to private consumers using far less current. They also took exception to £250 per annum being paid by the Tramways Department towards the City Engineer's salary, and £150 per annum towards the City Treasurer's salary.

London: *Holborn: Street Lighting.*—A most extraordinary report has been presented by the Highways Committee with regard to street lighting. The competition in Gower Street between gas and electricity resulted in a considerable margin in favour of the latter, and, based upon these figures, the tender for electric lighting for 405,000 c.p., the lamps varying from 60 c.p. upwards, amounts to £6,688 per annum, against £7,527 for gas. Nevertheless, the Council are recommended to give the contract to the Gas Co., on the ground that it is inadvisable to have two systems of street lighting, and that to adopt electricity would involve considerable interference with the roads in laying mains and making the necessary connections. We shall deal fully with the matter in our next issue.

County Council: Tramways.—The Highways Committee again report in favour of removing the disused horse tram lines in Liverpool Road, Islington. The Islington Council is very much opposed to this course.

Manchester: *Tramwaymen's Agitation.*—The dispute between the Tramways Committee and their employers still continues, and at a meeting on Sunday the men agreed to accept arbitration on condition that no reduction in wages is contemplated in conjunction with the reduction of hours asked for.

Motherwell: *Action against Tramways Co.*—An action for £1,000 damages for personal injuries against the Lanarkshire Tramways Co., which was commenced last year by Joseph M'Pherson, a Motherwell miner, has been abandoned.

Newcastle: *Tramway Extension.*—A request has been made for a poll of ratepayers, in view of the opposition to the Corporation's proposed tramway extension to Newburn, and the running of trolley omnibuses.

Stourport: *Electric Lighting.*—The Kidderminster & Stourport Electric Tramways Co. have possessed an electric lighting Provisional Order for several years, but as they have not made any commencement with the works, the Board of Trade propose to revoke it. Before doing so, however, they have asked for any observations from the Council.

Torquay: *Tramways.*—The Torquay Tramways Co. have raised the necessary £60,000 for extending the tramways to Paignton, and converting the system in Torquay to overhead trolley. The extension to Paignton, which at one time it was feared would have to be abandoned, is likely to be in operation in a very few months.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Aberdeen.—The recommendation of the Electrical Engineer to instal a 1,000 kw. direct-current dynamo, condenser plant, &c., at an estimated cost of £7,285, has been adopted, The details are as follows: 1,000 kw. high-pressure turbine, D.-C. dynamo, and condenser, £5,450; sub-station building at Culter, £438; one 50 kw. three-phase transformer, £95; E.H.T. switchboard panels, £200; laying E.H.T. cables, Murtle to West Cults, £265; one 65 B.H.P. three-phase motor, complete for coupling to existing dynamo, £175; and contingencies, £662.

Australia.—Tenders are invited by April 4th by the Deputy Postmaster-General, Melbourne, for the supply of 10¾ miles

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of lead-covered paper insulated telephone cable. Specifications, &c., at 72 Victoria Street, and 73 Basingnall Street, London.

Bedford.—Application is to be made for a loan of £22,837 for electrical extensions.

Belfast.—The Tramways and Electricity Committee invite tenders for twelve months' supply of V.B. cable. (See an advertisement on another page.)

Coventry.—A loan of £9,713 for extensions at the Electricity Works is to be applied for.

Dublin.—Tenders are invited for a turbo-alternator and other plant. (See an advertisement on another page.)

Gloucester.—Tenders are invited for a 750-kw. D.C. turbo-generator with surface condensing plant, a 150-kw. motor-generator; also switchgear. Particulars from the Town Clerk, and tenders by February 21st.

Heywood.—A Local Government Board inquiry was held last week concerning a loan of £4,355 for electrical extensions.

London: *Hackney.*—Mains are to be laid to Messrs. Gibson Bros.' premises, Andrew's Road, at an estimated cost of £77 10s.

St. Pancras.—The Finance Committee of the L.C.C. recommend sanction to a loan of £2,582 for electrical extensions.

Reigate.—Messrs. Handcock & Dykes are preparing specifications for two 100 kw. Diesel engine alternator sets at the Corporation power station.

St. Helens.—An additional 1,500 kw. turbo-generator, boiler, and coal-conveying plant is to be installed at an estimated cost of about £10,800.

Sale.—A new switchboard and crane are required at the generating station. Particulars from Mr. C. Hopkinson, 29 Princess Street, Manchester.

Wolverhampton.—Extensions are to be made to the power station at Messrs. Bayliss, Jones & Bayliss's works.

Worthing.—Additional generating plant is to be put down at an estimated cost of £4,500, and an accumulator at an estimated cost of £2,940. Schemes for the erection of steam plant and Diesel engines have been prepared by the Borough Electrical Engineer, and the committee recommend the Council to obtain the opinion of an outside electrical engineer.

York.—The City Electrical Engineer recommends the installation of a 1,000 kw. turbo-alternator, a water-tube boiler, pumps, transformers, switches, &c., at an estimated cost of £9,600, and mains and extensions at an estimated cost of £5,400. A loan of £15,000 is to be applied for.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Sanatorium for Consumptives at West Ham. Board of Guardians.

Twelve houses in Bingham Road, Croydon. R. Palmer, Sherwood Road.—130 houses in Dalmeny Avenue. A. Gosheron, 1 Tennison Road, Croydon.

PROVINCES.

Cardiff.—Block of houses, Spring Gardens Terrace. City Engineer.

Derby.—New County Offices, St. Mary's Gate.

Gloucester.—New Drill Hall and other buildings for Territorial Force Association. Architect, J. Craik, 12 Stevens Street, Bristol.

Hamilton.—Infants' School in Beckford Street.

Manchester.—Shakespearian Theatre and Grand Opera House, Deansgate. Architect, C. Twain, Exchange Street.

Paisley.—New offices and machine shops at Messrs. Fullerton, Hodgart & Barclay's works, Renfrew Road.

Renfrew.—New soap works. Messrs. Ogston & Tennant.

Salford.—New office accommodation for Guardians.

Stockport.—New police buildings in Fletcher Street.

Stockton-on-Tees.—New boys', girls', and juniors' blocks at Yarm Road Schools.

Stoke-on-Trent.—The Education Committee have been requested to consider the advisability of lighting all the schools under their control in Hanley and Tunstall with electricity.

Swansea.—A new theatre, also electric theatre in Oxford Street.

Weymouth.—Enlargement of Sailors' Home.

Wolverhampton.—Extensions to Royal Orphanage, Penn Road.

MISCELLANEOUS

Belfast.—The Tramways and Electricity Committee invite tenders for twelve months' supply of stores. (See an advertisement on another page.)

Bexley.—The question of spending £1,000 in order to fit new brakes to the tramcars is under discussion.

Burnley.—Alterations to the tramway track are to be carried out at an estimated cost of £800.

Grimsby.—A supply of continuous-current motors and starting panels is required. (See an advertisement on another page.)

Leeds.—Tenders are invited for a twelve months' supply of stores, including electric light fittings. Particulars from the Town Clerk.

The Tramways Committee invite tenders for points and crossings, rails, fishplates, tie-bars, and reconstruction of certain portions of tramway track, copper bonds, &c. Particulars from the Town Clerk, and tenders by February 16th.

London: *Bermondsey.*—Arc lamp carbons, brushes, cable, jointing material, and other electrical supplies are required by the Electricity Committee. Particulars from Town Clerk, and tenders by February 20th.

TENDERS RECEIVED AND ACCEPTED

Aberdeen.—The tender of the British Insulated & Helsby Cables, Ltd., for a twelve months' supply of cable has been accepted.

Bedford.—The tender of the British Thomson-Houston Co., Ltd., has been accepted for the supply of electricity meters during 1911.

Buckingham.—The tender of Messrs. Johnson & Phillips, Ltd., has been accepted for an electric lighting plant at the workhouse at £180.

Colne.—The tender of the United Electric Car Co., Ltd., has been accepted for four sets of tramcar brakes.

Stoke-on-Trent.—The following tenders have been accepted: D.-C. meters, Electrical Co., Ltd.; boosters, Electric Construction Co., Ltd.; portable current transformers, Weston Electrical Instrument Co.; portable sub-standard ammeter and wattmeter, Siemens Bros. & Co., Ltd.; volt meter switches, Crompton & Co., Ltd.; multiple way switches, Spagnoletti, Ltd.; cotton-covered wire, London Electric Wire Co. and Smith's, Ltd.

APPOINTMENTS AND PERSONAL NOTES

Mr. Newcomb Carlton, who has retired from the position of Managing Director of the British Westinghouse Electric and Manufacturing Co., Ltd., is taking up the position of Vice-President of the Western Union Telegraph Co. in New York.

Mr. Herbert Taylor, shift engineer at Accrington Electricity Works, has resigned.

Mr. W. G. Ritchie, assistant engineer to the Mexborough & Swinton Tramways Co., has been appointed manager to a tramway company in Nova Scotia. He sailed for Canada last week.

A switchboard attendant is required at Newport. (See an advertisement on another page.)

A. Southby has been appointed electrical assistant in the Chief Engineer's Department of the L.C.C. at 47s. 6d. a week, rising to 50s. a week.

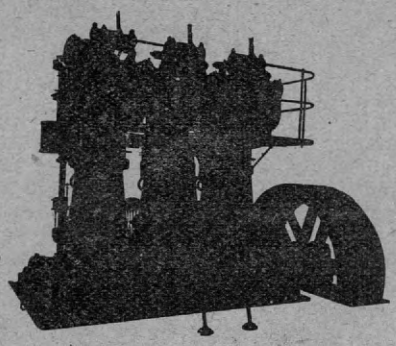
Wireless Telegraph Notes.—We are informed that the India Office has concluded a contract with Marconi's Wireless Telegraph Co., for the erection of wireless telegraph stations at Calcutta, Delhi, Allahabad, and Simla. These stations will be used primarily for military and Government purposes. In the case of the first three stations, the range will be 600 miles, whilst that at Simla will have a range of 300 miles. The total cost of the stations, which it is hoped to have in working order in time for the Durbar in 1912, will be about £50,000.

It is stated that a new English company is to be formed to exploit the Poulsen wireless telegraph and telephone systems. Successful experiments have been carried out recently between Copenhagen and Ireland, and it is said that the company hope to complete a station in Canada within a year, and then start a regular wireless transatlantic wireless service.

Herr Goldschmidt, of the Darmstadt Technische Hochschule, has developed a system of wireless telegraphy, using an extra high-frequency alternator to produce the oscillations. Satisfactory results are reported, but as yet no technical particulars are to hand.



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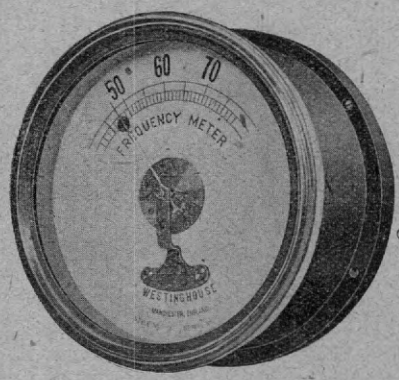
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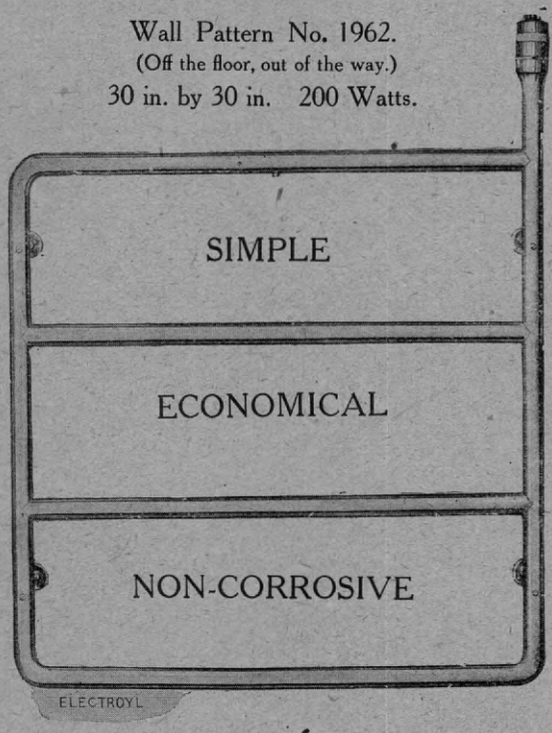
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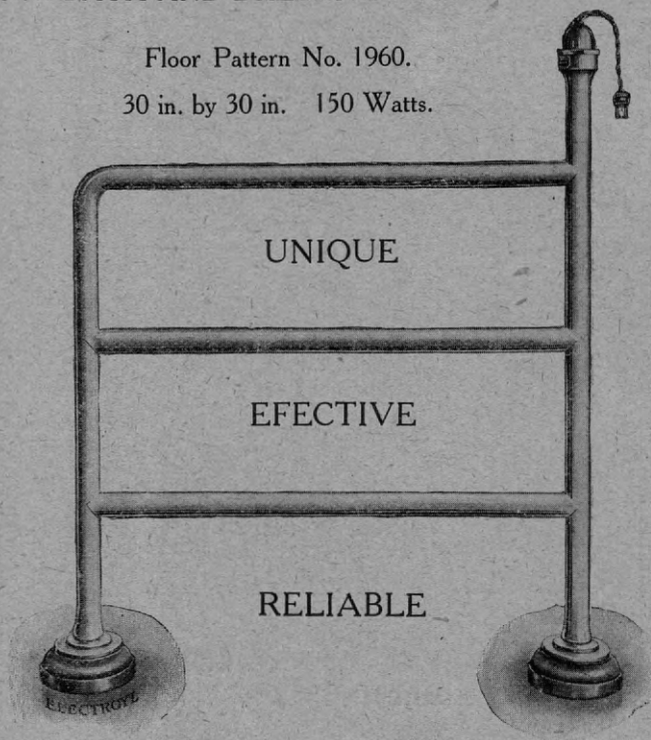
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Further particulars are given in an article of this journal, page 70.

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MISCELLANEOUS BUSINESS NOTES

The British Prometheus Co.—This company announce that Simplex Conduits, Ltd., are no longer agents for their specialities, and request that all orders and inquiries be sent either to their works (Salop Street, Highgate, Birmingham) or to their London showrooms (9 Newman Street, Oxford Street, W.). In view of apparatus of similar appearance on the market they remind their clients that all apparatus of their manufacture bears their diamond-shaped trade mark, with the word "Prometheus" in the centre and "British manufacture" below.

Silvertown Company's Dinner.—On Saturday, January 28th, the staff of the India Rubber, Gutta Percha, & Telegraphs Works Co., Ltd., of Silvertown, held their 28th annual dinner and social evening, and a very enjoyable evening was spent. Mr. W. E. Gray was in the chair.

Change of Address.—The Empire Roller Bearings Co., Ltd., have removed from No. 15 to more commodious premises, at No. 17 Victoria Street, Westminster, S.W.

Agency.—The Electric and Ordnance Accessories Co., Ltd., have appointed Mr. F. MacCallum (late of J. P. Hall & Co., Oldham) to represent them exclusively in Yorkshire. Mr. J. Booker will confine himself to the Lancashire district.

Osram Lamps.—The Chief Engineer of the Madeira Electric Lighting undertaking has informed the General Electric Co., of London, that a number of 32-watt, 230-volt Osram lamps used for street lighting on a D.C. system on which the pressure varies as much as 10 volts or more during the evening, have given every satisfaction, many having burned for as long as from 3,500 to 4,300 hours, in spite of being subject to much vibration.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

St. James' & Pall Mall Electric Light Co.—The net profits for the year 1910 amounted to £27,090, in addition to £2,025 carried forward. After meeting the 7 per cent. preference dividend, a dividend at the rate of 10 per cent. per annum is recommended on the ordinary shares, carrying forward £2,116. The total connections now amount to 12,999 kw., an increase of 1,134 kw. over the previous year. The main boiler plant at the Carnaby Street Works has been fitted with furnaces for the consumption of bituminous coal, and the Mason's Yard Works are being equipped as a high-tension transformer station.

Central Electric Supply Co.—The report for 1910 shows that 18,641,190 units have been supplied to the Westminster and St. James' Companies, and that, after making allowance for sinking fund and depreciation, the net profit is £4,991, in addition to £36 brought forward. A 5 per cent. dividend is declared.

London Electric Railways Co.—This report represents the combined figures of the Great Northern, Piccadilly & Brompton, Baker Street & Waterloo, and the Charing Cross, Euston & Hampstead Railways for the December half-year. The gross receipts show an increase of £6,837 over those of the previous corresponding half-year, whilst working expenses decreased by £4,106. The net sum available is £101,454, and after meeting the 4 per cent. preference dividend, a dividend at the rate of ¾ per cent. per annum is declared upon the ordinary shares.

Chelsea Electricity Supply Co.—Dividend at the rate of 6 per cent. per annum for the December half-year, making 5 per cent. for the year, placing £12,772 to depreciation, £704 to debenture premium redemption fund, writing off £1,089 from cost of extinction of founders' shares, and carrying forward £2,290.

Central London Railway Co.—At the meeting last week, Sir Henry Oakley, chairman of the company, said that the work upon the Liverpool Street extension was going on satisfactorily although somewhat slowly, owing to the fact that the whole of the work, including the station, will be underground. The question had been raised by several shareholders as to the position of passengers if a breakdown occurred on the line. In consequence the Board had considered this matter with their engineers, and arrangements had been made by which, in the event of failure at their power station, each carriage will be separately lighted, and passengers will be able to walk along the track to the next station. Provision had also been made for the lifts to be moved up and down by hand power. At the new Liverpool Street station a movable staircase was to be constructed.

Westminster Electric Supply Co.—Dividend at the rate of 10 per cent. per annum for the December half-year.

Yorkshire Electric Power Co.—The net profit for 1910 amounted to £6,503, compared with £2,665 in the previous year. The full dividend on the 6 per cent. cumulative preference shares is recommended, carrying forward £9,450, which includes £3,382 brought forward from 1909.

South London Electric Supply Corporation.—Dividend of 5 per cent. on the ordinary shares for 1910.

Brighton, Hove & Preston Omnibus Co.—At the annual meeting last week reference was made to the company's Bill in Parliament for running trolley omnibuses between Brighton and Worthing. The directors have been watching the developments in this method of traction with a view to its ultimate adoption, but their hand has been forced somewhat by the promotion of a Bill by the British Electric Traction Co. to run tramways between these places. The Tramway Company's Bill having been deposited, the directors of the Omnibus Company felt they had no alternative but to oppose it with a scheme of their own which they regard as more suitable to residential districts of this character than tramways.

TENDERS INVITED.

CORPORATION OF DUBLIN.

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The Electricity Supply Committee of the Corporation of Dublin desire to receive Tenders for the supply and installation at their Pigeon House Generating Station, of a complete GENERATING SET of approximately 3,000 Kw. capacity.

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As the entire plant must be completed for beneficial use by October 31st next, it is necessary that intending Tenderers should at once inspect the site in order that they may be fully informed of the conditions to be complied with as to space and local requirements, and no tender will be considered which is not based upon such inspection.

General Conditions, Specification, and Form of Tender may be obtained from the City Electrical Engineer, Fleet Street, Dublin, on and after Tuesday, February 14th, 1911, on payment of three guineas, which sum will be refunded on receipt of a *bona-fide* tender.

Tenders, sealed and endorsed "Tender for complete 3,000 kw. Steam-Turbo Generating Plant," must be addressed to "The Chairman, Electricity Supply Committee, 3 Cork Hill, Dublin," and delivered there not later than 12 o'clock noon on Monday, March 6th, 1911.

The Committee do not bind themselves to accept the lowest or any Tender.

FRED. J. ALLAN,
Secretary.

Electricity Supply Committee Offices,
3, Cork Hill, Dublin.
February 7th, 1911.

(*For other Small Advertisements, see pp.* viii. *and* ix.)

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WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

A Special Literary Supplement is included in this issue, containing notices and reviews of books, and a carefully revised list of selected works on electrical engineering and allied subjects.

The two Papers on high-tension transmission lines by W. T. Taylor and by R. B. Matthews and C. T. Wilkinson, respectively, were further discussed at the Institution of Electrical Engineers on Thursday last. Mr. S. G. Redman described the practice adopted for the north-east coast 20,000-volt lines. Mr. Trotter, speaking with regard to progress in this country, thought that 20,000 volts would be the highest that would be required. A new pattern of lightning arrester was described by Mr. J. S. Peck. Mr. Clothier referred to the use of the balanced system of protection on long-distance lines, and Mr. W. B. Esson, Mr. A. A. Campbell Swinton, Dr. M. Kloss, and Mr. B. M. Jenkin also spoke. A full report will be published in a future issue.

At a meeting of the Holborn Borough Council on Wednesday last week a report of the Works Committee to accept the tender of the Gas Light & Coke Co. for street lighting at a price per annum nearly £1,000 higher than the tender for electric lighting was referred back, with instructions to the Committee to bring up a fresh report within one month. (Page 81.)

The special committee appointed to inquire into the working of the special rules for the use of electricity in mines have issued their report, together with a suggested revised code of rules. The prohibition of the use of electricity where gas is continuously present is recommended, and it is suggested that the rules should apply to metalliferous mines also. (Page 82.)

The first meeting of the Advisory Committee of the Electrical Exhibition, which is to be held next September at Olympia, took place last week, when a number of schemes for adding to the utility of the Exhibition were considered. (Page 82.)

A new automatic voltage regulator has been designed by Messrs. H. M. Taylor and R. W. Scotson, of the Middlesbrough Electricity Department, in which a solenoid switch controls the excitation of a booster in the exciter field circuit of the main alternators. (Page 83.)

Among the specifications published by the Patent Office on Thursday last was one by the British Thomson-Houston Co. for a process for the manufacture of drawn tungsten filaments. Two patents cover devices for attaching shades to lamp-holders. E. H. Naylor describes a method of improving and renovating storage-battery plates. As the result of opposition, a patent by J. Neu for a supported-carbon arc-lamp with a pivotted stop has been surrendered. (Page 84.)

The Chelsea Borough Council have renewed a contract for street lighting with gas, although the electricity company quoted a lower price.—The Leicester Corporation are selling off their stock of electric fittings, in consequence of the recent decision of the Courts.—Bethnal Green Council seem unable to come to a decision with regard to electric supply.—A number of 1,000-c.p. metal-filament lamps are being used at Torquay for street lighting.—Newport Electricity Committee recommend an expenditure of £2,000 upon a Sales Department.—The Manchester Tramways Committee refuse to accept arbitration with regard to the men's conditions, unless the question of wages is also considered.—An offer by a private firm to run the Dover Electricity and Tramways Departments has been rejected. (Page 85.)

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Two water-cooling towers are required at Edinburgh; a 500-kw. rotary converter at Govan; a 300-kw. motor generator set at Brighton; and water-tube boilers, superheaters, &c., at Hammersmith.—Loans of £9,000 and £6,000 are required at Gravesend and Rathmines respectively.—Overhead tramway-line material is required at Brighton.—An electric lighting scheme is under consideration at Uttoxeter, and electrical stores are required by the Marylebone Council. (Page 85.)

ALTHOUGH the net revenue on the London United Tramways Co. for 1910 increased by £7,788, no dividend is declared upon the ordinary shares.—The accounts for Messrs. Bruce Peebles & Co., Ltd., for 1910 show a loss of £7,275.—Messrs. Mather & Platt, Ltd., declare a dividend of 10 per cent. and a bonus of 2 per cent. on the ordinary shares. (Page 86.)

Yorkshire Section of the Institution of Electrical Engineers.—The annual dinner of this Section was held at Leeds on Friday last, under the chairmanship of Mr. T. Harding Churton, the number present being over one hundred. In proposing the toast of the City of Leeds, Mr. Robert Hammond referred to the excellent results obtained by the electricity and tramways undertakings under the management of Mr. H. Dickinson, and, in replying to this toast, the Lord Mayor, Mr. W. Middlebrook, spoke of the diminution of fog consequent upon the more extended use of electricity. The toast of the Institution was proposed by Ald. C. F. Tetley, and responded to by Mr. S. Z. de Ferranti, President, who prophesied an enormous increase in the consumption of electricity.

Telegraph Traffic.—During the past week the El Arich route was down between Adana and Beyreuth, and also between Alep and Beyreuth. A stoppage also occurred in communication between Ceiba and Trujillo in Honduras on the 9th inst. —The *via* Hanekin route was deranged on the same date between Konia and Adana, and the *via* Batoum route between Samsoun and Trebizoude.—The lines of the Indo-European Telegraph Co. were repaired on the 9th, and the Hong Kong-Macao cable failed on that day, but was restored on the 11th inst.—The New York-Haiti Cable Co. was successful in restoring their Cape Haiti-Puerto Plata section on the 13th inst.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, FEBRUARY 16TH.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. Discussion on "School Lighting," to be opened by Dr. James Kerr, Medical Officer to the L.C.C., and Dr. N. Bishop Harman.

FRIDAY, FEBRUARY 17TH.

Institution of Mechanical Engineers.

8 p.m. At Storey's Gate, Westminster. Adjourned discussion on "Modern Electrical Dock Equipment, with special reference to Electrically-operated Coal Hoists," by W. Dixon and G. H. Baxter.

Institution of Electrical Engineers: Newcastle Section.

Annual dinner at Tilley's.

Institution of Civil Engineers.

8 p.m. At Great George Street, Westminster. Lecture I., on "The Uses of Chemistry in Engineering," by James Swinburne, F.R.S.

Tramways and Light Railways Association.

7 p.m. Annual meeting at Gaiety Restaurant, Strand, to be followed by annual dinner and smoking concert.

SATURDAY, FEBRUARY 18TH.

Birmingham and District Electric Club.

6.30 p.m. Annual dinner at Colonnade Hotel, New Street.

Institution of Electrical Engineers: Students' Section.

7 for 7.30 p.m. Dinner at Trocadero, London.

MONDAY, FEBRUARY 20TH.

Institution of Electrical Engineers: Newcastle Section.

7.30 p.m. At Armstrong College. (1) "The Relation between Phase Displacement and Load in Alternators," by W. Firth. (2) Demonstration of Fire-damp Cut-out Apparatus.

TUESDAY, FEBRUARY 21ST.

Institution of Electrical Engineers: Students' Section.

7.30 p.m. At Municipal School of Technology. "Sub-station Practice," by O. Welch and A. E. Dent.

Electro-Harmonic Society.

8 p.m. Concert (Ladies' Night) at Holborn Restaurant.

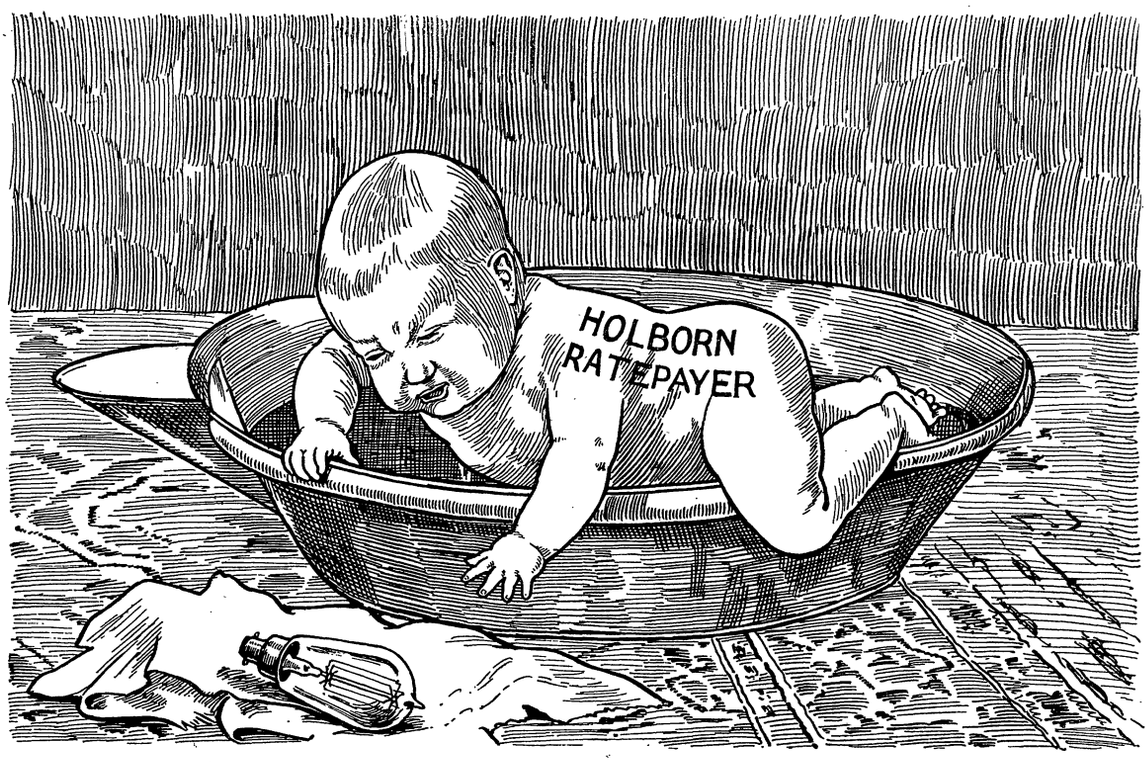
THURSDAY, FEBRUARY 23RD.

South Wales Institute of Engineers.

7 p.m. At Park Place, Cardiff. "Breaking High and Low Potential Circuits," by A. G. Collis.

Institution of Electrical Engineers.

8 p.m. Adjourned Discussion on Long-Distance Power Transmission.



"He won't be happy till he gets it."—With apologies to Messrs. A. & F. Pears, Ltd.

[Proposals for a new contract with the Gas Co. for the street lighting of the Borough of Holborn (London) have been twice referred back to the Works and General Purposes Committee by the Council, in view of the desire of the ratepayers to have electric light in the streets.—See page, 81.]

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"ELECTRICAL ENGINEERING"

LITERARY SUPPLEMENT

REVIEWS OF BOOKS

Three-phase Transmission. A Practical Treatise on the Economic Conditions Governing the Transmission of Electrical Energy by Underground and Overhead Conductors. By W. Brew. 178 pp. 8¾ in. by 5¾ in.. 82 figures. (London: Crosby Lockwood & Son.) 7s. 6d. net; abroad, 8s. 1d.

We recommend Mr. Brew's book to all engineers engaged in the design or extension of three-phase systems, and we recommend it still more as a pattern to the engineer who aspires to become a writer of technical literature. There is no "padding," no unnecessary verbiage; there are no "elementary" chapters containing definitions of familiar terms and long descriptions of stereotyped pieces of apparatus and standard practice with which technical books of recent years abound. Mr. Brew addresses himself obviously to the engineer who is fully equipped both in theory and practice for his work, and he gives him the benefit of the results of his own experience, observation, and deductions in a subject of which he has made a special study. If a larger proportion of the technical books which are published were of this character, the occupation of the reviewer would be more interesting.

The book starts with an introductory chapter, in which certain commercial considerations in connection with three-phase mains are considered. This is followed by an investigation, illustrated by apposite concrete examples, into the losses in the conductor, dielectric and sheathing, and the concluding pages of this second chapter afford an excellent indication of the spirit of the book. They deal with Kelvin's law of economy, not by repeating from beginning to end the explanation and proof to be found in innumerable textbooks, but by stating it simply, and then investigating its limitations and applicability to the actual conditions of modern three-phase practice. The next chapter discusses the question of working pressures; and the chapter on switchgear which follows is the only one in which the author has succumbed to some extent to the temptation of describing more or less standard apparatus in a more or less standard manner. The next chapter treats resonance, surges, and harmonics in a way which removes the veil of mystery and mathematics so baffling to the ordinary engineer; and in the last two chapters the questions of earthing and power-factor correction receive attention. The value of every electrical engineer's library will be enhanced by the addition of this book to its shelves.

Electric Trains. By H. M. Hobart. 201 pp. 8¾ by 5½ ins. 88 illustrations. (London: Harper & Bros.) 6s.; abroad, 6s. 8d.

With the enlargement of the field of electric traction there arises more and more need for specialised treatises dealing with particular parts of the subject, and in limiting himself to electric trains (and the limitation is even narrower than the title suggests, as only multiple unit trains for urban and suburban service are dealt with), the author is able to put forward a more straightforward and complete treatment of the matter in hand than could be done in a work of wider range. The main object of the book is to put forward thoroughly practical methods of calculating the energy required for working of such electric trains and of arriving at approximate estimates for the rolling stock proportioned for a given service. Descriptions of equipment do not form part of the scheme, but valuable quantitative data of motors, &c., in use and of actual tests are included. Numerous references are, however, given to papers read and descriptive articles in the technical press.

The subject is developed with the clear logical sequence that characterises all Mr. Hobart's work. The first chapter, entitled speed-time diagrams, deals generally with accelerations, maximum or "crest" speeds, &c. The influence of the number of stops per mile, and the duration of each stop is then considered, and the conclusion is arrived at that "for high-speed trains making frequent stops, it is of great commercial advantage to employ such systems of propulsion as shall, other things being equal, consist with low total weight of train for a given seating capacity." This statement prepares the way for the comparison for single-phase and continuous equipments that follow. The preponderating influence of momentum in a service with frequent stops is then treated more fully; the amount of energy wasted in the brakes is worked out, and modifications of the calculations to take into account the losses in the electrical equipment are indicated. A method of estimating the energy consumption of the train is then gone into, and the efficiency of the electrical equipment is then taken into account. Here, of course, comparisons between single-phase and continuous equipments begin to be made, but the author remarks, "There is little to choose between continuous and single-phase equipments as regards their efficiency under conditions of actual service, but any superiority in this respect which there may be is certainly possessed by continuous equipments." As we shall see presently, Mr. Hobart's well-known condemnation of single-phase working is based more on the greater weight of the train equipment for a given service. In the chapter just alluded to is a full specification of a standard train of the Lancashire and Yorkshire Railway, and the next two chapters are devoted to actual figures relating to the Central London and Piccadilly tube railways. After a further treatment of the relations between acceleration, tractive force, and train friction, the predetermination of the power curve to a given journey is taken in hand. Some particulars follow of the Midland Railway single-phase working, and the opportunity is taken for a statement that "It will be found characteristic of single-phase railway equipments that their weight per h.p. is of the order of twice that of continuous equipments." The comparison between single-phase and continuous-current motors is further developed in a study of the watts dissipated in internal motor losses per ton weight of motor, taking data of motors actually in use for the class of service considered. Weights and costs are then treated of, and for the same cost of train per seat, the appropriate schedule speed in m.p.h. for a given service is worked out, after making certain consumptions, greatly to the disadvantage of the single-phase system, and the author triumphantly remarks, "These results show that for the railway electrification work at present confronting engineers, *i.e.*, for the range of work where electrical methods are distinctly preferable to steam locomotive methods, the system employing series-wound continuous-electricity motors is decidedly the most appropriate." This point is further elaborated in the final chapter, entitled summary and conclusion, and a plea for the 1,200-volt continuous-current system is added.

Although, as may be gathered from the above, there is a certain amount of special pleading for the continuous against the single-phase system, Mr. Hobart has not indulged in the degree of abuse of the latter and its advocates that he thought fit to include in a former work; with the result that his words carry much more conviction. With regard to minor details we are pleased to see that the author has abandoned the employment of the comma instead of the decimal point, a usage to which we have taken exception on former occasions.

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A Dictionary of Electrical Engineering. Edited by H. M. Hobart. 2 vols. 648 pp. 10½ by 7¼ in. About 700 figures. (London: The Gresham Publishing Co.) 35s. net (abroad, carriage forward).

ALTHOUGH entitled a dictionary, this comprehensive work is considerably more than a mere glossary of technical terms; it contains, in the case of the more important entries, illustrated special articles, some of them a page or more in length, by contributors whose names are well known in the branches of electrical engineering upon which they write. In addition to the smaller illustrations in the text, there are also a number of full-page reproductions of photographs, which, although for the most part unnecessary from an explanatory point of view, at any rate enliven the appearance. The work is of monumental proportions, and is a production characteristic of the industry and methodical thoroughness of its compiler.

In a book such as this, the three qualities which are the best tests of its excellence are its up-to-dateness, its accuracy, and its homogeneity; but in making criticisms we must realise some of the difficulties always attendant upon work of this character. With a number of different authors some duplication is unavoidable, and even omissions may easily occur. Again, the size of the book prevents all parts of it going to press at the same moment, so that some portions are necessarily less up-to-date than others. But, nevertheless, there should have been greater uniformity in the ratio of the lengths of the articles to the importance of the subjects, and more care should have been taken to see that the illustrations were really typical of the class of article described.

Taking at random the subject of metal-filament lamps, to test the qualities laid down above as essentials, we must complain against the Osmium lamp being retained without being classed as commercially obsolete, and the omission from the list of processes on page 294 of the wire-drawing method of making tungsten filaments. Again, the "substitution process" is, we believe, no longer used commercially, and it is misleading to mention that this is covered by the patents of Just-Hanaman, whose much better-known patents refer to the paste process, in connection with which these names are not mentioned. These shortcomings are partly compensated for by the inclusion later in the book of a special heading, "Tungsten Lamps with Drawn Filaments," not bearing the initials of the same contributor, and to which there is no cross-reference in the main article. Similar examples might be multiplied, but such small faults must not be allowed to eclipse our appreciation of the merits of the way in which other subjects are handled. The switchgear articles, for instance, are excellent, and to say that those on dynamo design, &c., are worthy of Mr. Hobart's reputation is sufficient praise. Except for an occasional instance such as we have mentioned, the cross-referencing and other details of the arrangement are excellent.

General Foundry Practice. By W. Roxburgh. 296 pp. 8¾ in. by 5¾ in. 161 illustrations. (London: Constable & Co., Ltd.) 10s. 6d. net. Abroad, 11s. 2d.

IT is not too much to say that a better knowledge of the practical conditions of the foundry on the part of designers and draughtsmen would often lead to considerable manufacturing economies being effected. We think that a thorough study of a work such as this could be of great help in this direction, although, to quote the preface, it is "primarily intended for moulders and founders of every description." The whole work is thoroughly practical and bears the stamp of having been founded on many years' experience of the author as a foundry manager. More than half the pages are devoted to general iron founding, including many useful hints on starting a small foundry, and a section follows dealing in detail with loam moulding. The third division of the book treats of the casting of other metals, including brass, bronzes, speculum metal, aluminium

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and its alloys, &c., and the manufacture of "malleable" iron castings. Succeeding chapters deal with practical metallurgy in the foundry, pattern-making from a moulder's point of view, foundry ovens, fuels, and foundry tools. The first mentioned of these contains analyses of various brands of English pig-iron.

Practical Electrical Engineering for Elementary Students. By W. S. Ibbetson. 155 pp. 7½ in. by 5¼ in. 61 figures. (London: E. & F. Spon, Ltd.) 3s. 6d.; abroad, 3s. 7d.

THIS book contains a series of fifty laboratory experiments illustrative of elementary laws of continuous current work, and dealing with the measurement of current and resistance, fall of potential, potentiometer, and photometric measurements, and the principles of continuous-current motors and dynamos. Helpful diagrams and notes, with worked examples and curves plotted from actual readings are included, and suggestions are given for writing up the reports on the experiments. The experiments are particularly well chosen, and the book should be of considerable value as a guide to a laboratory course in technical schools.

The Development of the Telephone in Europe. By H. L. Webb, with an introduction by Harold Cox. 78 pp. 8¾ in. by 5¾ in. (London: The Electrical Press.) 1s. net; by post, 1s. 2d.

MR. WEBB'S book is an attack upon every action which the Government has taken with regard to telephony. If it obtains a wide circulation it will certainly not assist telephone engineers and officials in the difficult and delicate task which they are to have at the end of this year when the transfer of the telephone system of the country to the Post Office is to take effect. That telephone progress in this country, especially in the early days, has been seriously impeded by the action of the Government under its telegraph monopoly, can be unreservedly admitted, but we fail to see the object of stirring up animosity against Government control a few months before the Government is to become the sole owners of the telephone system. Mr. Webb's efforts would have been more praiseworthy had they been directed to showing that the Post Office telephone department have exhibited, in the work which they have carried out during the last few years, their thorough knowledge of the best practice in telephony—both local, inter-urban, and international. He could, moreover, have added with justice that as the Department will be in a position to avail itself of the services of the expert staff of the National Telephone Co., as well as of their own, and should be able to obtain wayleave facilities which have not been accorded to the Company, there is every reason to expect that telephony will make rapid and unprecedented progress when the transfer is completed, if the enterprise is not hampered by parsimony or indifference on the part of the Treasury or by hostility and hyper-criticism on the part of the public. The future of telephony in this country during the next decade will largely depend upon the smoothness with which the impending transfer is effected, and this in its turn will be controlled to an enormous extent by the attitude of the public while this difficult work is being carried out. Those who have the interest of the telephone industry at heart will not thank Mr. Webb for his book.

International Language and Science. Considerations on the Introduction of an International Language into Science. By L. Couturat, O. Jespersen, R. Lorenz, W. Ostwald, and L. Pfaundler. 87 pp. 8¾ in. by 6 in. (London: Constable and Co., Ltd.) 2s. By post 2s. 3d.

SEEING that the names of Ostwald and Lorenz appear on the title-page, we are bound to take this treatise seriously. It puts forward the claim for the adoption of an international language "ido," which is a development of or improvement on "esperanto." Much ingenuity has been expended on its creation, but we are bound to say that we should regret its adoption even to a limited extent as a medium for scientific or technical

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communication. Professors Ostwald and Lorenz both admit that a large proportion of the scientific and technical terms commonly employed are practically identical in all languages, and we can read between the lines of Prof. Ostwald's contribution that he realises that serious difficulties would have to be overcome in adapting "ido" for scientific literature. He gives one instance which is typical: Chlorine or chlor is inadmissible, for in "ido" ch has only one pronunciation—as in "church"—and the spelling clorine would also be impossible, as c is to be pronounced as ts; yet the symbol Cl must be retained. It is evident that there would be a large number of other terms already accepted in all languages that would have to be modified out of all recognition in order to conform with the spelling conventions of "ido." We are bound, however, to point out an even more serious objection to the employment of a new language by men of science and engineers, viz., the impossibility of ensuring absolute accuracy of expression and of avoiding ambiguity, and we have in the book itself an example ready to hand to illustrate our point. In one of the appendices a passage from an English book has been translated into "ido" by one expert and translated back again into English by another. In this, the expression "in print" becomes on re-translation "in the course of printing." If two such different ideas as these are expressed in the same words in "ido," one cannot imagine that it would be suitable either for scientific or technical literature or for engineering specifications.

Electric Motors. By F. B. Crocker and M. Arendt. 291 pp., 9¼ in. by 6¼ in., 158 figures. (London: Crosby, Lockwood & Son.) 10s. 6d. net; abroad, 12s. 2d.

ALTHOUGH this book is undoubtedly a good compendium of American practice, we do not find any very distinguishing feature to lift it, in point of utility to English readers, above the group of books written in this country dealing partly or wholly with electric motors. While it professes to deal more particularly with the operation of motors as distinct from their design and construction, the text may be described as somewhat academic in nature, dealing chiefly with the theory of characteristic curves and the various methods of control of D.C. and A.C. motors, nor does it cover very much new ground. American practice in electric driving is very similar to English practice, but there are some types of variable-speed motors described which are never seen in this country. This, however, rather adds to than detracts from the interest. In common with most American text-books, there is a disadvantage to English readers in the use of American rules and standards.

A Text-book of Physics. By H. E. Hurst and R. T. Lattey. 638 pp. 8¾ in. by 5½ in., 101 figures. (London: Constable & Co.) 8s. 6d. net; abroad, 9s. 6d.

IN the preface it is stated that the original intention was to cover the syllabus of the Preliminary Examination in Physics in the Oxford Natural Science School, but that "a certain amount of additional matter has been introduced." The authors are to be congratulated at once upon their modesty and upon the excellence of their work. For all examinations up to the standard of the Intermediate Science of London University, this is one of the most suitable books we have seen; moreover, it is exactly the kind of work that ought to be in the hands of engineering students. The various sections are:—Mechanics, Heat, Sound, Light, Magnetism, Statical Electricity, Current Electricity, and Mathematical Notes and Tables. While the treatment of the "pure science" is admirable, the authors have not been quite so happy when dealing with more technical matters, which, however, occupy very little space, and might, perhaps, have been omitted without detracting very much from the value of the book as a whole.

Matriculation Magnetism and Electricity. By R. H. Jude and J. Satterley. 415 pp. 7 in. by 5 in. 237 illustrations. (London: University Tutorial Press.) 4s. 6d.

ALTHOUGH the title of this work would lead one to expect a text-book limited to the requirements of those preparing for one particular examination, in reality a wide course is covered. The elementary principles of electricity and magnetism are explained and illustrated by a large collection of simple experiments, adapted to school requirements, and requiring only simple apparatus. In general, the text follows the lines of Dr. Jude's *School Magnetism and Electricity*, on which the present book is based, but both experiments and diagrams have been increased in number. The principles of magnetism are dealt with before those of electrostatics, as various phenomena common to both, such as the law of inverse squares and the conception of lines of force, are demonstrated more easily by practical methods in magnetism than in electricity. A useful feature of the book is the large number of diagrams of lines of force and equipotential surfaces. The latter portion of the book deals with primary and secondary cells, Ohm's Law, and the principles of electromagnetic induction, but in common with many text-books of the old school based on examination schedules, the prominence given to the properties of electric currents is considerably less than that given to out-of-the-way electrostatic phenomena.

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Practical Curve Tracing. By R. Howard Duncan. 133 pp. 8¾ in. by 5½ in. 77 illustrations. (Longmans Green & Co.) 5s. net; abr., 5s. 4d.

GRAPHICAL methods are employed both in practise on account of their convenience and for educational illustration on account of their clearness to such a large extent that one of the most essential parts of the mental equipment of an engineering student is a thoroughly clear idea of the meaning, properties and uses of curves. The author of the work has provided a very clear and useful introduction to the subject, forming an excellent bridge between the algebraic and the graphic aspects of the relations of variables, without going very deeply into their academic treatment either from the analytical or the geometrical side. The properties of the straight line, parabola, hyperbola, sine, logarithmic and exponential curves are clearly dealt with, and a useful chapter follows on the graphical solution of equations. An admirable sketch developing the ideas of differentiation and integration from the slope and areas of curves is contained in the final chapters. This, although brief, forms a much better introduction to a part of mathematics in the attacking of which difficulty is often found, than is given in many of the more orthodox text-books.

Elektrische Beleuchtung. By Dr. Ing. Berthold Monasch. Second edition, enlarged. 331 pp. 8¾ in. by 6 in. 112 illustrations. (Hanover: Max Jänecke.) Paper cover, 9s. 3d.; cloth, 10s.

THE greater part of this book is apparently a mere reprint of the first edition, which appeared in 1906; it contains some statements which are, at the present time, erroneous and misleading, and descriptions of obsolete types of lamps are retained. Some 100 pages have been added, however, as a "second part" to cover the progress of the last four years, and the matter in this is mainly a collection of useful abstracts of the more important contributions to the technical papers of Europe on the subject of illumination. Brief descriptions of one or two recent types of arc lamps are included, and the section on metal filament lamps is quite up-to-date, embracing much information as to their behaviour, properties, and economy. The various methods of manufacture are only briefly referred to.

Applied Mechanics for Engineers. By John Graham. 304 pp. 7¼ ins. by 4¾ ins. 246 figures. (London: Edward Arnold.) 5s. net; abroad, 5s. 5d.

THIS is an excellent text-book, presenting the elements of the essential parts of the subject in a most concise form. The clearness of the text and the frequent use of worked examples make it suitable for home study. Sections are included on graphical statics, roof structures, beams and girders, problems connected with the flow of water, and the theory of the steam engine. The chapter on balancing, written on the lines adopted by Prof. W. E. Dalby, should be found of considerable use. The general method of treatment in the book is graphical, but a knowledge of the elementary calculus is presumed.

Notes on Applied Mechanics. By R. H. Whapham and G. Preece. 203 pp. 7¼ ins. by 4¾ ins. 150 figures. (London: Edward Arnold.) 4s. 6d. net; abroad, 4s. 10d.

THESE notes are primarily intended for the use of naval cadets on the training cruisers after the completion of their course at Dartmouth.

Spon's Architects' and Builders' Pocket Price Book and Diary, 1911. 352 pp. 6¼ in. by 3½ in. 2s. 6d. net; by post, 2s. 8d.; Memoranda Section, 372 pp., 2s. 6d. net; by post, 2s. 8d. (London: E. & F. N. Spon.) The two sections, post free, 5s. 3d.

THE issue of this well known pocket-book in two volumes is due to the thickness becoming inconvenient for pocket use in consequence of the addition of much new matter in the Memoranda section. The diary is included in the Prices section, the latter being the one more generally required. Among the tables of "Measured Prices" for general building and house decoration work are some for estimating the cost of wiring and of lighting installations revised for metal filament lamps, and a complete specification of a country-house installation is given, together with some useful general notes on electric lighting in the Memoranda section. Some twelve closely-printed pages are devoted to extracts from the Wiring Rules of the Institution of Electrical Engineers. The general information in the Memoranda section with regard to building law, fire insurance, &c., is of considerable value.

The Local Government Annual and Official Directory, 1911. (20th year.) 296 pp. 7 in. by 4¾ in.. (London: "The Local Government Journal" Office.) 1s. 6d.

THE 1911 edition of this directory has been revised and brought up to date with the thoroughness characteristic of the publishers. To anyone seeking information relating to Local Government, the book is invaluable. In addition to lists of Committees, &c., the useful particulars of the various undertakings of the London boroughs, including electric supply, and the abstract of the Local Government legislation of 1910, cannot fail to be of the greatest service.

Rugby Engineering Society Proceedings. Vol. VII. 112 pp. 8¼ in. by 5½ in. 8 figures. (Rugby Engineering Society.) 10s. 6d.

THIS volume contains a Paper on "Shop Testing of Direct and Alternating Current Machinery," by J. W. Rogers, abstracted in ELECTRICAL ENGINEERING, Vol. V., p. 992, and others on the "Electric Furnace," by J. Harden, and on "The Design and Construction of Aeroplanes," by J. P. Chittenden and L. H. Robinson. Full reports of the discussions of these Papers are included.

The Practical Electrician's Pocket Book and Diary, 1911. 363 pp. 5¼ in. by 3½ in. Many figures. (London: Rentell & Co.) Cloth, 1s. net; by post, 1s. 2d.. Leather, 1s. 6d. net; by post, 1s. 8d.

THIS pocket book is too well known to need any introduction. The 1911 edition has been carefully revised by Mr. H. T. Crewe, and some additions have been made. The list of central stations now includes the names of the chief engineers. A section on armature repairs has been added, and the portion dealing with arc lamps has been entirely re-written.

Hazell's Annual, 1911. 592 pp. 7½ in. by 4¾ in. (London: Hazell, Watson and Viney, Ltd.) 3s. 6d.; abroad, 4s. 1d.

AMONG the innumerable details of information given in this yearbook, the electrical industry finds a place, the past year's happenings and future tendencies being recorded in concise language. The vast amount of information given upon practically every subject of interest to the average individual renders a book of this description indispensable, at any rate to business men.

Who's Who, 1911. 2,246 pp. 7¼ in. by 4¾ in. (London: A. and C. Black.) 10s.; abroad, 11s.

WITH some 23,000 biographies, "Who's Who" makes its appearance for 1911, as complete a guide as ever to the men and women of the day.

Englishwoman's Yearbook and Directory, 1911. Edited by G. E. Mitton. 384 pp. 7¼ in. by 4¾ in. (London: A. and C. Black.) 2s. 6d.; abroad, 3s.

THIS volume, which is in its thirtieth year of publication, deals with the woman's side of educational, professional and social matters.

Writers' and Artists' Year Book, 1911. 132 pp. 7¼ in. by 4¾ in. (London: A. and C. Black.) 1s.; abroad, 1s. 2½d.

THIS directory for writers, artists, and photographers, covers some of the ground dealt with by the ordinary press directories, but it gives a considerable amount of additional information not to be found in the latter, and yet which is indispensable to those to whom it appeals.

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"Applied Thermodynamics for Engineers," by W. D. Ennis. 438 pp., 10in. by 6½in., 316 figures. (London: Constable & Co) 24s. net; abroad, 25s. 3d.

Transactions of the Institution of Engineers and Shipbuilders in Scotland, Vol. LIII., Session 1909-10. 429 pp., 8½in. by 5½in., numerous figures and plates. (Glasgow: The Institution Offices, 39, Elmbank Crescent.)

"The Law Relating to the Generation, Distribution, and Use of Electricity, including Electric Traction." By C. M. Knowles. Part I., "Electric Lighting and Power," pp. 447; Part II., "Electric Traction," pp. 403; 9¾ in. by 6¼ in. (London: Stevens & Sons.) Price, two vols., 42s.; abroad 43s. 8d.

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"The Universal Electrical Directory (J. A. Berly's), 1911." 1,552 pp. 9¾ in. by 6¼ in. (London: H. Alabaster, Gatehouse & Co.) *A.* British and Colonial Sections only, 10s.; abroad, 11s. *B.* British and Colonial, with Continental and U.S.A. Sections, 14s. 6d.; abroad, carriage forward.

Lewis's Scientific Circulating Library.—Mr. H. K. Lewis has sent us a list of the latest books and additions added to his circulating library, a library which should be found of particular interest to those of our readers who require from time to time to consult standard works on not only electrical engineering, but also on allied subjects. The library now comprises some 15,000 standard works of a scientific character. Mr. Lewis informs us that a new supplement to the library catalogue is now in the press, which will include about 2,000 new titles. In connection with the library at Gower-street, a very well appointed reading-room is provided, where subscribers can, at their ease and convenience, refer to any of the works included in the catalogue.

The Central.—The current issue of the Journal of the Central Technical College Old Students' Association contains an article on the educational and social activities of the college session 1909-1910, and the usual interesting Old Students' Notes. Among the special articles is an account by Prof. W. J. Pope of researches on the structure of crystals and its relation to chemical constitution. A description of the new engineering laboratories of the College is written by Prof. W. E. Dalby. These shops include apparatus to be used in connection with the advanced courses in electric traction, and a dynamometer pit for testing tramcar trucks and electric power signalling equipments have already been installed. The other features of this number are articles on the cross-Channel steamers, the bonus system in a machine shop, and the development of the Humphrey pump. Excellent photographs of Mr. M. A. Bullock, Secretary of the Students' Union, and Mr. E. S. Hoare, Secretary of the Engineering Society, are included.

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LIGHTING IN THE BOROUGH OF HOLBORN

Committee's Recommendation for Gas Lighting Rejected

THE Holborn Council Works Committee seem determined to achieve notoriety over the lighting of the borough by their remarkable insistence in recommending gas lighting against the wishes of their own ratepayers and in the face of an offer from the electricity supply companies which will effect a saving of nearly £1,000 a year.

In July, 1910, an offer was made by the Gas Light & Coke Co. to instal and maintain an improved system of gas lighting in the majority of the thoroughfares for £6,688 per annum on a ten years' contract, a total candle-power of 260,000 being guaranteed. This was recommended for acceptance by the Committee, but the Council refused to accept the offer, and, after receiving a deputation of shopkeepers, headed by Mr. A.W. Gamage, desired information as to the comparative merits and cost of gas and electricity. Accordingly, in October last year, competitive demonstrations were given in Gower Street by the Gas Light & Coke Co. on the one hand, and the Metropolitan, County of London, and Charing Cross and West End Electric Supply Companies on the other; the Metropolitan Electric Supply Co. conducted the electric-lighting experiment on behalf of all three electric-lighting companies. Photometric tests taken at angles of 20° and 50° to the horizontal showed that the electric lamps were giving an average of 395 c.p. each, and the gas lamps 318 c.p. each. Readings taken in the centre of the roadway showed that there was very little difference between gas and electricity; the specification required that each lamp should give at least an average candle-power of 300 at the two angles. After this experiment the companies were invited to submit tenders for lighting the borough according to a schedule of prices per annum for lamps of different candle-power ranging from 60 to 2,000 c.p. each. The tenders were on the basis of a ten years' contract, subject to the Council having the option of determining it at the end of the first five years on payment of a proportion of the capital charges, estimated at from £2,500 to £3,000. Each company undertook to provide all services, lamps, columns, fittings, painting, and attendance, together with the necessary supply of electricity or gas. The Works Committee, in their report on the tenders, suggested 2,000-c.p. lamps in High Holborn and New Oxford Street, 600-c.p. lamps in Tottenham Court Road, 400-c.p. lamps in the other main thoroughfares, and 60-c.p. lamps in all other streets, and estimated that 405,000 c.p. would be required. It may also be mentioned that there are a certain number of streets at present lighted by gas, for which the contracts have not yet expired.

The respective tenders for electricity and gas were £6,602 and £7,527. And here comes the amazing part of the whole affair, for the Works and General Purposes Committee, at the meeting of the Borough Council last week, gravely recommended the Council to accept the tender of the gas company at £7,527 per annum—higher by £9,250 than the tender for electricity over the ten years' contract. The only reasons adduced were that it would not be advisable to have two systems of illumination in the borough, that there would be less interference with the streets, and that the difference in cost was not sufficiently great to warrant a radical alteration in the system of lighting.

Subsequent events in the Council Chamber demonstrated, fortunately, that it is only the Works Committee who are able to view £9,250 as a trifling sum. The subject has created such interest among the Councillors of Holborn—not to mention the ratepayers—that the Council meeting on Wednesday last week, when the matter was considered, was in distinct contrast to the air almost of lethargy which usually prevails. Mr. Max Clarke, the Chairman of the Committee, introduced the report with no more cogent reasons for accepting the recommendation than those mentioned above. One point made by him told rather against the Committee than otherwise—viz., that the Gas Light & Coke Co. intend to lay a high-pressure main down the middle of High Holborn and New Oxford Street, so that, as far as interference with traffic is concerned, it can hardly be claimed that there will be less than with electricity, as mains are laid in most of the Holborn thoroughfares, and the bulk of the street work would be under the pavements. The Chairman of the Works Committee expressed his indifference as to which way the Council voted, giving it as his opinion that the borough is well enough lighted at present; some other members held the same views. But the Chairman of the Committee followed this up by a statement not in accordance with facts—that many other boroughs in London had given up electricity for gas after having found it unsatisfactory, including some boroughs owning electricity works. He delegated to another member of the Works Committee, Councillor Edward Angel, the task of reading a list of these boroughs—a list prepared, he said, by the Holborn Borough Surveyor—and our surprise may be imagined when we heard the names of Bethnal Green, Chelsea, Lambeth, and Finsbury, as well as notorious Westminster, the vacillating City of London, and Paddington, with its one half-hearted single-street experiment. No mention was made of Hampstead and Shoreditch, in which electricity is entirely superseding gas for street lighting; and as for Marylebone, where the substitution of electricity for gas is complete, Mr. Angel actually said that some streets were lighted by gas. Councillor Fitzroy Doll, also a member of the Works Committee, testified that Chelsea have never had electric light in their streets. We can inform the Holborn surveyor that Bethnal Green has never had a supply of electricity in their borough at all, the statement as to Lambeth and Finsbury is hopelessly inaccurate, and in the other three districts the displacement of electricity by gas is either partial or temporary. The debate resolved itself into there being one or two members in favour of gas, a large majority in favour of rejecting the Works Committee's report and accepting the tender for electricity, and a few members who sat on the fence, with no fixed opinions of their own, and who practically admitted they would vote whichever way their constituents desired. The Committee's action in recommending the highest tender after requesting the electric light companies to tender and putting them to the expense of the experimental lighting was referred to by more than one speaker as an insult to the Council and the companies. One member thought the Council would be pilloried by the whole of London if gas were adopted. Others thought the matter ought not to be rushed through, but when those opposed to the recommendation insisted on a vote, which would undoubtedly have resulted in the electric light tender being accepted, the Chairman of the Works Committee pleaded that, as the contract with the gas company terminates on March 25th, there would not be time to carry out the change over before that date if the electric light tender were adopted. The fear of the Borough of Holborn being left in darkness for a certain period silenced those in favour of electric light, and the report was sent back to the Committee with instructions to bring up a new report within a month.

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The gas company may be congratulating themselves that in a month's time it will be too late to change the arrangements, as it would then be necessary to put in electric lighting within a few days if it is to be done before the expiry of the present gas contract. We trust, however, that a way out of this difficulty will be found, for otherwise not only the Works and General Purposes Committee, but also the Council themselves deserve severe censure for letting this matter, which has been under discussion for about nine months, to be postponed until it is too late to adopt the only course which will be satisfactory to the ratepayers.

ELECTRICITY IN MINES

THE report has been published of the special departmental committee appointed by the Home Secretary to inquire into the working of the existing special rules for the use of electricity in mines, and to consider the advisability of their amendment. It will be remembered that the committee consists of three members, namely:—Dr. R. A. S. Redmayne, H.M. Chief Inspector of Mines; Mr. C. H. Merz; and Mr. R. Nelson, H.M. Electrical Inspector of Mines. The report consists of some seven pages of general comment on the working of the rules, to which is appended a revised code of twenty special rules, together with various forms for notifying the installation of electrical apparatus, &c., which are suggested by the committee. A memorandum of ten pages deals with certain practical points, which, it is thought, may arise in connection with the rules. The report concludes with a list of fatal accidents resulting from the use of electricity in coal mines, together with the circumstances of each accident. Perhaps the most noteworthy feature of the revised rules is the prohibition of the use of electricity where, on account of the risk of explosion, such use would be dangerous. Other new features are the provision that inflammable material shall not be used in the construction of motor rooms, more stringent regulations as regards the earthing of the outer coverings of apparatus and the conditions to be fulfilled by switchgear and machinery, and the provision for proper supervision of plant. It is recommended that the special rules should apply to metalliferous mines, as well as to coal mines. We shall deal with this report at some length in our next supplement on Electrical Engineering in Mines.

The Society of Engineers.—Among the premiums presented at the opening meeting of the session on February 6th was one to Mr. A. H. Allen for a Paper on "Electricity from the Wind."

The Electrical Standardising, Testing & Training Institution.—Mr. Robert Hammond will begin a course of lectures to the senior students of Faraday House on Tuesday, February 21st, upon "Electricity Undertakings."

Physical Society.—We are informed that Papers read before the Physical Society of London in future will appear in general only in the "Proceedings" of the Society, and not in the *Philosophical Magazine*. "The Electrician" Printing and Publishing Company, Ltd., will publish the "Proceedings."

Institution of Electrical Engineers.—The following is the result of the ballot of new members at the Institution on Thursday:—Members: A. Dow, Dr. Max Kahn. Associate Members: J. G. Balsillie, W. F. Bartram, W. H. Bray, J. G. Hill, J. McCarthy, A. McKay, F. Mellor, H. A. Neale, C. Powell, W. Rogers, J. Russell, G. Schauli, G. Smyth, F. Talboys, J. Tarby, H. Trent, W. White, A. Williams, J. Wright. Associate: J. Webb. Students: F. Baxter, C. Cosens.

New Telephone Exchange in the City.—Considerable progress has been made with the new Post Office exchange in Creechurch Lane, E.C., which is necessitated by the rearrangements attendant upon the transfer of the telephone system to the Post Office at the end of this year. The building is practically complete, and the equipment, which is for 8,000 subscribers, is about to be installed by the Peel-Conner Telephone Works, Ltd. There will be 3,000 keyless junction lines, 36 per operator, and some new features in the multiples at the calling positions.

Systems of Wiring.—We published a note relating to the "Stannos" system of wiring on page 73 of our last issue. In it we said that "'Stannos' wires are used most extensively on the two-wire system in both continuous- and alternating-current districts, and Messrs. Siemens hold that the suggestion that two wires are unsuitable for an alternating supply, owing to eddy currents being set up in the metallic casings, is quite fallacious." Messrs. Siemens Bros. & Co. inform us that not only do they hold that this suggestion is fallacious, but that it has been proved to be so by exhaustive tests and actual experience.

THE ELECTRICAL EXHIBITION AT OLYMPIA

THE first meeting of the Advisory Committee of the Electrical Exhibition, convened by the National Electrical Manufacturers' Association, which is to be held at Olympia next September, was held at the Institution of Electrical Engineers on Wednesday, February 8th, to discuss the following matters:—The types of electrical exhibits best calculated to attract a large attendance of the public, in addition to the exhibits made by the manufacturers; to decide as to the best methods of inducing visits to the Exhibition by likely users of electricity, and the different methods required in the various localities supplied by the authorities; and to make suggestions as to the best means of making the Exhibition known to Colonial and foreign buyers.

There were present:—Messrs. S. W. Baynes (St. Pancras Electricity Department), F. A. Bond (Battersea Electricity Department), E. Calvert (Finchley Electricity Department), C. B. Clay (National Telephone Co.), G. H. Cottam (Hampstead Electricity Department), S. T. Dobson (St. James & Pall Mall Electric Lighting Co.), R. S. Downe (Brompton & Kensington Electric Supply Co.), B. G. Drummond (Hendon Electric Supply Co.), A. L. C. Fell (L.C.C. Tramways), G. Horley (Westminster Electric Supply Co.), J. Douglas Knight (Ealing Electricity Department), H. W. Miller (Kensington & Knightsbridge Electric Lighting Co.), E. Cunliffe Owen (Metropolitan Electric Supply Co.), G. W. Partridge (London Electric Supply Co.), W. J. D. Partridge (Wesminster Electric Supply Co.), C. Newton Russell (Shoreditch Electricity Department), A. Hugh Seabrook (St. Marylebone Electricity Department), R. W. Sprunt (South London Electric Supply Co.), Norman Staniland (Hornsey Electricity Department), and C. H. Wordingham. The following gentlemen regretted their inability to attend:—Sir Irving Courteney, Messrs. F. Bailey, E. Garcke, T. E. Gatehouse, J. Gavey, J. S. Highfield, J. Swinburne, and W. C. P. Tapper.

Mr. E. Cunliffe Owen addressed the meeting from the chair, pointing out the desirability of exhibits of the character of X-rays, wireless telegraphy, and high-tension currents for use in agriculture as being of the class that would interest the general public. These suggestions were discussed, and as regards electric cooking, it was urged that an endeavour should be made to induce the caterers to do their cooking electrically, and to obtain the necessary apparatus from exhibitors. It was proposed that the caterers be arranged with to supply tea in a separate room, in which the visitors should be allowed to make their own tea, toast, &c., all the operations being done electrically. Attention was drawn to the attractiveness of electrical advertising signs, and it was pointed out that a telephone exchange in the Exhibition should be of great public interest. Among other exhibits proposed were a model laundry in work, electrical furnaces, and demonstrations of electro-medical apparatus. The view was entertained that it would be of great interest to members of the medical profession if a conference could be arranged, and addresses given during the run of the exhibition on the use of electricity for medical purposes. A desire was expressed by several present that the Institution of Electrical Engineers should hold a meeting at the Exhibition, and the Secretary stated that he would communicate with the Secretary of the Institution of Electrical Engineers in the hope that such an arrangement can be made.

The subject of giving publicity to the Exhibition by the supply authorities was next considered on the basis that they should purchase tickets for distribution to the consumers of electricity in their various districts. The Exhibition authorities also stated that they would be prepared to supply posters and literature, which could be distributed by the supply authorities. This suggestion was favourably received, and a request was made that a letter containing full details of this proposal should be sent to all supply authorities, with a view to the matter being formally considered by each. The meeting considered that everything possible should be done to make the Exhibition known to Colonial and foreign buyers, and it was proposed that the attention of the Board of Trade and the Chambers of Commerce should be called to the matter.

Advertising Electricity.—A conference has been held by the London Electric Supply Authorities, at which it was decided to endeavour to raise a fund of about £1,500 for advertising, including an extended display of large-size posters on the principal hoardings throughout London. Borough Councils and companies are being invited to subscribe *pro rata* towards this expenditure.

L.C.C. Tramways and Railway Signals.—The South-Eastern & Chatham Railway Co. have made a claim of £241 14s. against the L.C.C. Highways Department for providing metallic returns to certain signalling circuits on their line, owing to the interference with the signals by the overhead system of the Council from Loughborough Junction to Norwood. It will be remembered that a similar difficulty recently arose between the Council and the London, Brighton and South Coast Railway Co., and as there is a probability of such claims becoming more frequent, the Council have decided to oppose the present claim in order to obtain a decision on the legal points involved.

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A NEW AUTOMATIC VOLTAGE REGULATOR

A DEMONSTRATION was recently given at the Hylton Road station, Sunderland, by the courtesy of Mr. A. S. Blackman, the Borough Electrical Engineer, of a new automatic voltage regulator possessing some interesting features which has been developed by Mr. H. M. Taylor (Borough Electrical Engineer, Middlesbrough), and his assistant, Mr. R. H. Scotson. The need for such an apparatus was felt by them in connection with the operation of a feeder booster regulating the voltage of supply to a long feeder, and at Middlesbrough the Taylor-Scotson system of control has been for a considerable time regulating the "boost" of this machine with reference to a point on the network two miles from the generating station. As the network is connected up solidly throughout, the voltage of supply throughout the system is thus automatically controlled. Another application of the gear has been made at the steelworks of Messrs. Bolckow, Vaughan & Co., Ltd., in connection with exhaust steam turbines, running on heavily fluctuating load.

The apparatus consists essentially of a small shunt-wound generator in series with the exciter field. The field of this generator is divided into two equal windings, fed from any suitable direct current supply, and arranged so that the two halves are in opposition. These fields are supplied through lamp resistances in order to eliminate sparking in the operation to be described. The armature can thus give either an opposing or an assisting boost to the terminal pressure on the exciter field, according to the half of the field which is placed in circuit. This effect is produced by short-circuiting the terminals of either half of the auxiliary field winding by a solenoid-controlled switch, the connections of which are shown in Fig. 1, where *E* is the main exciter, *A*

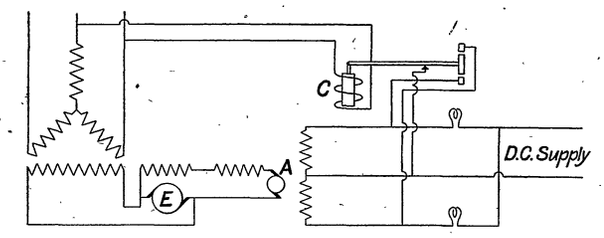


FIG. 1.—DIAGRAM OF CONNECTIONS.

the auxiliary generator armature under the influence of the divided field, and *C* is the controlling solenoid. This solenoid is a pressure coil placed across any point on the main supply at which it is required to maintain constant potential, and the position of the core depends, therefore, on the current in the solenoid *C*. This short-circuit method does away with all sparking at the points of contact. At Messrs. Bolckow, Vaughan's the gear has been working on a 24-hour day for a long period without any overhauling or adjustment, while the station superintendent at Sunderland reports that the gear there has worked since its installation without any adjustment. No attempt is made at graduating the boost in either direction. The whole of the positive or negative boost is given to the exciter field circuit at once, and this makes the gear very accurate and speedy in action. Fig. 2 shows a typical portion of a voltage chart furnished

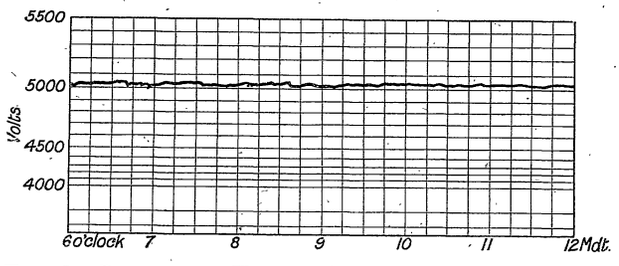


FIG. 2.—PORTION OF VOLTAGE CHART WITH REGULATOR IN ACTION.

us by the courtesy of Mr. Blackman, and the variation of voltage throughout the whole day did not exceed 0·5 per cent. on either side of normal. We are told that before the installation of the automatic control, it was difficult to keep within 1½ per cent. deviation with the most rigid hand-control.

We have given in Fig. 3 a daily load-curve at Sunderland plotted from board readings taken every half-hour, illustrating the combined lighting, tramway, and shipyard power load. The heavy changes of load at meal-times are apparent; during our visit, the load fell from about 2,600 kw. to 1,500 kw. in about eight minutes due to the shipyard dinner-hour. The engine was regulated for speed, but otherwise no voltage regulation by hand was effected, except at the moment of taking a machine out of parallel. In addition

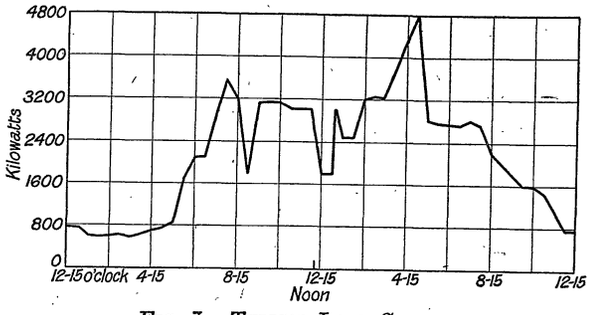


FIG. 3.—TYPICAL LOAD CURVE.

to the changes of load shown in the chart there were momentary rushes of power of as much as 500 kw., but the automatic regulator successfully dealt with these short-period fluctuations as successfully as with the slower ones.

The Bolckow-Vaughan equipment controls each or all of three 1,000-kw. exhaust steam turbines, running on a load varying from 200 kw. to over 1,000 kw., and having at times a power factor as low as 65 per cent. The motor-generator is of about 2 h.p., and is capable of giving a boost of 120 volts on a 200-volt circuit, but to meet the conditions of a short-circuit, where automatic maintenance of voltage is undesirable, an auxiliary contact comes into play on an excess movement of the core of the solenoid, which short-circuits the booster field. Automatic control can be restored by resetting the trip.

The Middlesbrough Corporation installation controls continuous-current generating plant of 1,300-kw. capacity, including a 600-kw. turbo-generator. The feeder-booster through which this control is effected, can be used as a floating booster in series with the main battery at the station so that an automatic control by means of the Taylor-Scotson device is given, which compares very favourably, in point of efficiency and cost, with other systems of booster-battery regulation. The apparatus has also been applied with success to the problem of rotary-converter regulation, so that the device may be said to have received a thorough testing. The salient points of the gear may be said to be the elimination of sparking at the contact points—a defect common in relay systems; and ease of application to existing plants without undue interruption of supply. The amount of boost which can be given to exciter fields is only limited by their saturation point being reached; and alternators of various types and with different excitations may be regulated simultaneously with one regulator without paralleling the exciters.

Electric Driving of Looms.—An important development of the application of electricity to the textile trade has just occurred in Lancashire. Messrs. Frears, Lord & Brother are building a new weaving shed at Darcy Lever, which is to be electrically equipped throughout, on the system of individual drive. The order for 519 ½ h.p. and 175 ¾ h.p. special loom motors was finally placed with Messrs. Siemens Brothers' Dynamo Works, Ltd. (Caxton House, Westminster). Three-phase current at a periodicity of 50 cycles and a pressure of 200 volts will be supplied by the Lancashire Electric Power Co., who will provide a sub-station for the purpose of transforming their extra high tension supply down to the required pressure. We believe that this is the first individual loom drive of such large size in this country, though it is extensively adopted on the Continent, where the Siemens firm alone have supplied over 13,000 motors for the purpose. The individual driving of looms gives a very considerably increased output, and a much better quality of cloth. The bigger and more complicated the loom is, the better are the results that individual electric driving show. Other advantages accruing are that through the absence of all shafting and belting the light is much better, while in the construction of the shed a large amount of money can be saved. Messrs. Siemens Brothers' Dynamo Works are also supplying the switchboard, and the wiring will be carried out with their material, making use of their well-known "Zed" fuses and distribution boards.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published February 9th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

23,499/09. **Drawn Tungsten Filaments.** BRITISH THOMSON-HOUSTON CO., LTD. (*General Electric Co., U.S.A.*). This specification relates to the mechanical treatment of tungsten whilst hot in order to render it ductile, as described in specifications 21,513/06 and 16,530/07. Pure tungsten powder is compressed into sticks about 8 in. long and $\frac{3}{8}$ in. square, in heated steel moulds. After heating in hydrogen to dispel any impurities, the sticks are sintered so as to become dense and hard by passing an alternating current of about 1,400 amperes through them for several minutes. They are then rolled or worked in a special swaging machine described in the specification, and after repeated and prolonged working the crystalline structure is said to change to a pronounced fibrous structure, so that the sticks are pliable, ductile, and very strong. Drawing is begun when the diameter is reduced to 35 mils, and is continued in successive stages until the diameter is 1 mil or less, as is required. It is found that the tungsten wire can be drawn at ordinary room temperatures after prolonged mechanical working, and the claims of this patent cover this. Three figures.

415/10. **Lamp-shade Collar.** R. J. ESKRIGGE (New Brighton, Chester). A collar for holding the shade on a lamp-holder consists of two pivoted flat rings with a spring urging them into eccentric relation so as to grip the threaded portion of the holder. They are brought into the concentric position by means of two depending tabs. Six figures.

1,164/10. **Lamp-holders, Plugs, &c.** H. E. EVANS (London). This patent covers the provision of separate openings and cord-grips for the two or more flexible conductors entering a lamp-holder, plug, or other device. Five figures.

1,434/10. **Petrol-electric Propulsion.** H. PIEPER (Liége). A system of "multiple-unit" control is described for a train of several vehicles, each with a petrol-electric drive, as covered by specification No. 28,082/09. The controller in use receives the control current from the battery of the vehicle on which it is mounted. Four figures.

1,465/10. **Lamp-shade.** F. D. and R. C. DEWSE (Wilmslow, Cheshire). An arrangement of spring arms is attached to the lamp-holder, and the shade has a collar with an annular groove. The springs enter the groove when the shade is slipped on. To remove the shade it is forcibly pulled off. Three figures.

1,558/10. **Storage Batteries.** E. H. NAYLOR (London). Old plates are renovated or new ones improved by immersing them in a solution of a compound of sulphur and a halogen. After heating, the active material is reduced electrolytically in a bath of dilute sulphuric acid, and then formed in the usual manner. The material expands by this treatment, and fills up vacant spaces.

4,262/10. **Rotary Transformer.** SIEMENS BROS. DYNAMO WORKS and W. PARKER. This specification describes a drum-armature machine with split field poles. The motoring halves alternate with generating halves round the circumference. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: ALLGEMEINE ELEKTRICITÄTS-GES., 9,209/10; WESTMINSTER ENGINEERING CO., and WAY [Projector lamps] 9,225/10; SIEMENS SCHUCKERTWERKE-GES. [Searchlights] 14,354/10; BISSON and BERGÈS [Magnetic blow-outs for arc lamps] 28,382/10.

Dynamos, Motors, and Transformers: SIEMENS BROS. DYNAMO WORKS (*Siemens Schuckertwerke-Ges.*) [Stator windings for single-phase induction motors] 18,837/10; MASCHINENFABRIK OERLIKON [Regulation of compensated single-phase commutator motor] 23,122/10.

Electric Ignition: DELAGE and WOOG [Electric ignition of gas burners] 11,362/10 and 13,797/10.

Electrometallurgy and Electrochemistry: FULLER and FULLER [Dry cells] 2,300/10; LANGBEIN-PFANHAUSER-WERKE A.-G. [Manufacture of electrolytic iron bars, sheet and wire] 22,204/10.

Heating and Cooking: GRAY [Distributor or switchboard for cooking appliances] 7,882/10; EVERSHED & VIGNOLES, LTD., SCHNEIDER and CLARK [Electric heaters] 10,595/10.

Switchgear, Fuses, and Fittings: BRITISH THOMSON-HOUSTON CO., HASTINGS and WISE [Motor controllers] 29,785/09; ELECTRIC EXPORT WERKE GES. and GOTTSCHALCK [Portable lamp] 29,789/09; PAUL [Terminals] 4,599/10; WEIL [Theatre illumination] 10,043/10; THORNTON (*Clarke*) [Switches] 11,260/10; VON ZWEIGBERGK [Motor controllers] 11,830/10; WALDER [Wall plug and socket for solid walls] 19,433/10.

Telephony and Telegraphy: KEITH [Telephony] 1,420/10; WILSON and WILSON [Oscillation generator for wireless work] 1,649/10; KITSEE [Cable telegraphy] 2,350/10; BISHOP [Locking nuts for telegraph pole insulators] 6,190/10; GALLETTI [Production of continuous wave-trains] 15,497/10; CEREBOTANI and SILBERMANN [Printing telegraph] 16,253/10; FRANCIS [Central battery signalling system] 16,329/10.

Traction: CHAUMERET [Operating tramway points] 24,102/09; MAHONEY [Braking systems for electric vehicles] 15,836/10.

Miscellaneous: LUTH and ROSENS ELEKTRISKA A.-G. [Electrically worked pendulums, bell-ringing devices, &c.] 1,798/10; HAUNZ [Electric clocks] 2,315/10; ELDRED [Platinum-clad metals] 4,466/10; SCHOOP [Coating surfaces with metal, soldering, &c.] 5,712/10; GUNNILL [Advertising signs] 5,773/10; HERBECK and HOLZ [Advertising and signalling apparatus] 19,282/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: JULIUS PINTSCH A.-G. [Lighting plant for railway trains] 996/11; SOC. ALSACIENNE DE CONSTRUCTIONS MÉCANIQUES [Obtaining rapid variation or maintaining constant the voltage of a generator] 1,252/11.

Electrochemistry, &c.: URBAIN, FEIGE and SCAL [Use of metals in the arc employed for sterilisation of liquids] 4,795/10; W. C. HERAEUS GES. and TRENZEN [Electric furnaces] 1,544/11.

Incandescent Lamps: SCHRÖTER [Manufacture of metal filament lamps] 23,121/10.

Opposition to Grant of Patents

23,014/09. **Arc Lamp.** J. NEU. As the result of opposition, this patent has been surrendered. The specification, abstracted in ELECTRICAL ENGINEERING, November 10th, 1910, describes a lamp of the supported carbon type with a pivoted stop which tips up and cuts the lamp out of circuit when the carbons are fully consumed.

27,590/09. **Gyroscopic Mono-rail Apparatus.** R. SCHERL. This patent has been allowed, in spite of opposition, but the Comptroller requires an amendment of the specification. It covers a device to produce forces to act on the gyroscope proportional to the precessional speed.

Restoration of Lapsed Patents

7,526-7/04. **Petrol-Electric Systems.** H. PIEPER. These two patents, which expired due to the non-payment of renewal fees, have been restored to the Société Anon. L'Auto-Mixte. The specifications abstracted in ELECTRICAL ENGINEERING, October 27th, 1910, cover the single controlling lever connected with the throttle of the carburetter and the ignition control lever, and a solenoid for automatically regulating the petrol supply.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: H. LEITNER and R. N. LUCAS [Train-lighting systems] 23,066/02; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [A.C. traction motors] 22,819/04.

Electrometallurgy, &c.: A. F. HARRIS [Apparatus for electro-plating small articles] 24,884/97; J. T. NIBLETT [Primary cell] 23,114/02.

Instruments, &c.: H. P. DAVIS and F. CONRAD [A.-C. induction motor meters] 10,705/98; E. A. REEVES [Prepayment meter mechanism] 23,572/02; F. T. FLETCHER [Speed indicators for automobiles] 23,093/03.

Storage Batteries: C. T. J. OPPERMANN [Active material] 21,362/01; J. T. NIBLETT [Positive element] 23,114/02.

Switchgear, &c.: M. BAUMER [Electromagnetically operated ratchet gear] 21,897/05.

Telephony, &c.: H. T. CEDERGREN [Central battery telephony] 6,485/02; G. GABET [Wireless control of torpedoes] 17,645/05.

Traction: J. JOHNSON [Brakes] 21,581/01; E. DE PASS (*Soc. Anon. des Freins "Stop"*) [Brakes] 23,018/02; R. H. RADFORD [Automatic points] 22,952/03; J. GRESHAM and G. KIERNAN [Vacuum brakes] 22,962/04.

Miscellaneous: G. B. BOWELL and PEARSON FIRE ALARM, LTD. [Fire-alarm system] 23,265/02 and 23,302/03; J. BARR and R. ANDERSON [Portable wood-jointing machine] 23,357/02.

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LOCAL NOTES

Dover: *Electricity Undertaking.*—An offer by Messrs. Balfour, Beattie & Co., of London, to manage the electricity and tramway undertakings for a term of years has been rejected by the Council. This firm have already reported in what directions they consider the undertakings can be improved, and the Borough Electrical Engineer and Tramways Manager are to be requested to prepare similar reports.

Leicester: *Municipal Wiring.*—A local firm of auctioneers have been instructed to offer for sale the stock of electric fittings and accessories at the Corporation's showrooms. The cost price was £530.

London: *L.C.C. Tramways.*—A meeting of tramway authorities in the Metropolitan Police area is to be held on Friday to discuss steps to be taken for dealing with tramcars that have become disabled whilst running in service.

Bethnal Green: Electric Supply.—A noisy Council meeting took place last week in connection with the proposal to take a supply of electrical energy from the Shoreditch Borough Council. The Electricity Committee presented a report in which it was stated that various objections to the agreement with the Shoreditch Council raised by the London County Council and the Board of Trade had been met. The Shoreditch Council have agreed that any loss to the Bethnal Green Council shall not exceed 5 per cent. for the first three years. It is also proposed that the agreement should be for seven years, but whilst the London County Council regard this as far too short, and considers that 20 or 30 years would be a more economical basis, the Electricity Committee, foreseeing considerable reductions in generating costs in the near future, prefer to have the shorter period in order that they may then secure further competitive prices. There was considerable opposition to the scheme at the meeting, which, according to local newspaper reports, broke up in confusion without any definite decision having been arrived at.

Chelsea: Street Lighting.—A similar dispute to that in Holborn, mentioned on another page, is taking place in Chelsea with regard to street lighting, the Council having resolved to accept an offer of the Gas Light & Coke Co., on a seven years' contract, at a price higher than that tendered by the Chelsea Electricity Supply Co. We shall return to this matter at greater length in our next issue.

Hammersmith: Curtis Turbine.—The Curtis turbine supplied to the Council in 1908 was not quite in accordance with specification, and it was arranged that the contractors should rebuild the alternator portion free of cost and incorporate the latest improvements in order to increase the output of the machine from 1,500 to 2,000 kw., this latter being undertaken at a cost of £550. The reconstruction is now complete, but the machine does not give the additional output. The B. T.-H. Co. have offered to settle the contract by foregoing the extra £550, and the Electricity Committee recommend the adoption of this course.

Maidstone: *Tramways.*—At the last meeting of the Council a resolution that inquiries be made upon what terms the tramway system can be leased for a term of years, was defeated by 11 votes to 3. The matter arose out of a report by the Tramways Manager, showing a further decrease in receipts.

Manchester: *Tramway Employees.*—The Tramways Committee have informed the Tramwaymen's Union that the only terms upon which they will accept arbitration is that the whole case of their working conditions is discussed, including the question of wages.

Newport: *Sales Department.*—The Electricity & Tramways Committee recommend an expenditure of £2,000 upon showrooms and stores for the Electricity Department.

Sheffield: *Street Lighting.*—A proposal to light part of the Attercliffe Road by electricity has been referred back in order that a larger scheme may be considered.

Torquay: *Municipal Showrooms.*—The Electricity Department's new showrooms in Fleet Street were opened last week.

Street Lighting.—A number of 1,000-c.p. metal filament lamps have been installed for street lighting.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Austria-Hungary.—A loan of £10,400 is to be taken up by the municipal authorities at Kralup for an electric generating station, says the *Board of Trade Journal.*

Brighton.—An additional 300-kw. motor-generator set and switchgear is required at Southwick.

Canada.—It is proposed to form a company for the construction of an electric railway from Port Dover to Lake Erie to Simcol, Waterford, Brantford, Paris, and Galt. Addresses to which communications might be sent can be obtained at 73, Basinghall Street, London.

Edinburgh.—Tenders are invited for two water-cooling towers at Dewar Place. (See an advertisement on another page.)

Govan.—The Council require a 500 kw. rotary converter. (See an advertisement on another page.)

Gravesend.—Electrical extensions are contemplated at a cost of £9,000.

London: *Hammersmith.*—A loan of £5,429 is to be taken up for electrical extensions, and an application is to be made for a further loan of £25,253.

Water-tube boilers, superheaters, mechanical stokers, economisers, &c., are required by the Council. (See an advertisement on another page.)

Rathmines.—An inquiry was held last week concerning a loan of £6,000 for electrical extensions.

Roumania.—The *Board of Trade Journal* states that tenders are invited by March 14th for an installation of electric lighting in Tecuci. Address, "Monsieur le Maire, Conseil Municipal," Tecuci.

Uttoxeter.—The Council are considering an electric lighting scheme.

MISCELLANEOUS

Argentine. Thirteen telegraph lines are to be erected in various parts of the Republic, at an estimated cost of £44,000. In connection with the above, cable material to the value of about £17,000 is to be purchased in London, through the Argentine Legation there.

Australia.—The Deputy Postmaster-General, Melbourne, invites tenders by June 14th for the installation at Ballarat of 12 sections of a branching multiple magneto lamp signalling switchboard. The Deputy Postmaster-General, Adelaide, requires tenders by the same date for three sections of a similar board. Copies of specifications, &c., at 72, Victoria Street, or 73, Basinghall Street, London.

Birmingham.—A loan of £32,000 is to be taken up for the completion of Kyott's Lake Road depôt, the reconstruction of a portion of the Bristol Road tramways, and street widenings.

Bournemouth.—A loan of £3,640 is to be taken up for fitting 35 cars with mechanical attachments to the magnetic brakes.

Brighton.—The Tramways Department invite tenders for the overhead and line material, trolley wire, copper bonds, and other materials. Tenders by February 17th.

Dunoon.—There is every prospect of the Council and the promoters of the tramway scheme for this district coming to terms.

Japan.—The British Acting Commercial Attaché at Yokohama reports, says the *Board of Trade Journal,* that a company has been formed for the construction of an electric railway from Hili to Sujiwara, in Kiushiu. The total cost is about £150,000. Particulars of the company in question may be obtained at 73 Basinghall Street, London, E.C.

London: *L.C.C.*—The Highways Committee of the L.C.C. recommend the construction of tramways from Brixton to Herne Hill, at an estimated cost of £28,800.

Marylebone.—Tenders are invited for various electrical stores (see an advertisement on another page).

Nottingham.—A heavy expenditure is contemplated upon track renewals during the next few years.

Portrush.—Three short extensions of the Giant's Causeway electric tramway are to be undertaken.

OSRAM·LAMPS

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TENDERS RECEIVED AND ACCEPTED

Horsham.—A contract for electricity meters for all sizes, except 5 amps. capacity, has been given to the Electrical Apparatus Co., Ltd.

London: *L.C.C.*—Tenders for the provision of new and the alteration of existing switchgear, and the provision of transformers at the Camberwell, Elephant and Castle, Holborn, New Cross, and Wandsworth sub-stations:—Johnson & Phillips, Ltd., £7,056; Electric Construction Co., Ltd., £7,224; British Westinghouse Co., £7,884 18s.; General Electric Co., Ltd., £7,975; Electric Ordnance and Accessories Co., Ltd., £8,491 10s.; Ferranti, Ltd., £8,639 13s.; A. Reyrolle & Co., Ltd., £8,846. The tender of Messrs. Johnson & Phillips is recommended for acceptance.

The tender of Messrs. G. Munday & Sons at £687 has been accepted for the construction of switch galleries at the Camberwell and New Cross sub-stations.

Hammersmith.—The following tenders have been received for a 3,000-kw. turbo-alternator and condenser:—Willans & Robinson, Ltd., £7,938; Richardsons, Westgarth & Co., Ltd., £7,942; Brush Electrical Engineering Co., Ltd., £8,052; J. Musgrave & Co., Ltd., £8,081; British Westinghouse Co., Ltd., £8,400; J. Howden & Co., Ltd., £8,430; Eicher Wyss & Co., £8,528; C. A. Parsons & Co., Ltd., £8,831; Belliss & Morcom, Ltd., £8,885; Maschinenfabrik Oerlikon, £9,068; Fraser & Chalmers, Ltd., £9,420; British Thomson-Houston Co., Ltd., £9,664; General Electric Co., Ltd., £10,801. The tender of Messrs. Richardsons, Westgarth & Co., which is for an impulse and reaction type of turbine and a Siemens alternator, is recommended for acceptance.

The following tenders have been accepted for 8,180 yards of extra-high-tension cable:—A. Grenier & Co., £2,656; Union Cable Co., Ltd., £2,783; Western Electric Co., Ltd., £2,920; Johnson & Phillips, Ltd., £2,977; British Insulated & Helsby Cables, Ltd., £2,979; Siemens Bros. & Co., Ltd., £2,991 10s.; W. T. Glover & Co., Ltd., £2,999 15s.; Craigpark Electric Cable Co., Ltd., £3,025; W. T. Henley's Telegraph Works Co., Ltd., £3,033; Callender's Cable & Construction Co., Ltd., £3,037 14s.; Standard Cable Manufacturing Co., £3,061; R. R. Todd, £3,081; General Electric Co., Ltd., £3,262. The lowest English tender, viz., that of the Western Electric Co., Ltd., is recommended for acceptance.

APPOINTMENTS AND PERSONAL NOTES

In consequence of the retirement of Mr. J. W. Woods, Senior Assistant Engineer-in-Chief to the General Post Office, owing to the age limit, Mr. A. J. Stubbs is now Senior Assistant Engineer-in-Chief. Mr. W. Slingo has been appointed to fill the vacancy created by Mr. Stubbs' promotion. Mr. Slingo joined the service in 1870, and in 1876, at the Central Telegraph Office, he started the Telegraphy School of Science with five pupils. This school, which was carried on after office hours, was limited to members of the Service, and when it was closed in 1898 there were 850 students. Many of the higher officers in the Engineering, Stores, and other Departments were students in the school. Mr. Slingo was then transferred to the Engineering Department as Technical Officer, taking charge of the secondary battery working, and developing a new system which resulted in great economy and increased efficiency. He also had charge of the Continental communications, and established and developed duplex Hughes working between Germany, Holland, Belgium and France. In 1903 he was appointed Superintending Engineer of the North Wales District, and in September, 1910, was transferred to London to take charge of the work in connection with the inventory now being taken of the National Telephone Company's plant. In his new position he will retain the charge of this work and take over generally the telephone side of the General Post Office. Mr. Slingo has lectured largely throughout the country, and has contributed to most of the technical journals. Mr. Slingo is well-known as the joint author of Slingo and Brooker's "Electrical Engineering for Electric Light and Power Artisans and Students."

In consequence of the above change Mr. E. J. Eldridge and Mr. J. M. G. Trezise, First-class Staff Engineers, and Mr. T. Plumber, Mr. F. Tandy, and Mr. J. Sinnott, Assistant Superintending Engineers, have been appointed Superintending Engineers. We understand that Mr. Eldridge will take charge of the Midland District, Mr. Trezise of the Electric Light Department, Mr. Plumber of the North Wales District, Mr. Tandy of the South-Eastern District, and Mr. Sinnott of the North-Eastern District.

The salary of Mr. A. L. C. Fell, the chief officer of the L.C.C. tramways, is to be increased from £1,750 to £1,875 per annum on April 1st, 1912.

At the Bermondsey Borough Council meeting last week, Mr. C. J. Oake, a son of a member of the Council, was nominated for the appointment of Third Engineer-in-Charge at the Electricity Works, at a salary of £110 per annum. Strong objection was taken to the nomination, and the Committee were instructed to submit three candidates for the appointment.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 12s. 6d. to £57 17s. 6d. per ton (last week, £57 10s. to £57 15s.).

Change of Address.—Mr. Thomas W. How has removed from No. 15 to more commodious offices at No. 17 Victoria Street, S.W.

Simplex Conduits, Ltd.—This firm have purchased the fittings and art metal business of Messrs. Jesson, Birkett & Co., Ltd., of St. Dunstan's Works, Birmingham, at 9 Newman Street, W. The services of Mr. T. Birkett will be retained.

Brimsdown Lamps.—The Imperial Lamp Works (Brimsdown), Ltd., are extending their offices at Kingsway House to about double the present floor space by taking over the whole of an additional suite of rooms.

We have received from Chas. H. Blume (Western Road, Mitcham, Surrey, and The White Building, Sheffield) one of their useful opal glass "slates" for telephone numbers, which the firm are sending out to their friends.

Messrs. Ferranti, Ltd., Hollinwood, Lancashire, have sent us a miniature meter, similar in appearance to one of their well-known house meters, in which the days are metered instead of ampere-hours, as the apparatus is really a calendar.

Callender's Cable & Construction Co., Ltd., have prepared a most effective photogravure plate representing the Thames-built battleship *Thunderer* as she will be when completed for sea. The main electrical distribution on board this ship will be effected by means of Callender's cable and special boxes.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Mather & Platt.—Including £19,879 brought forward, the available balance for 1910, after providing for depreciation, was £129,600. A 10 per cent. dividend, and a bonus of 2 per cent., are recommended on the ordinary shares, carrying forward £37,600.

Bruce Peebles & Co.—After meeting mortgage interest, a loss of £7,275 is shown in the accounts for 1910. All contracts left unfinished by the old company have now been completed satisfactorily.

Metropolitan District Railway Co.—Presiding at the half-yearly meeting last week, Lord George Hamilton said there had been an increase in the number of passengers carried of 7·82 per cent., which constituted a record for the company. It is hoped to increase the number of trains to forty per hour in the near future. Reference was made to the Bill which the Company has in Parliament. (See ELECTRICAL ENGINEERING, Jan. 5th, p. 4.)

London Electric Railway Co.—Lord George Hamilton presided at the half-yearly meeting of this company last week. The revenue from the three companies now represented by the London Electric Railway Company shows an increase of £3,997. The extension of the Bakerloo line from Edgware Road to Paddington is to be undertaken, satisfactory arrangements having been made with the Great Western Railway Company.

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SUMMARY

Marconi's Wireless Telegraph Co. have been successful in their action against the British Radio-Telegraph & Telephone Co., in respect of the first of the three patents which are alleged to be infringed. Mr. Justice Parker holds that this patent, covering the use of two circuits in both transmitter and receiver, tuned and linked together by a transformer, is valid and not anticipated by any previous work. He further holds that the defendants' apparatus infringes every essential feature of the patent, and that the substitution of an auto-transformer for a two-coil transformer is of no import, as the latter is not an essential feature of the Marconi patent. (Page 89.)

The Manchester Electricity Committee have replied to the criticisms of the Gas Committee with regard to their policy. They deal at length with the suggested unfair cutting of prices and the inadequacy of the annual contribution from the Electrical Department to the relief of rates. It is also suggested that the Electricity Department should now have a share in the street lighting of Manchester, which has hitherto been the monopoly of the Gas Committee. (Page 89.)

The Chelsea Council have accepted a tender of the Gas Light and Coke Company for street lighting at a price above that offered by the Chelsea Electricity Supply Company. Until the latter entered a protest, they were not allowed to tender at all. (Page 90.)

Mr. L. F. Mountfort read a Paper last week before the Birmingham section of the Institution of Electrical Engineers, on the electrical undertaking of the Birmingham, Tame and Rea District Drainage Board. Centrifugal pumps driven by squirrel-cage induction motors are largely employed, and part of the power is obtained over an overhead transmission line from a destructor station. (Page 90.)

Some new alternating current motor starters are described and illustrated. (Page 92.)

An illustration is given of a lighting fitting for suspension from tramway span wires. (Page 92.)

Particulars are given of an aluminium 3-core cable. (Page 92.)

The Midland Railway Co. have constructed a new electric power station for the supply of current for driving the locomotive, signal, and carriage works, and the lighting of the offices, &c., at Derby. The main generating sets are driven by Willans "disc and drum" turbines, each for an output of 1,250 kw., running at 3,000 r.p.m. Special arrangements are made for obtaining circulating water from the river. (Page 93.)

Our report of the adjourned discussion on high-tension transmission before the Institution of Electrical Engineers appears this week. The discussion is to be further continued to-night. (Page 96.)

In a Paper read before the Manchester Section of the Institution of Electrical Engineers, Messrs. A. P. Fleming and R. Johnson discussed the breakdown of the insulation of high-pressure windings due to chemical action. Ozone and nitric acid formed by brush discharge in cavities destroys most insulating materials, mica excepted. Various methods of obviating the trouble were suggested. (Page 97.)

A letter from Mr. G. Wilkinson, of Harrogate, goes into the causes of the economies obtainable by the use of live steam feed water heaters. (Page 98.)

Mr. A. R. Bennett contributes some observations, in our correspondence page, on the early history of loading telephone lines. (Page 98.)

Demonstrations of electric and gas lighting for railway stations are being made in Birmingham. (Page 98.)

Some notes on the progress of electrical iron and steel furnace work in Scandinavia are given under "Electrometallurgy and Electrochemistry." (Page 99.)

Among the specifications published by the Patent Office on Thursday was one by the British Thomson-Houston Co., for a traction controller, with separate drums for each motor, loosely arranged on a common spindle, so that any one motor can be cut out by fixing

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the corresponding drum relative to the spindle. G. F. Fuller describes a dry cell, which is sealed up air-tight to prevent evaporation until required for use. (Page 100.)

SOME notes are given in a short article on some Continental and American submarines. (Page 101.)

AN arbitration is taking place in London to determine the price to be paid by the Belfast Corporation for the Cavehill and Whitewell tramways.—The Bethnal Green Council have decided not to take a supply of electricity in bulk from the Shoreditch Council.—An effort is to be made by the Islington Lighting Committee to push shop lighting more vigorously.—At the last meeting of the Marylebone Council, it was stated that nothing has come of the proposal to supply electricity for electrical vehicles at ½d. per unit.—The Board of Trade is to be asked to revoke the powers of the Scarborough Tramways Co. (Page 102.)

A 300 kw. three-phase induction motor is required at Brighton; switchboard extension at Edinburgh; four electrically-driven centrifugal pumps at Calcutta; and cooling tower at Halifax. Electrical stores are required by the Hornsey, Ilford, Bristol, and Acton Councils, and the Great Central Railway Co. Loans are proposed as follows:—Dover (£2,000); Ealing (£20,000); Kettering (£13,100); and Stepney (£3,060). (Page 102.)

THE City of London Electric Lighting Co. recommend a dividend of 7 per cent.; National Telephone Co., 6 per cent. on the deferred shares; London Electric Supply Corporation, 2 per cent.; and the Charing Cross, West End, and City Electricity Supply Co., 5 per cent. The London, Brighton & South Coast Railway Co. have entered into a new contract with the London Electric Supply Corporation for a further 13,000,000 units per annum. (Page 103.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, FEBRUARY 23RD.

South Wales Institute of Engineers.

7 p.m. At Park Place, Cardiff. "Breaking High and Low Potential Circuits," by A. G. Collis.

Institution of Electrical Engineers.

8 p.m. Adjourned Discussion on Long-Distance Power Transmission.

SATURDAY, FEBRUARY 25TH.

Association of Mining Engineers.

2.30 p.m. *Newcastle Branch.* At Milburn House. (1) "Electricity in New South Wales Collieries," by E. K. Scott; (2) "Oils for Transformers and Switches," by G. W. Humphrey; (3) "Considerations Specially Relative to Small Colliery Installations," by T. Thompson.

3.30 p.m. *Notts and Derbyshire Branch.* At University College, Nottingham. (1) "Oil for Transformers and Switches," by G. W. Humphrey; (2) "The Use of a Milli-Ampere Testing Set," by E. E. Beadsmore.

5.30 p.m. *Warwickshire and S. Staffs Branch.* At Imperial Hotel, Birmingham. "Considerations Specially Relative to Small Colliery Installations," by T. Thompson.

TUESDAY, FEBRUARY 28TH.

National Electrical Manufacturers' Association.

2.30 p.m. Annual General Meeting at Institution of Electrical Engineers.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At University. "Heating Effects in Cables," by C. J. Beaver.

SATURDAY, MARCH 4TH.

Junior Institution of Engineers.

3 p.m. Visit to the L.C.C. generating station, Greenwich.

Annual Dinner of Newcastle Section I.E.E.—The annual dinner of the Newcastle Section of the I.E.E. was held on Thursday. Among those present were Mr. S. Z. de Ferranti, Mr. J. F. C. Snell, Mr. C. H. Merz, Mr. R. B. Morison, and Mr. H. W. Clothier. Mr. Ferranti, in reply to the toast of the Institution of Electrical Engineers, said we were coming to the time when the country was becoming more and more electrical; but notwithstanding all that had been done, it was hard to realise what a very small amount of electrical work had been done in relation to the immense requirements of the future.



[The Gas Department of the Manchester Corporation are complaining that the Electricity Department, who do not contribute to the same extent towards relief of rates, are therefore able to quote low prices for power and are taking away their power consumers. The Electricity Department reply that they have to supply the tramways at cost price and have to make heavier allotments to sinking fund, so that they are equally burdened, and suggest that the Gas Department should no longer have a monopoly of street lighting.]

Reader of "Electrical Engineering":—I wish you boys would not quarrel; there is plenty of sand for both of you, and it doesn't matter where you dig it.

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THE WIRELESS TELEGRAPH PATENT CASE

Marconi Patent declared Valid and Injunction Granted

MR. G. MARCONI and Marconi's Wireless Telegraph Co., Ltd., have been successful in their action against the British Radio-Telegraph & Telephone Co., Ltd., in respect of the first and most important of the three patents in question, namely, No. 7,777 of 1900. Mr. Justice Parker gave judgment with regard to this patent on Tuesday, declaring the patent valid, and holding that the defendants' apparatus contained everything of real value in the Marconi patent, and therefore infringed it. Judgment was therefore given for the Marconi Co., subject to appeal, with costs, an injunction against further infringement, and damages. Concise reports of the proceedings at the trial were given in ELECTRICAL ENGINEERING of Dec. 15th and 22nd, 1910, and Jan. 19th last. The actions in respect of the other two patents are to stand over for the present.

Mr. Justice Parker's judgment, the reading of which took over an hour and a half, commenced with a clear summary of the history of wireless telegraphy previous to the date of the patent in question. His lordship stated that though the importance of tuning to obtain selectivity had been well recognised, and Lodge had clearly explained the difficulties met with, no one had succeeded in making a transmitter both a persistent oscillator and a good radiator until Marconi used a closed oscillating circuit inductively coupled to an open aerial circuit by means of a transformer, the two circuits being tuned to one another as described in the 1900 patent. He thought that the effect of the arrangement was perfectly clear, although the object of tuning the circuits was nowhere expressly stated in the specification. It was evident that Marconi desired to make the primary circuit a reservoir of energy and to build up the oscillations in the radiating circuit on the principle of resonance. A transformer had previously been used to step up the pressure in the receiving circuit, and so in this patent Marconi only claimed, in respect of the receiver, the tuning of the two circuits to one another and to the transmitter. The possibility of an accumulative effect depended upon there being loose coupling, as if the circuits were too closely interlinked inductively, the reaction of one upon the other prevented their oscillations being free and independent. He was satisfied that the couplings of the transformers described in the specification were sufficiently loose. The direction to tune contained in the specification premised a direction to couple loosely. He interpreted the patent to cover the substitution of two circuits for one in the case of both transmitter and receiver, the circuits being tuned and linked by a transformer. The utility of the patent was undoubted; it had immediately doubled the distance of communication and had made selectivity practicable under certain conditions.

With regard to the alleged anticipation by Braun, his lordship held that Braun had no intention of tuning at all. The letterpress of the patent contained not the slightest suggestion of the problem dealt with by Marconi, and it appeared that Braun expected the frequency of the oscillations of his primary circuit to be forced upon the secondary circuit, as would result with a very tight coupling. In applying Braun's patent, one would not necessarily arrive at Marconi's arrangement. As to the alleged want of subject-matter, there was no novelty in the use of two circuits in the receiver, but it was new and not obvious to utilise the principle of resonance between these circuits. The adjustment of Tesla coils to get the maximum effect was a different problem altogether; there the tuning was to cure the necessary evil of loose coupling and not to get an accumulative effect. His lordship also dealt in some detail with the earlier patents of Lodge, Thompson, and Tesla, which had been put forward by the defendants as anticipating Marconi, but concluded that none of them gave any indication of the solution of the problem as given by Marconi. He therefore held that the Marconi patent was valid.

Turning to the question of infringement, his lordship held that the defendants' apparatus contained all the essential features of Marconi's patent. It was contended that the coupling used by them between the oscillating and radiating circuits was not a two-circuit transformer, but a one-to-one auto-transformer or an inductive shunt, and that all mutual induction could be eliminated. Further, it was claimed that this one-to-one coreless auto-transformer was new since the date of the patent, and was therefore not an equivalent as regards infringement. His lordship concluded, however, that the name transformer had reference to the effect produced, namely, conversion from electric to magnetic energy and back to electric energy, and though originally applied to a two-coil device, was now rightly applied also to a single winding device, which gave the same effect whether there was a change in pressure or not. The suggestion that there was no conversion and reconversion in the one-to-one auto-transformer in the defendants' apparatus could not be sustained. The experts had agreed that if the working of the device were considered at different instants in the cycle of operations, there were times when the energy in the secondary was the result of induction. In 1900, the substitution of an auto-transformer for a two-coil transformer would not have been subject-matter for a patent. He did not think that the use of a two-coil transformer was an essential feature of the patent, the merit of which was in the idea and not in the means of carrying it out. It did not matter whether one or two coils were used for the inductive link. When a patent was for a combination of parts or a process, and that combination or process produced new and useful results, everyone who produced the same results by using the essential parts of the combination or process was an infringer, even although he had omitted some unessential part or step and substituted another which was equivalent to that omitted. The defendants' apparatus was essentially the same, and therefore infringed.

Mr. J. Hunter Gray asked for costs on the higher scale and for three counsel, but Mr. Justice Parker allowed the latter only. A certificate of validity of the patent was granted, and an order made granting an injunction against the defendants and an inquiry to determine damages. If an appeal is lodged within fourteen days, the injunction will be suspended as relating to infringing apparatus already supplied until judgment has been given in the Appeal Court.

THE MANCHESTER GAS AND ELECTRICITY DEPARTMENTS

ON page 75 of our issue for February 9th we discussed the dispute which has arisen between the Manchester Gas and Electricity Departments. The matter has arisen out of criticisms of the policy of the Electricity Committee. Briefly, these criticisms are: (1) it is alleged that for certain purposes electricity is being sold below cost; (2) that insufficient provision has been and is being made for depreciation; and (3) that the amount paid in relief of rates by the Electricity Department compared with the amount paid by the Gas Department is altogether insufficient.

A very lengthy reply to these criticisms has now been prepared by the Electricity Committee; it outlines the whole history of the Manchester Electricity Department. Incidentally, it is interesting to note that Alderman Gibson, Chairman of the Gas Committee, and the chief critic of the policy of the present Electricity Committee, was Chairman of the Electricity Committee in the early days.

The charge that electricity is being sold below cost applies particularly to power supplies and the supply to tramways, and the Gas Committee have not been able to avoid the common fallacy of assuming that the average costs must represent the cost of each individual supply. The "reply" points out that the costs depend on load factor and that the supply to some consumers necessarily costs less than the average, and to others greater than the average.

As regards depreciation, it is mentioned that the Corporation are under no obligation, legal or prudential, to do more than repay capital within the "lives" of the assets concerned. Legally the obligation ends when the statutory sinking fund has been provided, but voluntarily the Committee have thought fit to supplement this sinking fund by building up a substantial renewals fund. Owing to the delay in starting this latter fund it has been necessary to appropriate all surplus revenue during the past few years. It is pointed out that all the assets acquired up to 1900 have been replaced, and the Department stands as if it were established on that date.

Next comes the question of "unfair" competition, the Gas Committee having put forward a special list of 34 firms who, it was alleged, had previously been customers of the Gas Department, with a turnover of £10,000 per annum, representing a profit of £1,000. The Electricity Committee state that in the majority of cases the Gas Department had already lost the consumers through the installation of private steam generating plants, and through competition by the Electricity Committee, not "by unfair means at cut-throat prices." The words in inverted commas are those employed by Ald. Gibson. No less than thirteen of the firms mentioned have been consumers on the books of the Electricity Department for eleven years, and several do not take any power from the Corporation at all, but have their own generating plants. In another and earlier list of power consumers, although it represents many thousands of horse power obtained by the Electricity Department, less than 100 h.p. were formerly driven by gas. Objection is taken to the claim by the gas interests that details of every contract should be made public, an objection which, it is said, has been supported by the Local Government Board at a Manchester inquiry.

A point against the Gas Committee is that hitherto they

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have had a monopoly of street lighting, and the suggestion is made that the Electricity Committee should now receive fair consideration in this matter and share in this remunerative business. It is the opinion of the Committee that it is futile to hope that there should be no competition between the two Committees, as this would be a reflection on municipal direction of trading interests. As to the suggestion that a larger sum should be paid to relief of rates, apparently by increasing prices, it is pointed out that the charges for power supply have been passed by the Council, and that the Gas Committee repeatedly overlook the fact that nearly £1,000,000 have been invested in machinery for supplying the tramways, from which no profit is obtained. Further, the general supply to the outdistricts of the Greater Manchester area will for some time to come involve a serious loss, put roughly at £22,000 per annum at present.

STREET LIGHTING IN CHELSEA

Grievances of the Supply Company

THE London Electric Supply Companies certainly have cause for complaint at their treatment by some of the London Borough Councils in the matter of street lighting. Following the curious action of the Works Committee of the Holborn Borough Council, which was discussed in our last issue, comes an instance at Chelsea where the Lighting Committee were prepared to accept an offer from the Gas Light & Coke Co. without even asking for a tender from the Chelsea Electricity Supply Co., and did eventually accept the gas tender, although it was higher than that for electricity.

As we pointed out last week in connection with our article on the Holborn lighting, all the streets in Chelsea are lighted by gas, the contracts for which have about two years to run. Apparently, in order to avoid meeting the competition of electric lighting, which obviously is becoming embarrassing, the Gas Light & Coke Co. offered to forego the period still to expire of the existing contract if the Council would award them a fresh contract for seven years. Quite accidentally the Chelsea Electricity Supply Co. heard that the Lighting Committee had recommended the Council to accept the offer, and an immediate protest brought the message that if the Electricity Company desired to submit a scheme they must do so in six days. No specification was offered, and obviously it was impossible to ascertain the requirements of the Council and to prepare a tender in so short a time. Another protest was therefore made, and the Borough Surveyor informed the company on December 2nd that if they desired to do so, they could submit a scheme for the lighting of the whole of the borough within twelve days. The company immediately set to work, and collected particulars of the present number and situations of the gas lamps, and prepared the details of a complete scheme. The scheme prepared was very similar to that in Marylebone, viz., metal filament lamps in the gas standards; as no specification could be obtained of the illumination or candle-power desired, the company selected lamps of stated wattages, which they thought suitable for adequate lighting of the streets. The price quoted by the Chelsea Electricity Supply Co. was £5,762, whilst that of the Gas Light & Coke Co. was £5,865. It will thus be seen that on a seven years' contract there would have been a considerable saving to the ratepayers by accepting the electric lighting tender.

As a matter of fact, the tenders were only considered by the Lighting Committee about half an hour before the Council meeting on December 21st, so that there could have been no proper deliberation on the matter, and the committee's recommendation that the Gas Company's tender should be accepted was immediately adopted by the Council without discussion. Further, a request by the Chelsea Electricity Supply Co. that one or two streets or portions of streets might be reserved for experimental electric lighting, in order that the Council might obtain some experience and make comparisons with gas-lighted streets, was ignored.

Railway Electrification.—It has been authoritatively announced that the London & North Western and the Great Central Railway Cos. have under consideration the conversion to electric traction of nearly 200 miles of track in the Manchester district.

Central Technical College, Old Students' Association.—The thirteenth annual dinner of this Association was held at the Trocadero Restaurant last Saturday. Mr. W. J. Pope, F.R.S., the President, was in the chair, and the evening was a most successful one. An innovation was introduced in having several small tables instead of one large one, so that students who were at College more or less at the same time were seated together. The speeches were few in number, and an excellent musical programme was provided. Mr. W. Duddell, F.R.S., was elected President for the ensuing year. Old students of the Central who have not yet joined the Association should lose no time in sending in their names to Dr. E. Frankland Armstrong (98 London Road, Reading), the energetic honorary secretary.

ELECTRIC POWER IN THE BIRMINGHAM DRAINAGE SYSTEM

A PAPER by Mr. L. F. Mountfort, entitled "The Electrical Undertaking of the Birmingham Tame and Rea District Drainage Board," was read before the Birmingham Local Section of the Institution of Electrical Engineers on Wednesday, February 8th. An electrical power distribution system was introduced by the Board in 1905 to replace a group of independent outlying steam pumping plants. Power is derived principally from a destructor station in the Nechells district, and distributed at 2,250 volts three-phase. An additional coal-fired boiler is provided, and two 115-kw. generators are installed. The line is of copper on creosoted wooden poles, except at road crossings, where underground cable is used, and is about 5½ miles long. As a rule, each sub-station contains a transformer in a room adjoining the motor and pumps, and in two cases the low-tension transmission is carried a short distance outside the sub-station for miscellaneous power purposes. The motors connected now aggregate 360 b.h.p., the maximum demand is 150 kw., the load factor 40 per cent., and the diversity factor 2·40 per cent. A standby supply from the Aston Corporation mains is also available, and is sometimes employed on peak loads. The drop in the line is rather large at heavy loads, even reaching 12 per cent., but this does not occur during hours when lighting is required. The cost per unit for power averages 0·875d.

Some notes were given in the Paper on the various processes in sewage disposal to which electric power may be applied, from which it was seen that the incidental power required for various purposes, apart from pumping, may in large works amount to 100 b.h.p., with a fairly good load factor.

The author then passed on to describe in some detail the electrically-driven pumping plant for sewage and storm water at Nechells. When complete this will represent some 1,000 h.p. for lifting the sewage and distributing it over a large area of bacterial filters. The rate of flow varies enormously, but the plant is designed for a maximum of 70,000 gallons per minute. Very heavy peaks are produced by storm conditions, and the annual load factor is as low as 3·5 per cent. Centrifugal pumps are used exclusively. Power is supplied from the Corporation mains at 6,000 volts three-phase through a paper-insulated lead-covered armoured cable, which crosses under the River Tame 3 ft. below its bed. This is connected at a steel terminal pole to an overhead line, 750 yards in length, protected by horn lightning arrestors, and provided with an earth wire. This line runs alongside the 2,250-volt line from the destructor station, and the way they enter the station is seen in the figure which shows the general arrangement of the plant.

The author describes some trouble experienced with the horn arrester, which, when first put in, used to flash over from no apparent reason. They have worked better since 500 ohm graphite resistances were placed in series, and the gaps were shielded by an expanded metal screen from snow.

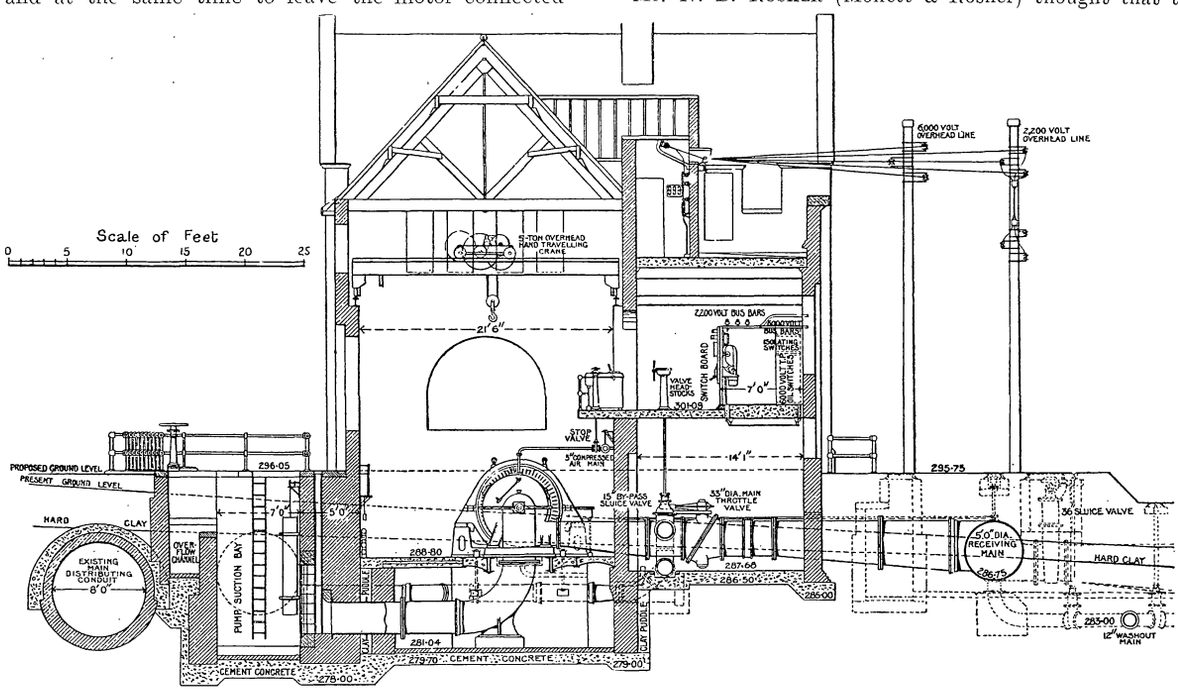
Of the pumping sets, two are designed for 4,700 gallons per minute, and the three large sets, of which two only are in place, have a capacity of 20,200 gallons per minute. A special pattern of centrifugal pump is used, in which a very flat pressure curve is obtained over the best range of efficiency by making the vanes of the pump disc radial at the outlet edge instead of with a large backward curvature. Thus a variation in pressure of only 15 per cent. is obtained between full and half load. These pumps were made by Messrs. W. H. Allen & Co., of Bedford.

Each pump is direct-coupled to a three-phase squirrel cage, 50-cycle induction motor, with a rating about 33 per cent. above the power required on normal load, to provide for the increased power required in this type of pump with a drop-in head. The smaller motors are designed for 55 b.h.p. at 360 revs. at 2,000 volts, and the larger ones for 225 b.h.p. at 194 r.p.m. on the 6,000-volt circuit. Divided end rings were first tried to improve the starting torque, but afterwards abandoned owing to the current fluctuations caused. The motors are started up by half-voltage tappings from autotransformers. In the case of the motor last installed, a special starter has been employed. This consists of a drum-type switch mounted in a separate tank, and two autotransformers and two choke coils, also in separate oil tanks. The choke coils are inserted between the "starting" and "running" position, so that there is no break in the circuit during the change-over, and are cut out before the running position is fully reached, the whole operation being performed by a single movement of the switch handle.

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The 2,000-volt bus-bars are in two sections, one set being supplied from the 6,000-volt mains through step-down transformers, and the other set from the Drainage Board power station. When destructor steam is not available the supply is taken from the 6,000-volt feeder, which is also used to help the existing station during times of heavy load, or when steam is low, and no difficulty has been experienced in running the two supplies in parallel. If necessary, one small pumping set can be operated from each supply, without the necessity of running in parallel. The transforming plant consists of three single-phase 100-k.v.a. oil-cooled transformers, with a ratio of 6,000 to 2,200 volts, and one 30-k.v.a. three-phase transformer with a ratio of 2,200 volts to 200 volts.

The 30 twelve-inch sluice valves about the filter beds are all electrically worked from the pumping station, and for this purpose an overhead pole-line has been erected alongside the valves for supplying current to the small driving motors. Each sluice valve has a small ½-h.p. three-phase enclosed motor mounted on a bracket, and operating through spurwheel and worm-gearing, and the time taken to open or shut the valve is about two minutes. Two triple-pole double-throw switches are provided in each motor circuit, one mounted on the station switchboard and the other fixed on the sluice valve, acting as a limit switch to break the circuit when the valve has reached the top or bottom of its travel, and at the same time to leave the motor connected up in the opposite direction when the switch at the station is thrown over. These switches are operated by a travelling nut actuated by the gearing on the valve, and some difficulty was experienced at first in obtaining a suitable switch owing to the two motors being worked in parallel, it being impossible to ensure that both motors should cut out at precisely the same moment.



CROSS SECTION AT NECHELLS PUMPING STATION.

Some figures of costs are given, which work out to a cost per W.H.P. hour of 5·15d., and the paper concludes with some curves of the torque of the motors under starting conditions. It may be mentioned that the main contractors for the generating station were the British Thomson-Houston Co., Ltd., Rugby. For the sewage pumping station, the contractors for the whole of the electrical equipment, with the exception of the 225-h.p. motors, were Messrs. Johnson & Phillips, Ltd. The 225-h.p. motors were supplied by Messrs. Crompton & Co., Ltd.

At the close of the Paper the author described an extraordinary effect on the barbed aerial earth wire; a short circuit occurred on the L.T. windings of a transformer, and the effect of this was made manifest in the aerial earth wire by a number of the barbs, over a length of approximately two feet, being bodily displaced and bunched together. To have allowed of the movement of the barbs the strands of the aerial must presumably have become untwisted, but when discovered the strands appeared as usual.

The discussion was opened by Mr. J. D. WATSON, engineer to the Drainage Board, who gave particulars of the inception of the scheme. Mr. W. J. LARKE (British Thomson-Houston Co.) made some criticisms on the estimates of comparative cost of gas plant *versus* electricity, and remarked on the increasing use of squirrel cage motors instead of the slip ring type. Mr. W. F. MILNES (Birmingham Corporation) also disagreed to some extent with these estimates.

Mr. A. H. MORTON (D. & A. H. Morton) agreed that the whole of the destructor plant should be under one management, in order to get the best results. He considered that in many cases reciprocating engines and pumps were more suitable for pumping sewage than the system described.

Mr. S. P. SMITH (General Electric Co.) disputed the author's statement that a reduction in the speed of the squirrel cage motors necessarily reduced the efficiency. He held that it was quite unnecessary to instal motors of 33 per cent. greater capacity than the pumps, as the motors can be easily designed so that their overload capacity can readily deal with any unusual demand made on the pump.

Mr. A. L. RAWLINGS (Johnson and Phillips), referring to the electrically operated sluice valves, described how he had overcome difficulties in connection with the electrical operation of a large number of railway points with which he had to deal, and which was a very similar problem.

Mr. A. LINDSAY FORSTER (Chance Bros.) stated that his unbiassed opinion was that electricity had the advantage. He considered that there were dangers incidental to the use of an aerial earth wire. He wished to know why the sluice valve motors were worked in parallel.

Mr. N. B. ROSHER (Moffett & Rosher) thought that the cost of 0·875d. per unit for the destruction plant was decidedly high in view of the fact that steam was provided free; it was about the same as paid for that part of the supply that was bought.

Dr. G. KAPP (Birmingham University) described a drainage installation with which he was connected 15 years ago, and where he installed seven squirrel cage motors having 6 per cent. slip and coupled to water wheels. On receipt of a signal in the power house that water was rising in any one district, the motor in that district would be started by simply dropping the voltage of the generators which fed the motors on that side of the power house and then switching in the required motor. He did not believe in guard wires beneath overhead lines, but preferred an electrically operated relay at the generating station, which would operate when the electrical centre of gravity of the system had been disturbed by a broken live wire coming in contact with the earth. With regard to the statement that the horn type lightning arrester is unsuitable for use at 6,000 volts, owing to the smallness of the gap allowing particles to lodge, a gap of one inch might be used at this pressure if a very thin pointed wire were fixed to one horn and terminated at the correct sparking distance for 6,000 volts from the other horn. On a high pressure surge occurring it will first of all discharge across the fine wire gap, and the small arc set up would enable, so to speak, the main body of the surge to discharge across the wide gap, due to the decreased dielectric strength of the wide gap caused by the discharge across the narrow gap.

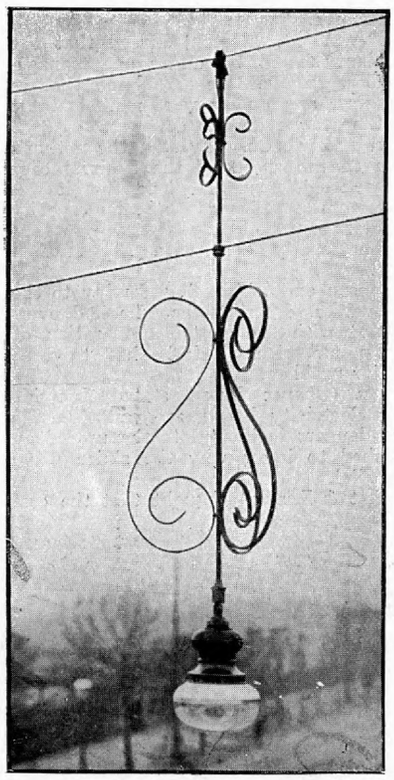
Mr. MOUNTFORT, in his reply, defended his figures of costs, and said that the sluice valve motors were worked in parallel in order to reduce the numbers of conductors.

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STREET-LIGHTING FITTING

THE accompanying figure illustrates a street lighting fitting introduced by the Wardle Engineering Co., Ltd. (196 Deansgate, Manchester), for suspension from the span-wires between tramway poles. A convenient and effective arrangement is to hang one such fitting on either side of the road midway between the trolley wires and the poles. The lantern is of the well-known "Streetlite" pattern, with a spun-metal case and an aluminium reflector, and can be provided with one or more high candle-power metal filament lamps. The lamps may be wired in series and supplied from the trolley line, or may be connected with the lighting mains if preferred. At Barrow these fittings have been suspended from the ordinary span wires and an additional span wire above, which may support a guard wire. It is found that an effective illumination with a minimum of shadows is produced, and that the fittings are inexpensive to install and not unsightly.



WARDLE SUSPENSION FITTING.

WESTINGHOUSE STARTERS

THE British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester), have drawn our attention to a line of starters which possess some interesting features. Fig. 1 illustrates a double automatic open-type starter for slip-ring motors, which has been designed to control both the rotor and stator circuits, thus obviating the use of separate main switches. It is provided with automatic overload and no-voltage release, and fully protects the motor against overload and failure of supply on one or all phases. All release coils are in the stator circuit, and do not prevent the use of brush-lifting and short-circuiting gear. Renewable contacts are provided in all sizes. These starters can be used with three-phase motors having two-phase three-wire or three-phase rotor windings; two-phase three-wire motors with rotor windings, as above; or with two-phase four-wire motors with rotors as above. In the latter case, however, it is necessary to take one line of one-phase direct to the motor. The resistances are either of the cast grid or the Westinghouse patent unit type, and are designed to start motors against their full-load torque up to 50 h.p.

For use in fiery mines, textile mills, chemical works, damp situations, &c., the British Westinghouse Co. recommend the use of their oil-immersed starters, as illustrated in Fig. 2. We are informed that the total immersion of all contacts in oil provides perfect protection against the ignition of inflammable gases and explosive dust-laden atmospheres. The mechanism and arrangement of these starters are similar to the above described open pattern, or can be supplied to control the rotor circuit only. Attention is also drawn to an ammeter attachment, which can if required be fitted to all these starters. This provides a ready means of checking the power being used, and indicates at once if the machine is running inefficiently or is being overloaded. Further, it shows the attendant the normal full load, and also, if required, the maximum starting current. He then knows at once when starting up if the machine is not in working order or if he is starting too quickly. The normal full-load current of the machine is indicated in red on the scale.

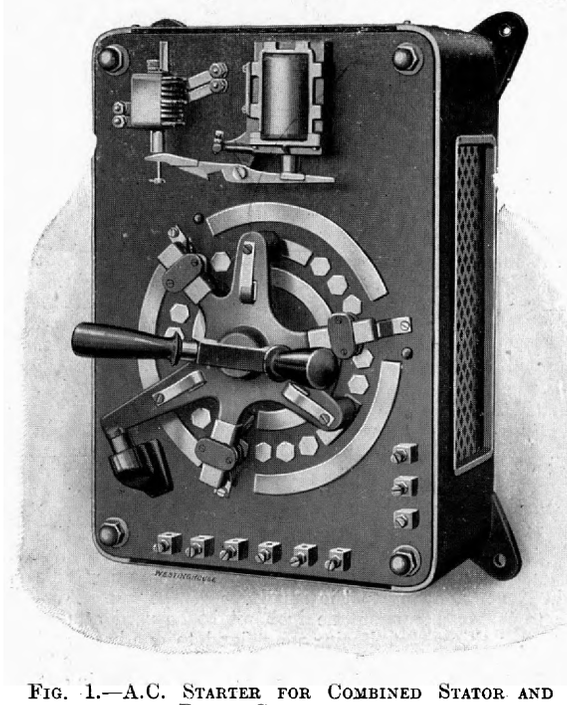


FIG. 1.—A.C. STARTER FOR COMBINED STATOR AND ROTOR CONTROL.

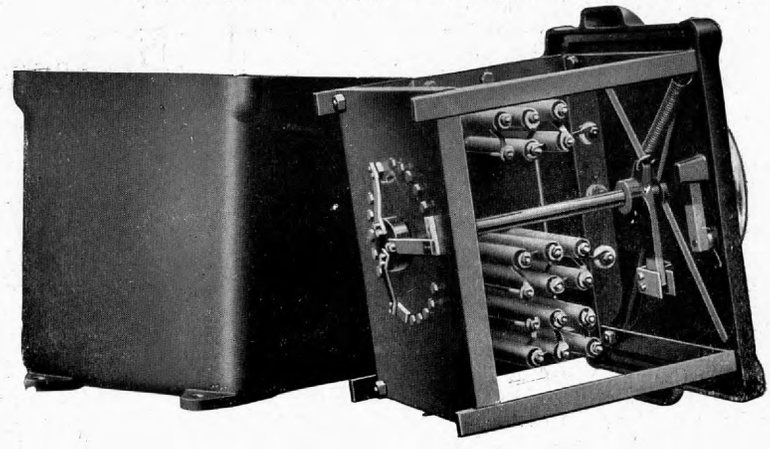
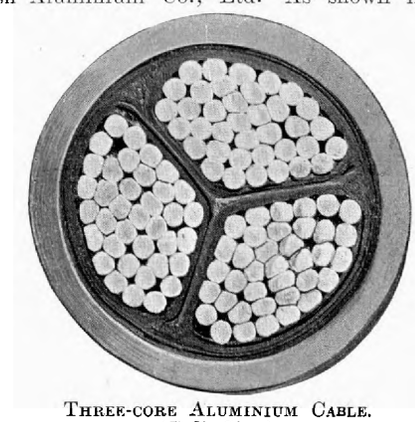


FIG. 2.—OIL-IMMERSED STARTER FOR MINES, &C.

ALUMINIUM 3-CORE CABLE

THE accompanying illustration is from a photograph of a section of a three-core aluminium cable supplied by the British Insulated & Helsby Cables, Ltd., to the order of the British Aluminium Co., Ltd. As shown in the illustration, the cable is paper-insulated, lead-sheathed, served with a covering of jute, and each core consists of 37 wires, 0·118 in. in diameter. The sectional area of conductor is therefore 0·4 sq. in. which is equivalent in conductance to 0·24 copper. It supplies three-phase current at 550 volts across phases to an electrically-driven pump in the works, and is 100 yards in length. We understand from the British Aluminium Co. that the cable was purchased some five weeks ago, when the prices of copper and aluminium were £59 and £72 per ton respectively (corresponding to about 7·6d. and 10d. per lb. of wire), and that the respective prices were £1,090 per mile for the copper cable and £880 per mile for the aluminium cable.



THREE-CORE ALUMINIUM CABLE.
(*Full Size.*)

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NEW POWER STATION AT THE MIDLAND RAILWAY WORKS, DERBY

FOR some time the small electric power station, which the Midland Railway Co. established at Derby in 1896, has been inadequate for the electrical requirements of the company's large works and offices, and as, on account of lack of both condensing facilities and space, further extensions were impossible, the decision was arrived at last year to put down an entirely new up-to-date steam-driven power station, which would enable the economies of electric driving to be taken advantage of throughout the works. The old station was intended originally for lighting, but later a considerable power load was added. The construction of the new station has been pushed forward with great rapidity. The final decision to proceed was only arrived at in March, 1910, and the work of drawing up specifications was commenced. The first sod was turned on the site on June 26th, and by October 21st last some of the plant was running on load. The old station has now been dismantled.

The site of the power house, separated from the main locomotive works by a canal, and within 200 yards of the river Derwent, is excellent as regards coal and condensing water supply, as well as possibility of extension; its position also has the advantage of being near the centre of gravity of the load. The plant capacity is at present just about 3,000 kw., and power is supplied to the adjoining locomotive and signal works, stores, &c., and is also transmitted at a higher voltage to the carriage and wagon works a short distance away. When the portion of the scheme for converting to electric drive in the works already in hand is complete, the locomotive and signal shops, &c., will require some 1,100 kw., and the carriage works a further 700 kw. The lighting of the general and other offices, &c., accounts for about 200 kw., and doubtless, in course of time, the present gas lighting in the railway station and other parts of the premises will also be supplanted by electric light.

As shown in Fig. 1, the canal between the locomotive works and the power house is spanned by a bridge, which forms a coal- and ash-conveyer, as well as the run for the outgoing feeder cables and the feed water supply pipes. Coal is raised by a bucket elevator from the 20-ton hopper into which it is emptied from the wagons, and taken by a belt-conveyer inside the bridge across the canal, and in a straight line over the coal-bunkers, into which it is distributed by suitable deflecting plates. Separate motors drive the elevator and conveyer, and the whole arrangement is simple and straightforward. The bridge was constructed by the Railway Co., and the conveying plant was manufactured by Messrs. Leech, Goodall & Co. As only fine coal is used, a flat belt can be employed; this is of waterproof canvas, 185 ft. long by 18 in. wide. A 10-ton crab by Messrs. Royce & Co. runs on the bottom flange of the girders, and is now used for the conveyance of ashes. It was, however, of great utility for the transport of machinery, &c., during erection.

The station itself is a brick building consisting of parallel engine and boiler rooms. The boilers are three in number, each of the Stirling Boiler Co.'s five-drum pattern for 20,600 lbs. per hour, 170 lbs. pressure, and are provided with Messrs. Heenan & Froude's "Tester" superheaters, giving 150° F. superheat. Each boiler has 480 3¼ in. tubes, and heating surface of 6,021 sq. ft., and is fired by two automatic stokers by the Underfeed Stoker Co., arranged to burn low-grade "smudge." As regards flues, the three units are entirely independent, and, as shown in Fig. 1, each has its own steel chimney. These are 60 ft. in height and 4·11 ft. internal diameter, lined with firebrick half-way up, and were made in the company's own shops. Forced draught is used, and each boiler has its own Heenan & Froude fan, driven by one of the Midland Railway Co.'s own make of variable-speed motor. The fans each give normally 12,000 cu. ft. of air at 2¼ in. water gauge, but can work up to 15,000 cu. ft. at 2¾ in. The flue gases are sampled continuously by a Simmance-Abady CO_2 recorder. It is intended ultimately to supply a certain amount of steam for heating purposes, &c., in the works. The main steam range consists simply of one header, which can be suitably sectionalised, and the necessary branches direct from the boilers and to the generating sets. It is all of steel with welded flanges and branches, and was supplied by Messrs. Aiton & Co. The valves throughout are of Messrs. Hopkinson's make. Feed water is obtained from a softening plant in the locomotive works, with an alternative town main supply. One steam and one electric feed pump are installed, the former by Messrs. J. P. Hall & Co., and the latter a Rees-Roturbo centrifugal set, driven at 2,250 r.p.m. by a 15-h.p. variable-speed motor. The feed piping is of cast iron in duplicate. A Lea recorder can be used to

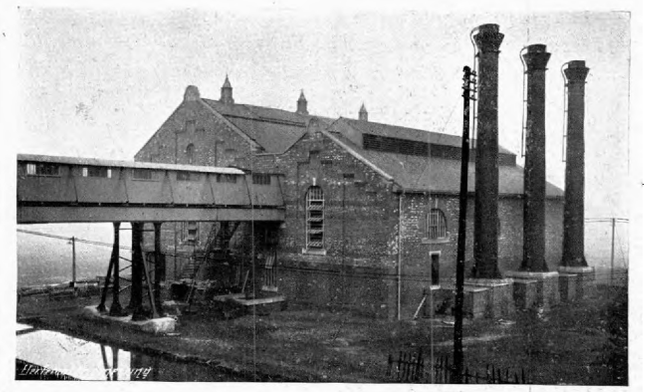


FIG. 1.—VIEW OF POWER-HOUSE SHOWING BRIDGE AND STEEL CHIMNEYS.

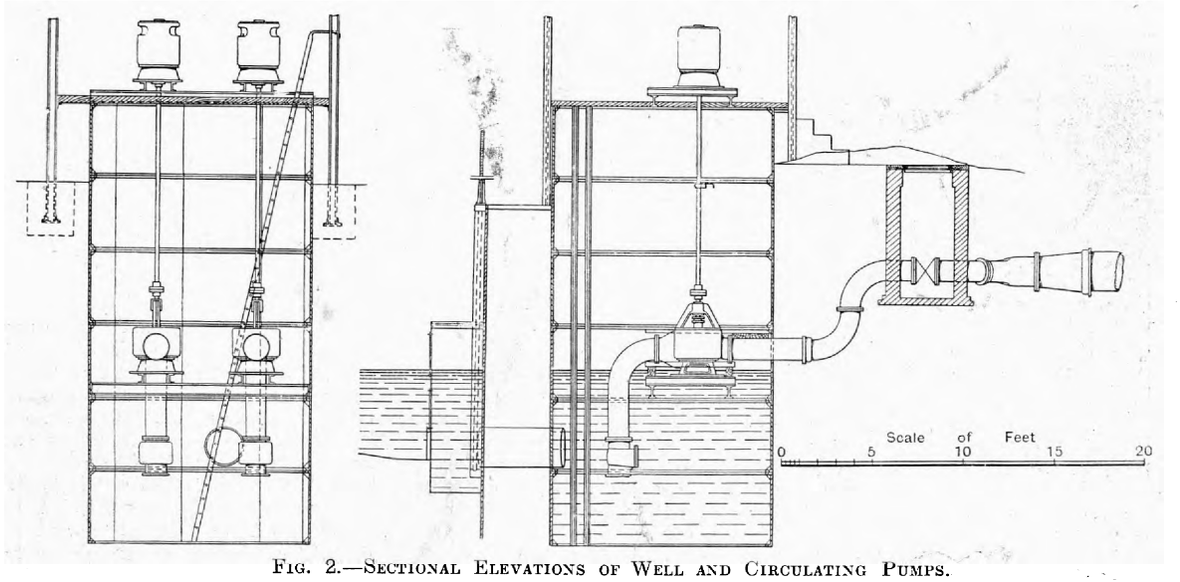


FIG. 2.—SECTIONAL ELEVATIONS OF WELL AND CIRCULATING PUMPS.

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measure the flow into the hot well from any or all of the condensers.

Some interest attaches to the condensing water arrangements, which may be described before proceeding to the engine room plant. The condensing water, which, as already stated, is derived from the river Derwent, is pumped up by one of two vertical spindle Rees-Roturbo pumps, each of a capacity of 2,200 gallons per minute, placed in a well alongside the river, and driven by vertical shaft 25-h.p. variable-speed continuous-current motors of the Midland Railway Co.'s own manufacture, running at 400 r.p.m. These motors are controlled entirely from starters in the engine room, to which both main and shunt leads are taken over a pole line. The water is taken through buried pipes 2 ft. in diameter to the condensers, and returned to the river, and the outlet is arranged to be drowned at all levels of the river to maintain the syphon action. Replaceable straining screens are placed in the well, but no special arrangements for reversing the flow in the pipes are provided. A steam ejector removes air from the pipes, and a small pump is also to be installed for this purpose. A section of the well is given in Fig. 2.

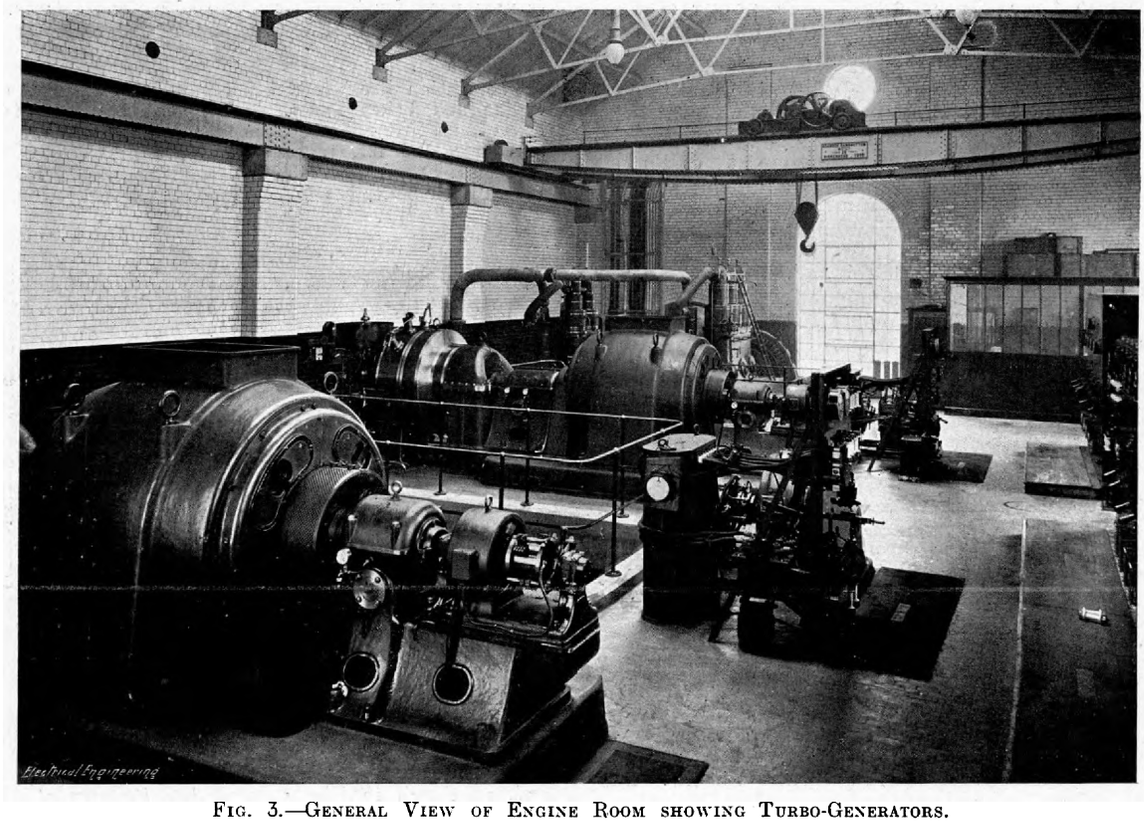


FIG. 3.—GENERAL VIEW OF ENGINE ROOM SHOWING TURBO-GENERATORS.

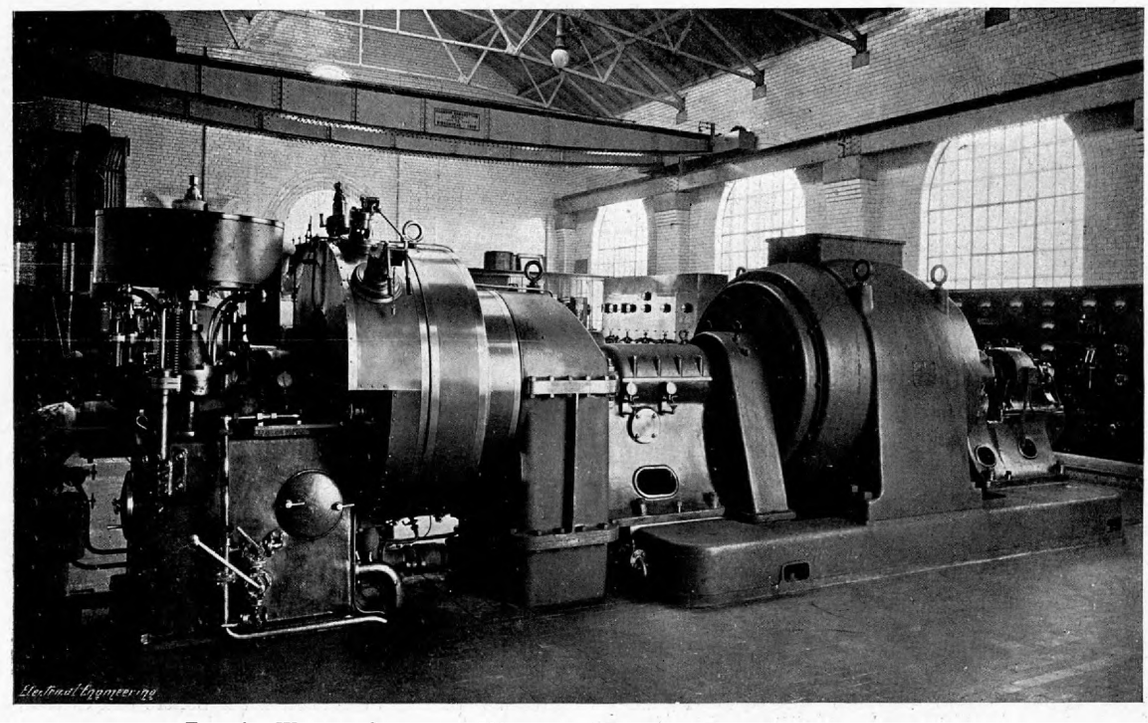


FIG. 4.—WILLANS-SIEMENS 1,500 K.V.A. "DISC AND DRUM" TURBO-ALTERNATOR.

A view of the engine room is seen in Fig. 3. Attention is at once arrested by the compactness of the two main turbo-generating sets, which in spite of their capacity of 1,500 K.V.A. are only 25 ft. in length

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over all. The turbines are of Messrs. Willans & Robinson's new "Disc and Drum" type, which is much shorter than the purely reaction pattern formerly built by them, and the total size of the sets is further reduced by the fact that they run at as high a speed as 3,000 r.p.m. A view of one of the sets is given in Fig. 4, and a cross section is shown in Fig. 5. The turbines are of interest as being among the first of this type of as large a size to be put to work. In these turbines the steam is first supplied to two impulse rings from the main nozzles, and then passes to five stages of three rows each of Parsons reaction blading. There are altogether 14 nozzles all in the upper half of the case; of these, four are permanently open, three are opened and closed automatically by a steam relay controlled by the difference in steam pressure between the steam pipe and steam chest, and two more sets of three and four respectively can be opened by hand in case of overload. In addition to the ordinary governing, the usual Willans emergency governor is fitted and forced lubrication at 10 lbs. per square inch is supplied to all the bearings. Each set has its own condensing plant with Edwards type air pumps and vacuum augmenters, situated immediately below, and Messrs. Alley & Maclellan's pattern of automatic atmospheric valves are provided for free exhaust in case of failure of the vacuum.

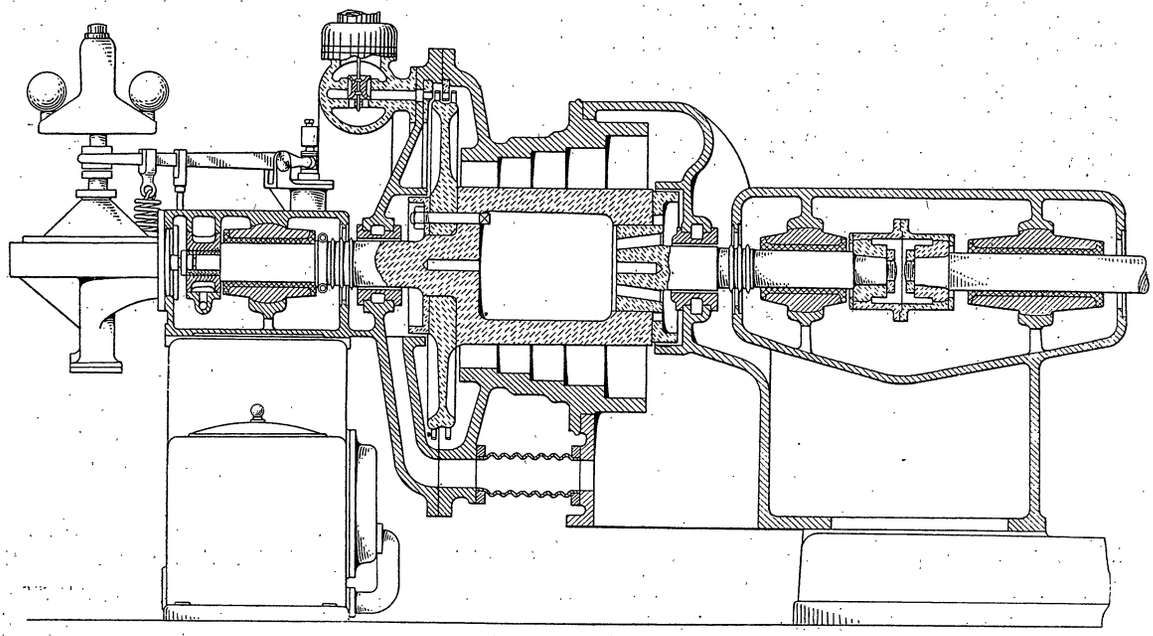


FIG. 5.—CROSS SECTION OF WILLANS "DISC AND DRUM" TURBINE.

The alternators coupled to these turbines are of the latest high-speed pattern of Siemens Brothers Dynamo Works. In view of the high speed they have two-pole rotors. They are of the enclosed self-ventilating pattern, drawing air through ducts from below the floor and expelling it through open chimneys into the engine room. Each machine is rated at 1,250 kw. or 1,500 K.V.A. at 0·8 power factor 460 volts three-phase 50 cycles. Direct coupled interpole 110-volt exciters are provided on each set, and the maximum excitation provided for is 125 amperes. Regulation is by both shunt and series rheostats. The sets have shown good figures for steam consumption on test, especially at medium loads.

Besides these two sets there are two smaller Scott & Mountain alternators of 250 kw. and 160 kw. respectively, driven by Willans reciprocating engines, moved from other stations of the company. These exhaust into a common condenser by Messrs. Story, of Manchester, and are used for light loads. The only other plant in the engine room is a pair of 150-kw. Westinghouse rotary converters, which provide a continuous current supply for cranes, and certain other variable-speed motors in the works and for the station auxiliaries. These are fed through autotransformers placed together with their own switchgear close to the machines (see Fig. 3), and are always started up from the A.C. side by reduced voltage tappings. A fine 15-ton three motor-traveller by Adamson, Ramsbottom & Co. spans the engine room.

The position of the switchgear can also be seen in Fig. 3. The main board is by Messrs. Cowans, Ltd., and is arranged in a straightforward manner, with oil-switches behind the slate panels, and an exceptional amount of light and space at the back of the board. The main generator switches have instantaneous reverse current releases, but the smaller generators are also protected by overload relays with time-elements. Overload relays are provided on the feeder panels, and it should be mentioned that all the trips are worked off the A.C. circuit. Only one set of 'bus-bars is provided. There are in all four generator panels, three transformer panels, for the transmission to the carriage works, four feeder panels, two lighting panels, a testing panel, and a spare panel. The synchronising gear is of Messrs. Everett, Edgecumbe & Co.'s standard pattern, and their instruments are used throughout the board. A very simple leakage-indicating device is employed, consisting of a group of four lamps, one between each phase and earth, and the other shunting a resistance between the neutral point and earth. Inequalities in the glowing of the phase lamps immediately signal on which phase a fault lies, and the excessive current to earth from the neutral causes the fourth lamp to light up brightly. The indications are, however, slightly complicated by the fact that the A.C. and D.C. are connected owing to the use of autotransformers with the rotary converters.

Three Westinghouse 400-K.V.H. transformers in the basement transform up to 6,600 volts for the carriage works feeders, and for the high-tension side a special board, constructed by the Midland Railway Co., but employing Ferranti switches, &c., has been installed. The H.T. gear is in cells behind the board, and three transformer and two feeder-panels are provided. The tripping in this case is D.C. from the circuit of one of the exciters, and change-over switches make connection to whichever one happens to be running.

The transmission to the carriage works is by duplicate feeders, consisting of paper-insulated lead-covered cables supplied by British Insulated & Helsby Cables, Ltd., and a transformer sub-station is provided at the further end. The low-tension distribution at the carriage works is principally overhead. The 440-volt A.C. feeders to the locomotive works, &c., are carried over the bridge and run for the most part over the roofs and high up along the walls of the shops. They, and also the less extensive D.C. cables for the cranes and variable-speed motors, are three-core bitumen-insulated cables, but inside the shops plain braided aerial cables on insulators are used. A part of the D.C. distribution is effected by bare trolley wire. The work of changing over from the old methods to electric driving in the works is being rapidly pushed forward. The Midland Railway Co. have themselves electrical shops of considerable proportions, established originally for repair work, but now build a large number of their own motors. Except for the special cases mentioned above, where D.C. drive has special advantages, induction motors are employed throughout

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the works, and a combination of group and individual drive is adopted.

The lighting of the offices, stores, &c., is now practically entirely by Osram lamps, and these are run at 2×100 volt networks, supplied by balancing autotransformer, each connected across a 270-volt leg of the star-connected 460-volt circuit, the tappings being arranged so that the neutral is in the centre of the winding, and a certain number of primary turns beyond the outers at both ends. There are three 60-kw. and one 30-kw. transformers at suitable points arranged in this way.

We wish, in conclusion, to record our indebtedness to Mr. H. Fowler, Chief Mechanical Engineer to the Midland Railway, for permission to publish this description, and for putting drawings, photographs, and particulars at our disposal, as well as to Mr. J. Dalziel, who, under Mr. Fowler's direction, designed and supervised the work. We would also express our thanks to both these gentlemen, and to Mr. C. G. Conradi and other of Mr. Dalziel's assistants, for much kind assistance and hospitality on the occasion of our visit to the station.

HIGH-TENSION TRANSMISSION LINES

THE two Papers on this subject by Mr. W. G. Taylor and Messrs. R. Borlase Matthews and C. T. Wilkinson, which were read and discussed at the Institution of Electrical Engineers on January 26th, were further discussed on February 9th. Abstracts of the Papers and a report of the first evening's discussion were given in ELECTRICAL ENGINEERING, February 2nd, p. 57, and the discussions at Newcastle and Manchester were reported in the issue of February 9th. The discussion is to be continued to-night.

Mr. S. G. REDMAN (Merz & McLellan) showed a number of slides of H.T. transmission work carried out in the north-east coast district, where there are at present about 80 miles of 20,000-volt overhead work, and extensions now in hand for a further 50 miles. The first lines put up about six years ago had "A" poles with 40-yard spans, but the spans had since been increased to 80 yards and more. The original practice of having two circuits on one pole had been abandoned, as there were difficulties in screening one line while the other was being worked on. Experience on the north-east coast had shown that an earthed conductor above the line was not a certain safeguard against lightning. He regarded it even as a source of danger, and said that better results had been obtained by placing it below. The standard "A" poles were 40 ft. long and 6 ft. in the ground, the insulators being on a tripod bracket. The earthed wire underneath the conductors sometimes formed the suspension for the lead-covered pilot cables. These had caused some trouble through the lead cracking, but this had now been overcome by avoiding sharp bends. The railway companies insisted upon the same precaution being taken with wires crossing goods lines as for passenger lines. The guard consisted of triangular wooden frames supported by heavy steel cables. In the middle of the span there was an earthed bar which a broken wire was bound to touch. The whole of the lines on the north-east coast were protected with balance gear. On no occasion had they had a wire fall, and although in one or two cases the wires had come away from the fastenings to the insulators, and had touched another wire, they had not broken, and the protective gear had immediately cut out the particular section. The slides included an instance of a 6,000-volt transformer with its switchgear, mounted on a pole for supplying a small village eight miles from Newcastle.

Mr. A. P. TROTTER said that the cost of E.H.T. switchgear at terminal stations was about proportional to the pressure, so that it was rather doubtful if we should have lines in this country long enough to make it worth while running at the high pressures mentioned in the Papers. It seemed probable that we should not go much further than 20,000 volts with ordinary A.C. supply. Somebody had recently stated that Great Britain was behind as regards pressures and lengths of overhead transmissions, due largely to the stringent restrictions of the Board of Trade. This might be so, but he had not come across these restrictions himself. At present there was a limit in pressure for ordinary alternating current overhead work, namely, 250 volts, and anything over that had to comply with certain regulations, be it 2,500, 25,000, or 250,000 volts. In this connection he also drew attention to the fact that Mr. Ferranti twenty-two years ago startled England and the whole of the world with a 10,000 volt system, using a concentric system of mains which had been absolutely safe. Mr. Highfield, a few years ago, had referred to the possibility of a 120,000-volt continuous-current scheme in this country, and he looked forward to the realisation of this with great interest. This hardly indicated that Great Britain was backward in these matters. He did not agree that wooden poles were practically a thing of the past so far as this country was concerned, although it might be so in America, where the process of creosoting was practically unknown, and was almost impracticable on account of the great distances the poles would have to be caried. There seemed to be a great difference of opinion as to the life of wooden poles. This had been put as low as seven or eight years, but in the discussion on Mr. Wade's Paper four years ago, 50 years was given, whilst Major O'Meara put the life at from 30 to 40 years as the average for a well creosoted pole. In certain soils it might be reduced to 15 or 20 years. The Board of Trade regulations did not limit the span between poles, they merely prescribed a factor of safety. There had been a proposal to carry cables across the Tyne with a half-mile span, but the cost of the towers killed it, and a tunnel had to be built. He had also discussed carrying cables across some of the valleys in South Wales, whilst Edmundsons' Electricity Corporation would shortly be carrying high-pressure conductors across Hayle Harbour (Cornwall) with poles 146 ft. high and a 600 ft. span. He wished some engineer would go into the question of flexible poles from a practical point of view. It was necessary to know the stress which was going to be put upon the pole when it was pulled over by the breaking of the line. The clashing of wires together was a point to be reckoned with, and there was also a difficulty of the wires swinging in big waves, which raised the question of the binding of the wire to the insulator. In this country we had been very careful to fix the wires to the insulators so that they could not move at all. In conclusion Mr. Trotter asked whether way-leaves in America, which seemed to be a trouble as they are here, were granted by the Local Authorities for running cables alongside roads, and whether railway companies granted way-leaves to run alongside their tracks, enabling way-leaves on agricultural ground to be avoided?

Mr. J. S. PECK (British Westinghouse Co.) said that cases were only likely to arise where the whole power available at any point could be used within an area, such that the distances would only require pressures up to 200,000 volts. The suspension insulator could no doubt be developed to make 200,000 volts quite possible. The E.H.T. direct-current system was ideal as regards the transmission line, but it was the insulation of the generators and motors which had retarded its development. He did not know of any condenser which could be connected direct to improve the power factor. It was useful to remember in connection with inductance calculations that by doubling the diameter of the wire it was possible to double the spacing with the same inductive drop, and the converse was also true. It would be necessary to use some form of load equaliser for motors as large as 5,000 or 6,000 h.p., connected to a long-distance line. He regarded it as unnecessary to put lightning arresters on the low-tension side of the transformer, because it was possible to insulate the few turns of the winding against any excess pressure. With regard to Mr. Taylor's remarks as to regulation and capacity current of the line, he pointed out that as the capacity current of the line was constant, it would not in itself improve the regulation, which was dependent upon the load. The capacity current might cause the pressure at the receiving end to be higher than at the generating end, however, and it was possible by the use of synchronous machinery at the receiving end to compensate automatically for the fall in pressure with increasing load. He then described a new type of lightning arrester for circuits up to 100,000 volts, consisting of a series of blocks of concrete impregnated with a substance to render them to some extent conducting. Sheets of expanded metal were placed between the succsssive blocks, and were shunted by spark-gaps.

Mr. H. W. CLOTHIER (Messrs. A. Reyrolle & Co.) remarked that five different systems of protection were shown in the diagrams of Mr. Taylor's Paper, and it seemed that breakdowns were regarded as inevitable, but he preferred to so design the switchgear that the faulty part was cut out without causing a cessation in the supply. The balanced system of protection was a far sounder method than any described in the Paper. An earth wire underneath the cables gave a better chance of obtaining sufficient current to earth, in the event of a break, to trip the release. He suggested the possibility of the ground line enclosing the pilot wire.

Mr. W. B. ESSON thought it was quite a misnomer to refer to flexible poles. The primary idea was not to give flexibility but simply to save the cost of materials by having lighter poles specially made to withstand wind pressure at right angles to the line. Aluminium cables, although these were half the weight of copper cables for the same conductivity, were 30 per cent. greater in diameter, and offered greater surface to wind pressure in proportion to the weight. He believed that he had himself originated the rule that the distance between wires should be one foot for every 10,000 volts. It was particularly above 100,000 volts that there was need for star connection to reduce the pressure between the wires and earth. Whilst there might never be any necessity for very high voltages, it should be remembered that it was easier to work lines at 60,000 volts than 30,000 volts, because the surges in the line were proportional to the current and not to the voltage.

Mr. A. A. CAMPBELL SWINTON thought the real limiting factor as regards pressure was the point of brush discharge. One way of increasing the pressure was to use larger wires, such

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as of aluminium or even iron or steel. The condition of the surface of the wire had an enormous effect in connection with brush discharge. If it were very smooth there was very much less tendency to brush discharge. He would like to know whether these losses increased with time due to the effect of the atmosphere upon the wires. Another method might be to cover the wires with insulating material, but it was doubtful whether solid insulation would really give a better result than the layer of air round the wire.

Dr. M. KLOSS (Siemens Bros. Dynamo Works) said that though there did not seem to be a great demand for high-tension lines in the near future in this country, there was no doubt that many more would shortly be installed abroad. He referred to several long-distance lines carried out by his company. Continental practice was to have spans from 400 to 650 feet, and a maximum stress in copper wire of 22,700 lbs. per square inch. For railway or telegraph line crossings, they attached two auxiliary pieces of wire about 4 feet long to the conductor, and tied all three to separate insulators. For protection against lightning, &c., no overhead aerial wire was used, but the lines were protected at both ends, and sometimes at intermediate points. With regard to corona effect, he thought the loss up to about 115,000 volts was due to the charging current. The corona loss seemed to start at that point, and to be proportional to the pressure above that point.

Mr. B. M. JENKIN (Messrs. Kennedy & Jenkin), on the point of the limiting voltage in this country, called attention to the fact that by doubling the pressure it was possible to transmit twice as much power by only altering the insulators to take the higher pressure, thus practically reducing the cost of the line per kw. transmitted to one-half.

CHEMICAL ACTION IN H.-T. WINDINGS

IN a Paper read before the Manchester Section of the Institution of Electrical Engineers on February 14th, Messrs. A. P. Fleming and R. Johnson described researches into the causes of the chemical action and consequent breakdown in the windings of high-voltage machines. Their investigations show that no case of chemical action has been observed on windings having a lower voltage than about 3,500 to earth; and that such action only occurs where air-pockets are present, and then only when the voltage across them is high enough to produce a discharge. While the action commences on the surfaces of the insulation exposed to air-pockets, the gases produced may be carried beyond the zone where they are formed, and produce action on other portions of the insulation. The action of the products of the discharge—whether these be ozone, oxides of nitrogen, nitrous or nitric acid—on the insulation is most commonly one of oxidation, and the effects produced are as follows: Untreated cellulose materials have their fibrous structure destroyed, and disintegration follows. The oils and gums in insulating varnishes are subjected to super-oxidation and yield organic acids. Linseed oil is most readily affected, but certain asphaltum compounds are attacked only to a limited extent. Mica is itself unaffected, but the cements used in building it up are liable to attack. The authors also find that the production of nitric acid is not essential for deterioration of the insulation to occur, although, when it is produced, the action is greatly accelerated. The final disintegration of varnish-treated materials is greatly accelerated by the action of the released organic acids. Failure due to chemical action is almost invariably the result of a short circuit between turns, and not a breakdown of the slot insulation between windings and frame. The short circuit is caused either by a destruction of the insulation on the conductors, which allows the turns to make actual contact, or by the hygroscopic and therefore conducting matter formed between conductors when nitric acid is present. The authors' experiments showed that unless the air in the cavities of the winding is replenished by "breathing," the chemical action will cease. They also find that when the stress is very high, deterioration other than that due to chemical action may be produced. Thus, if the insulation is made up partly of materials such as mica, of high specific inductive capacity, and partly of material such as paper, of low specific inductive capacity, the insulating value of the latter may be destroyed on the application of a high voltage without the insulation as a whole breaking down, as has been proved before in the case of cables. They conclude that for the range of voltages at present used, failure of machines from chemical action is not to be expected when the average stress across the slot insulation is less than about 35 volts per mil, with any of the methods of winding and insulating commonly employed. A much higher average stress than 35 volts per mil is safe when the size and number of conductors permits the best method of grouping and insulating to be employed, and when the interstices are properly filled with an asphaltum compound. The Paper contains detailed suggestions in this respect. Mica is recommended for use between turns, and the more thorough impregnation of the windings before and after applying the slot insulation is urged. Finally, the authors point out that the green discoloration which frequently occurs on coils treated with linseed oil gum varnishes should not be confused with the chemical action due to high voltage. Such discoloration is quite harmless with the best makes of varnishes.

DISCUSSION.

Mr. C. J. BEAVER (W. T. Glover & Co.) confirmed the authors' views regarding the formation by the action of ozone of super-oxidation products of linseed oil on varnished cambric and cotton coverings. These products were acid, soluble in water, and attacked fabrics and metals. Fabrics impregnated with asphaltum dissolved in a suitable solvent were better than the same fabrics impregnated with the same compound in a molten state, and it would seem better to use varnished fabrics and to keep the maximum stress within limits. Metal foil in the slot insulation connected to one of the conductors to lower the potential gradient should be worth trying. The principle had been used successfully by the speaker's firm for cables from 50,000 to 100,000 volts.

Mr. MILES WALKER (British Westinghouse Co.) described experiments demonstrating that the current flowing through the insulation was partly a capacity and partly a conduction current. The curve representing the power lost per cycle in the insulation showed that the insulation behaved like a number of condensers in series with a number of resistances. The resistance was much decreased as the temperature was raised, and it was necessary to specify the working temperature before the thickness of insulation could be decided upon, as if the heat cannot be dissipated the insulation might heat up and finally break down under a comparatively low stress. This had occurred in the case of several H.T. transformers.

Mr. W. CRAMP (Municipal School of Technology, Manchester) pointed out that the Paper was confined to A.C. machines only, and would require considerable modification to include D.C. machines. He thought that a certain amount of oxides of nitrogen were produced, however weak the discharge. Ozone alone could not produce the effects noticed. It had been found that an extremely unstable compound of nitrogen and oxygen was produced by the electric discharge, and this was a powerful oxidising agent. The presence of moisture considerably accelerated this action. He had found varnishes prepared from paraffin wax very satisfactory, but even paraffin wax became oxidised at very high pressures. It had been shown that the production of ozone was proportional to the frequency, and more trouble was therefore to be expected with high-frequency machines.

Mr. H. D. SYMONDS (British Westinghouse Co.) described a case of breakdown due to destruction of the insulation. The presence of nitric acid was proved in this case. Contrary to the authors, he thought that the action was accelerated by the presence of copper, as a deliquiscent salt is formed as soon as the insulation gets tacky. With regard to the use of a metal sheath round the conductors and on the surfaces of the insulating tubes, he had obtained good results by painting these with an aluminium paint. Test coils which had been running at 6,600 volts for nearly two years showed no signs of destruction of the insulation.

Mr. P. V. HUNTER (Merz & McLellan), in a written communication, described the destruction of a 20,000-volt insulator bolt of Muntz metal enclosed in an insulating tube. The nitric acid fumes generated by the silent discharge penetrated into microscopic cracks in the bolt, and caused these to widen until ultimately the bolt gave way. He preferred one conductor per slot for stator windings whenever this was possible.

Mr. J. S. HIGHFIELD (Chief Electrical Engineer, Metropolitan Electric Supply Co., London) wrote stating that the coils he had used recently for H.T. windings were wholly insulated with mica and a filling compound. Small spaces were left, due to the contraction of the compound on cooling, but these had caused no difficulty. He believed 10,000 volts to earth was the maximum pressure at which it was commercially sound to wind machines, even of large size. Turbo-alternators should not be wound for such high pressures, as in the case of a burn-out the whole winding is destroyed, whereas in slow-speed machines only one or two coils would be damaged. In his opinion the maximum pressure to earth for machines of 3,000 kw. and under should not exceed 5,000 volts.

Mr. H. W. TURNER (Stirling Varnish Co.) suggested that the windings of machines should be treated immediately after a prolonged overload test when the moisture is driven out, with a non-volatile air-drying varnish to fill the interstices, and then be allowed to cool before applying the flash test, as this otherwise caused the formation of nitric acid. He confirmed the author's statement as to the harmlessness of the green discoloration produced on certain varnishes. Proper drying and baking facilities were seldom provided in works, the temperature of the ovens being generally too low or irregular. It was unfortunate that untreated cotton and other cellulose materials were often used. Proper impregnation while hot with non-volatile black varnishes to eliminate cellular air spaces would prevent chemical action.

The authors have submitted a written reply to the discussion.

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CORRESPONDENCE

LIVE STEAM FEED WATER HEATING.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—As one who has manufactured and sold large numbers of live steam feed water heaters for boilers during the last few years, which are in use in all parts of the world, I have been much interested in the articles and correspondence which have recently appeared in the technical press arising upon the published results obtained by Prof. Gibson in his researches at the University College, Dundee.

The opinion amongst engineers as to the efficacy of live steam temperature feed water is sharply divided, and a number of correspondents have tried to explain away Prof. Gibson's results by stating that the increased evaporation with steam temperature feed water is due to priming. That this is not so is proved beyond contention by the fact that where superheaters are used it is found that the superheat is higher with live steam feed water in use than where the feed water is used from the economiser direct. If, as the said correspondents have alleged, water were carried over with the steam there would be a drop of temperature in the superheater. Increased superheat is realised in all cases under equal conditions, and this effectively disposes of the contention that live steam heating produces wet steam.

There is another curious result which I have observed on many occasions, *i.e.*, where full steam temperature feed is used there is a decided increase in the temperature of the water from the economiser. The increase may be anything from 10° F. upwards; and this greater activity in the economiser shows that live steam feed water has also a beneficial effect on combustion, probably due to hotter boiler surfaces presented to the flues, which allow the flames to reach further without being damped out by the otherwise cooler surfaces which obtain with the lower temperature feed water.

It is a fact that in many instances years ago the application of live steam feed heaters resulted in failure, but this was due to the want of knowledge as to the conditions which must obtain in order to ensure beneficial results. The comparatively few engineers who have had extended experience in the application of live steam heaters have no difficulty in showing continuously economical results, but they would not think of putting heaters to work under conditions such as have been named, and which have resulted in failure and disappointment.

Yours faithfully,

GEO. WILKINSON.

Harrogate, Feb. 18th, 1911.

LOADING TELEPHONE LINES.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Absence from London caused me to miss the discussion on Major O'Meara's Paper on the loading of long telephone lines, but it may not be too late to add a few particulars thereto. I see that doubt exists as to when Mr. Oliver Heaviside's investigations were first translated into practical action. Mr. Heaviside discussed two methods of improving the efficiency of long-distance lines: (1) by leaks (which was not new); (2) by reducing resistance and increasing inductance. The former plan I tested practically in 1888, when erecting the first trunk lines through Fife for the purpose of bringing Dundee and Aberdeen into communication with the Scottish southern systems. The line from Stirling to Dunfermline and thence on to Burntisland was furnished with weatherproof shunt coils at every half-mile, this section being approximately midway between Edinburgh and Glasgow and Dundee. The line spoke quite well over the longest distances which could then be brought into circuit, about 200 miles, roughly, but not appreciably better than it did on a wet day without the shunts. It was, of course, an early observation—anterior to Mr. Heaviside's work—that long lines spoke better in damp than in dry weather, the uniform leakage due to wet insulators being decidedly better than very high insulation, at least for the distances then practised. It chanced that Lord Kelvin, then Sir William Thomson, asked me soon after the coils were fitted if anything had been done in this direction, and was delighted and very much interested on hearing about the Stirling-Dunfermline trunk, about which he made minute inquiries. He then spoke of the inductance theory, mentioning Mr. Oliver Heaviside's name with much appreciation, although I am not sure that the Paper on the subject had then appeared in print. I had, however, previously heard of the theory in some way. Lord Kelvin said that probably a practicable way to apply the inductance method would be to insert coils at intervals along a line. If I am not mistaken, Mr. Heaviside did not himself suggest loading lines with coils till the first volume of "Electromagnetic Theory" appeared in 1893. The copper wire with which the trunks were run provided speaking good enough for existing purposes, and I did not think it worth while, especially in view of the negative results obtained from the shunts, to trouble about inserting coils on any of the lines. But Mr. Heaviside's labours did save the National Telephone Co. a little money on one occasion by preserving in use an iron wire that would otherwise have been scrapped. Selkirk was originally joined to Galashiels by a single No. 11 galvanised iron junction wire about six or seven miles long. When the copper metallic circuit trunks were extended from Edinburgh to Galashiels and Hawick in 1889, it became necessary to turn this into a metallic circuit in order that Selkirk might use the trunks to best advantage. This was done by running a No. 14 copper alongside, and crossing it every half-mile with the iron, so that the loop was half copper and half iron in alternate half-mile lengths. Of course, the iron brought resistance with it as well as inductance, but mixing it with copper enabled it to be used over the longest lengths then available, which a loop composed wholly of No. 11 iron could not have been without notable disadvantage to the speaking. Both this line and the shunted Dunfermline trunk were still at work when I resigned from the National Telephone Co. in 1890. I understand that the foreman, Mr. A. Maclean, who erected the shunts, is still with the company, and will surely recollect them. The Selkirk compromise, I learnt two or three years ago, was well remembered by Mr. C. M. Gardner, who was local manager in the Galashiels District in 1889. The sale of the trunks to the Post Office, where inductance for telephone lines was not then believed in, put a stop to such experiments; but I think I have said enough to show that Heaviside was not, in the early days, ignored entirely by engineers of his own nationality.

I am, sir, yours, &c.,

A. R. BENNETT.

Queen Anne's Chambers, Westminster, S.W.,
February 16th, 1911.

RAILWAY STATION LIGHTING

THE London & North-Western Railway Co. recently invited the electricity and gas departments of the Corporation of Birmingham to submit schemes and to give demonstrations with a view of improving the lighting of the New Street Station. The high-pressure gas system has been installed on one platform, and the electric system on another. This latter has been arranged by Mr. Haydn T. Harrison for Mr. R. A. Chattock (Chief Electrical Engineer to the Birmingham Corporation), and four distinct schemes are shown. Suspended from the roof on one side of the footbridge are seven fittings, each containing three Osram lamps. These are hung at a height of 14 ft. 6 in. above the platform, and suitably spaced to give even lighting. They are controlled by two switches, so that one, two, or three lamps in each fitting may be turned on as required. Besides these, there are four "Excello" flame arc lamps, hung with counterweights so that the height may be adjusted. On the other side of the footbridge are thirteen fittings, each containing three Osram lamps. These are so spaced that a high degree of illumination can be obtained without the aid of arc lamps. These fittings are arranged on two switches, and the wiring is such that alternate lanterns can be switched off. A high degree of illumination on the platform has been aimed at, and special precautions have been taken to avoid glare. The lanterns have special reflectors to equalise the distribution over the platform and to prevent dark patches. All the lamps are hung from the roof. The switching arrangements allow part of the lights to be turned off between train times, or during the night. An official inspection of the electrical installation was made on February 14th. The work has been carried out by Messrs. Reynolds & Bradwell, of Birmingham.

The Institution of Civil Engineers.—The annual conversazione of the Institution has been fixed to take place on Thursday, June 29th, at 8.30 p.m., in the Royal Albert Hall.

The Telephone Service.—In a Paper read before the London Chamber of Commerce on Friday, Mr. H. L. Webb recommended that as an alternative to the acquisition of the whole telephone system of the country by the State at the end of this year, a "Telephone Authority" should be created on the lines of the Port of London Authority, which would take over the telephone plant both of the National Telephone Co. and of the Post Office.

Earthing Resistances for Lightning Arresters.—Difficulties have often arisen on large transmission systems with regard to the choice of suitable resistances for placing between protective spark-gaps and earth, as where the power behind the discharge is considerable, damage is liable to be caused to the resistances. The vessels containing liquid resistances have blown to pieces, and even carborundum rods have been rendered useless by a heavy discharge. To overcome these difficulties, Messrs. Reyrolle & Co. have introduced a special form of resistance in the form of woven asbestos resistance nets immersed in oil in strong cast-iron tanks, provided with suitable porcelain insulated terminals, the resistances for the three phases being contained in the same tank. We understand that these are in very successful use on the north-east coast transmission systems.

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ELECTROMETALLURGY AND ELECTRO-CHEMISTRY

The *Board of Trade Journal* states that H.M. Legation at Stockholm now reports that the experimental furnace established at Domnarfvet with the object of ascertaining whether it was possible, on a commercial basis, to smelt iron ore and produce pig-iron by electricity derived from water-power, has proved a success; at all events the expenses incurred are said to have been made good by the sale of the pig-iron produced, and the experimental furnace has now been replaced by a new furnace on a larger scale. It is proposed to build ten such furnaces, each to use 4,000 h.p.

The Legation at Christiania sends the following particulars with regard to the electric smelting of iron ore in Norway. Of the four principal undertakings in Norway, the Tinfos Paper Mills, near Notodden, in Telemarken, uses a process stated to be the invention of Messrs. Blakstad, Holta & Co., of Skien, and of Mr. Bie-Lorentzen. It is stated that experiments have been conducted since January, 1910, with such success that the directors of the company have decided to erect works for electric smelting in connection with foundries and steel-works, employing up to 15,000 h.p. from a power station now under construction at Hitterdal Lake; 5,000 h.p. is to be available by next summer, and the remainder by 1912. Mr. O. H. Holta, of Skien, is stated to be the promoter of the undertaking, but communications regarding it should be addressed to the Tinfos Papirfabrik, Notodden, Norway.

The "Aktieselskabet Hardanger Elektriske Jern-og Staalverk," at Odda, Hardanger, will employ the Swedish Grönwall method, of which the patent for Norway is held by the Norwegian Electro-Metal Co. Power will be derived from the Tysse Falls. The estimates for the equipment of the works provide for two furnaces of 2,900 h.p., one steel furnace of 800 h.p., and rolling mills with a producing capacity of 6,800 tons of billets. These last, it is calculated, could be delivered at British ports at a price of about £8 per ton. Communications regarding these works should be addressed to the A/S. Norsk Elektrometal, Christiania.

The "Nordenfjeldske Grubecompagni," Trondhjem. This company intends to employ the Lyons method as used at Héroult, California. It is stated that the company intend next spring to erect a furnace similar to the Héroult type, and that considerable iron deposits and waterfalls in the Tromsö district have been acquired. Communications regarding this company should be addressed to Hr. Ingeniör Boholm, Trondhjem.

The Ulefos Ironworks will adopt the methods of the Tinfos Paper Mills and of Mr. Bie-Lorentzen, and also the patents of the Norwegian Electro-Metal Co. Satisfactory trials are said to have been made, and plant for a second electric smelting furnace has been ordered and is expected to be at work shortly. The furnace now being used is supplied with power from the Fehn Mines power station. In future, power is to be derived from a new works which is now approaching completion. The water power of the Eidsfos and the Vrangfos Falls has been acquired for the same purpose, and is being kept in reserve for future extensions. Communications regarding these works should be addressed to Hr. Kammerherre D. Cappelen, Ulefos Jernverk, near Skien.

Arrangements are being made for very complete representation of British chemical and physical apparatus at the forthcoming International Exhibition at Turin, and two actual laboratories are being equipped to show processes at work. The organisation of these exhibits is in the hands of Dr. F. Mollwo Perkin.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

MOTORS AND GEARING.—A pamphlet from the British Thomson-Houston Co., Ltd. (Rugby), gives full details of a series of small motors for continuous current ranging up to 2 h.p. These are of particularly substantial design, and can be arranged as protected, ventilated, or totally enclosed machines. These are provided with laminated poles, and all the refinements of electrical design which distinguish the company's machines of larger size. They are known as type D.A., and are standardised for no less than 16 different voltages ranging from 110 to 530. Another new list deals with the use of worm reduction gears with motors, and illustrates the forms of gear standardised by the company in actual use.

SWITCH FUSES.—Another of the British Thomson-Houston Co.'s new lists deals with porcelain handle switch fuses of a design with several good points to recommend it.

ELECTRIC IRONS.—The British Thomson-Houston Co. have also issued a new list of their "Calorite" flat-irons, which were described and illustrated in ELECTRICAL ENGINEERING, Dec. 8th, p. 777.

CO_2 RECORDERS.—Leaflets have been issued by the Albion Recorders Co. (427 Tower Buildings, Water Street, Liverpool) describing the construction and use of this firm's CO_2 recorder. The simplicity and strong construction are claimed to eliminate the necessity of skilled attention, while the cost of working it is under 1d. per day. The control of the firing provided is claimed to effect a saving of from 5 to 15 per cent. in fuel.

CORONATION ILLUMINATIONS.—A special catalogue of materials, fittings, devices, &c., for Coronation illuminations is being issued by Siemens Brothers Dynamo Works, Ltd. (Incandescent Lamp and Fittings Department, Tyssen Street, Dalston, N.E.). This contains particulars of the company's "Brolite," which has porcelain insulation, aluminium holders, and can be made watertight by rubber sleeves. Various other accessories are listed, together with a fine collection of crystal glass and other devices.

INSULATORS.—A price list from the Sloan Electrical Co., Ltd. (12 Golden Lane, London, E.C.), covers porcelain insulators of all classes, leading-in tubes, cable suspenders, iron brackets, pins, and stay-rods for pole-line work, and a patent wooden plug for fixing insulators in brick or stone. The pamphlet is well arranged; dimensions and prices being given under each item illustrated.

CORONATION ILLUMINATIONS.—An advance copy is to hand from the British Westinghouse Electric & Manufacturing Co. (Supply Department), of a special catalogue of enamelled wood letters and designs, with rows of coloured or frosted lamps, special reflectors, which can be made up into crowns and stars, "Trafford" illumination strip and other accessories for illuminations. Some very effective illustrations of illuminated buildings are also included.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

CORONATION ILLUMINATIONS.—A handsomely illustrated brochure containing a number of night photographs of buildings, garden arches, &c., outlined with "Striplite" and miniature lamps, has been issued by the Electrical Co., Ltd. (122 Charing Cross Road, London). Full particulars and prices of the various patterns of "Striplite" are given, together with various forms of rosette signs and round bulb lamp decoration chains. A one- or two-way mercury flasher for from 1·5 to 24 amperes is also described.

MOTOR CONTROL APPARATUS.—A new catalogue from the British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester), illustrates a considerable range of motor starting and controlling apparatus, including ordinary lever and multiple switch starters, field regulators, oil-immersed starter, complete motor panels, pillars, and control boxes, as well as drum type controllers and special oil-immersed controllers for mines. The A.C. starting gear is particularly complete, comprising some compact enclosed star-delta switches, complete auto-transformer starters, and the new A.C. starters referred to on another page of this issue. Liquid starters and automatic slip regulators are also included.

We have received from Messrs. John Swain & Son, engravers, a wall calendar decorated with a splendid specimen of their three-colour art reproductions.

Physical Society.—At the meeting of the Physical Society on January 27th, Prof. F. T. Trouton showed a simple apparatus for demonstrating the phase difference between the primary and secondary currents of a transformer. These currents energised two electromagnets with their planes at right angles, and the speed of a copper disc between them showed the torque due to the phase difference between them. The effects of different cores in the transformer were shown. Prof. J. A. Fleming then read a Paper discussing a method of comparing the resistance to high frequency and steady currents of a conductor by a differential air thermometer. Another Paper by the same author, in conjunction with Mr. G. B. Dyke, described an apparatus for measuring the energy losses in condensers traversed by high-frequency oscillations. It was seen that the condenser could be regarded as equivalent to a hypothetical series resistance of a value such that the total resistance is inversely proportional to the square of the current. In a further communication the same author showed some resonance curves with impact and spark ball dischargers. With the spark ball discharger, for close coupling, the resonance curve has three peaks which correspond with the free oscillation period of the secondary and with the two-period oscillations set up by the reaction of the secondary upon the primary circuit. As the coupling is weakened the double-period oscillations die out, and only the free oscillation of the secondary survives. A certain coupling, not far from 10 per cent., gives the maximum current in the secondary circuit in the form of a free oscillation. If the secondary circuit is more highly damped, then the two-period oscillations are more strongly marked, and the maximum free period oscillation has a lesser maximum value. With an impact discharger the double-period oscillations are only apparent when the coupling exceeds about 30 per cent. The curves show how very quickly the primary spark is quenched when using the impact discharger.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published February 16th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

29,785/09. **Traction Controller.** BRITISH THOMSON-HOUSTON Co., H. C. HASTINGS, and W. L. WISE. This is a reversing controller for series-parallel control, and permits of a faulty motor being cut out without interfering with the remaining motors. A separate drum is provided for each motor or group of motors. These are mounted loosely on a common spindle with means for locking them so as to rotate with the spindle. Each drum carries three sets of contacts; one set engages the fingers when the handle is in the "reverse" position, another when the handle is set for forward running, and the third set engages with the fingers in such a manner that the corresponding motor or group of motors is cut out. Thus, to cut out a motor, the corresponding drum is fixed in this position, while the others are free to rotate with the spindle. Four figures.

1,649/10. **Oscillation Apparatus.** PROF. E. WILSON and W. H. WILSON (London). An inductance is connected with a source of current. The primary winding of a transformer and a capacity connected in series are connected directly across the inductance, so that both condenser and inductance receive energy from the source. On disconnecting the source, the energy of the inductance surges into the condenser, and after the first oscillation the condenser and transformer primary winding are short-circuited so that the condenser then discharges directly through the transformer. A rotary commutator to reproduce this cycle of operations is described. The apparatus is stated to be particularly suitable for wireless telegraphy and X-ray work. Nine figures.

2,300/10. **Dry Cells.** G. F., G. J., and L. FULLER (London). Dry cells for hot climates, or to withstand continued storage, are made air-tight to prevent evaporation until the cell is to be used. Another improvement described is the formation of the carbon in the shape of a screw to enable the contact with the manganese block to be improved. Four figures.

4,599/10. **Terminals.** R. W. PAUL (London). A terminal especially suitable for stranded conductors consists of a threaded male portion with an axial slot wide and deep enough to take the largest cable to be clamped. The bottom of the slot is rounded and flush with the shoulder on the base. A nut is screwed over the terminal on to the conductor, and may be locked by passing a pin through the nut and the slot in the terminal. Three figures.

9,209/10. **Arc Lamp Globe.** ALLGEMEINE ELEKTRICITÄTS GES. To prevent the deposit on the inside of the globes of enclosed flame lamps, the upper portion is provided with an air jacket of glass to keep it hot. The fumes are thus condensed only on the lower portion of the globe, where a deposit does not interfere with the light radiation. A device for regulating the air pressure in such a jacket is described. Three figures.

10,595/10. **Heating Apparatus.** EVERSHED & VIGNOLES, LTD., A. SCHNEIDER and W. CLARK. A heating element consists of a resistance wire wound longitudinally or spirally in grooves on a tube of soap-stone or steatite. An envelope of copper entirely surrounds the coil, and has an extension passing up the centre of the core. The insulation between the copper and the wire may be mica, but is preferably air only. The copper envelope is in direct contact with the body or vessel to be heated. Three figures.

28,382/10. **Magnetic Blow-out for Arc Lamps.** A. BISSON and G. BERGÈS (Paris). A blow-out arrangement for flame lamps with converging carbons consists of two core-less coils of different numbers of turns, the individual fields of which interact to produce a horizontal field across the arc. Three figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad. Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: BRITISH THOMSON-HOUSTON Co. *(General Electric Co., U.S.A.)* [Electrodes] 17,278/10.

Dynamos, Motors and Transformers: WITTEK [Motor control] 30,262/09; MASCHINENFABRIK OERLIKON [Driving of ring spinning machines] 2,237/10; ELECTRIC CONSTRUCTION Co. and PENSABENE [Control of induction motors] 4,736/10; SIEMENS BROS. DYNAMO WORKS *(Siemens Schuckertwerke Ges.)* [Commutation of frequency converter] 5,479/10; SIEMENS-SCHUCKERTWERKE GES. [Motor control] 14,345/10; FRIED. KRUPP A.-G. [D.C. machines] 25,167/10.

Electric Ignition: CUNNINGHAM [Magneto armatures] 3,802/10; MALSON [Electric blasting fuses] 17,694/10.

Electrometallurgy and Electrochemistry: LAKE *(Fabrik Elektrischer Zünder-Ges.)* [Production of porous electro-deposits] 5,691/10; ANSON, HENDERSON, and EASTICK [Primary cells] 8,996/10.

Heating and Cooking: CUTLER [Liquid heater] 13,864/10.

Incandescent Lamps: BRITISH THOMSON-HOUSTON Co. *(General Electric Co., U.S.A.)* [Manufacture of ductile filaments of refractory metals] 2,759/10.

Instruments and Meters: SPALAZZI [Device for transmitting angular movements to a distance] 2,633/10; BRITISH THOMSON-HOUSTON Co. *(General Electric Co., U.S.A.)* [Measuring instruments] 6,894/10.

Storage Batteries: APOSTOLOFF and DE KARAVODINE [Manufacture of plates] 66/10.

Switchgear, Fuses, and Fittings: BRITISH CONTINENTAL ELECTRICITY Co. *(Brodie)* [Current limiting device] 2,097/10; HERBING [Oil-switch cable box] 2,311/10; ADAMS MANUFACTURING Co. *(Cutler Hammer Mfg. Co., U.S.A.)* [Switches] 2,981/10; POOLEY [Motor starters] 3,068/10; BRITISH THOMSON-HOUSTON Co. and WEDMORE [Leakage indicators for D.C. systems] 6,292/10; STANIAR and CLEGG [Fixing wiring conduit] 6,589/10; LAMB and KELVIN & JAMES WHITE, LTD. [Controlling devices] 7,260/10; DRUSEIDT [Switches] 9,399/10; HOADLEY and TINDALL [Limit switch] 10,654/10; RAUSCH [Switches] 10,799/10; HIRST and COATES [Insulating device for lamp-holder] 13,481/10; DEUTSCHE GASGLÜHLICHT A.-G. (AUERGESELLSCHAFT) [Lamp globe supports] 17,011/10; SCHATTNER [Electrically-operated switches] 22,842/10.

Telephony and Telegraphy: MARTIN [Telephone exchange] 30,458/09; GRAHAM [Telephonic apparatus] 10,965/10; CONNER and PEEL CONNER TELEPHONE WORKS, LTD. [Telephone receivers] 13,177/10; GOLDSTEIN and POOL [Central battery signalling system] 16,330/10.

Traction: CONSOLIDATED BRAKE & ENGINEERING Co. and LUARD [Vacuum brakes] 6,301/10; A.-G. BROWN, BOVERI ET CIE. [Electrically-propelled vehicles] 6,404/10.

Miscellaneous: SHORT [Electromedical apparatus] 2,187/10; SWAN, HUNTER, & WIGHAM RICHARDSON [Minimising oscillatory movements of ships, &c.] 6,878/10; REID and GOOD [Electric clocks] 11,494/10; BRITISH THOMSON-HOUSTON Co. *(General Electric Co., U.S.A.)* [Governors for centrifugal compressors] 12,946/10; SOC. ANON. ATELIERS H. CUENOD [Automatic electric governors] 20,957/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: SIEMENS-SCHUCKERTWERKE GES. [Search lights] 28,356/10.

Dynamos, &c.: ALLGEMEINE ELEKTRICITÄTS GES. [Polyphase commutator machines] 1,942/11.

Telephony, &c.: SOC. DES TELEGRAPHES MULTIPLEX (SYSTÈME E. MERCADIER) [Mono-telephonic relays] 29,271/10.

Traction: PIEPER [Electrically-driven vehicles] 1,776/11.

Miscellaneous: ADAM [Electric tightening device for cable conveyors] 1,909/11.

The following amended Specification can now be obtained.

BRITISH THOMSON-HOUSTON Co. *(General Electric Co., U.S.A.)* [Electrical propulsion of ships] 19,872/09.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: A. P. STECKEL [Electric clutch and brake mechanism for rolling-mills, &c.] 23,557/03; C. S. SCHULTZ [Electric reversing mechanism] 23,958/03; BRITISH THOMSON-HOUSTON Co. *(General Electric Co., U.S.A.)* [Control of A.-C. and D.-C. compensated series traction motors] 23,817/04, and [Rotors for turbo-alternators] 22,262/05.

Electric Ignition: H. M. CROUAN [Sparking plug] 25,582/97.

Electrometallurgy, &c.: J. HARGREAVES [Carbon electrodes] 25,519/97.

Instruments, &c.: G. F. MANSBRIDGE [Iron-free variable inductance] 22,206/05; BRITISH THOMSON-HOUSTON Co. and F. HOLDEN [Mercury ampere-hour meter] 22,620/05.

Switchgear, &c.: H. P. DAVIS [Circuit-breakers and fuses] 11,445/99; T. BELL and S. S. BERRY [Tumbler switch] 21,720/99.

Telephony, &c.: J. STOVER [Signalling apparatus] 19,411/00; D. MURRAY [Perforated tape machines] 21,880/01.

Traction: BRITISH THOMSON-HOUSTON Co. *(W. B. Potter, U.S.A.)* [Electric braking] 21,651/99; BRITISH THOMSON-HOUSTON Co. *(E. A. Sperry, U.S.A.)* [Multiple-unit control] 21,656/99; BRITISH THOMSON-HOUSTON Co. *(C. E. Barry, U.S.A.)* [Multiple-unit control] 21,657/99; W. GRIFFITHS and B. H. BEDELL [Collector for surface-contact system] 21,974/01; A. BROWN and L. W. CROSTA [Rail grinder] 23,796/03; J. F. DINEEN [Surface-contact switch] 22,616/05.

Miscellaneous: J. J. HICKS and G. H. ZEAL [Bell alarm] 25,125/97; H. H. LAKE *(Economic Machine Co., U.S.A.)* [Electrically released stop-motions for printing presses] [illegible]151/02.

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CONTINENTAL AND AMERICAN SUBMARINES

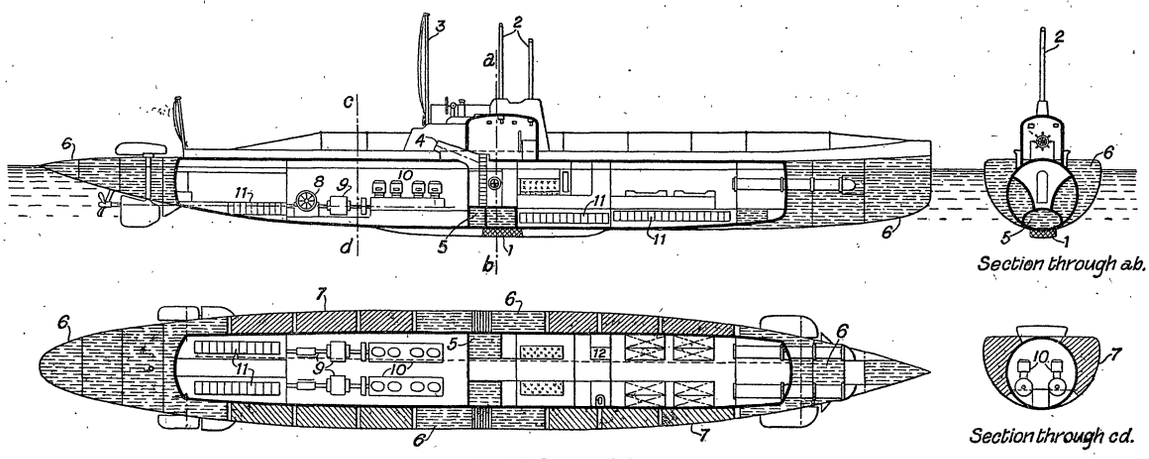
A FEW particulars of the "Germania" type of submarine built by the Krupp firm at Kiel for the German, Norwegian, Russian, and Austrian navies are given in *Le Génie Civil* (Paris). One of these boats, the *Kobben*, supplied to the Norwegian Navy, is of the following approximate dimensions:—Length, 129 ft.; beam, 12 ft.; draught, 9 ft. 6 ins.; surface displacement, 205 tons; submerged displacement, 255 tons. The hull is double, and the main fuel and water-ballast tanks occupy compartments between the inner and outer shells. The general arrangement of the boat and the position of the oil engines and motors forming the propelling machinery are seen in the figure. The engine-room and a portion of the storage battery are situated aft, the interior adjusting ballast tanks are amidships below the conning tower, with its pressure gauges and periscopes and control apparatus, while the forward part of the boat is devoted to the crew's quarters, the torpedo-room, and the main portion of the battery. The positions of the vertical and horizontal rudders are also shown.

The boat is driven by twin screws with reversing blades by a pair of four-cylinder marine type Diesel engines of 220 h.p. each, using heavy oil fuel, so that the dangers of the highly volatile spirit used in other submarines are avoided. The two electric motors coupled to the shafts are used alone when running submerged, and supplied by the battery. Each is rated at 125 h.p., and the capacity of the battery is 590 kw. hours. The maximum surface speed is 12 knots and the submerged speed is 9 knots. The radius of action at the surface when running at a cruising speed of 9 knots is 1,450 miles, and when submerged it can run 45 miles at 6·5 knots. The ordinary crew numbers six. When running on the surface, the air from the engines is drawn from the engine-room and fresh air enters through pipes. When submerged, an elaborate arrangement of air-cooling and purification is used which permits of the boat remaining under water for 24 hours without inconvenience to the crew. The preparations for diving occupy three to five minutes.

The engine-room also contains various electrically driven pumps, air compressors and fans. The battery spaces are stated to be hermetically sealed. Rapid emptying of the water-ballast tanks can be effected from a reservoir of compressed air kept constantly charged, and increased buoyancy can be obtained in case of accident by detaching a 5-ton keel. An important feature is a telephone equipment, by which communication can be established with a sunken submarine through a cable attached to a buoy which can be released from the interior. The design of the 12 new seagoing submarines which the German Navy will have completed by the end of the year is based on the type we have described.

An account is given in *The Electrical Review* and *Western Electrician* of a trip from Quincy, Mass., to Bermuda and back (about 1,600 miles), made last summer by one of the submarines of the United States Navy, the *Salmon*. It is stated that this record voyage is largely due to her improved electrical equipment, although, naturally, few details are available. The boat is a development of the original Holland type, and is 135 ft. long and of 14 ft. beam. She is a twin-screw craft, propelled on the surface by two 300 h.p. petrol engines, and when submerged by electric motors supplied by storage batteries. Owing to improvements in the electrical equipment, a maximum submerged speed of 12 knots is obtainable, which is stated to be considerably higher than that of any European submarine. The radius of action when submerged has also been increased to 115 nautical miles at an economical speed. There has also been a considerable reduction in the time necessary to change from surface to submerged running conditions, a change which can now be accomplished in three minutes. During speed trials a surface speed of 14 knots has been maintained for 70 hours continuously, but the run to Bermuda was carried out chiefly at a cruising speed of from 6 to 10 knots. Electricity is used for various auxiliary purposes on board, such as for ventilation, working air-compressors, &c., and also for cooking. She has dived to a depth of 200 ft., which is stated to be considerably in excess of the depths accomplished by European submarines.

It may be interesting, for the sake of comparison, to recall the principal data of some of the French "submersibles" which were given in ELECTRICAL ENGINEERING, June 2nd, 1910. The latest boats there described are considerably larger than either of those described above. They displace 800 tons, and are equipped with engines of about 2,000 h.p. Their submerged speed, using only the electric motors, is, however, only 10 knots. The smaller class to which the ill-fated *Pluviôse* belonged displaced 398 tons, and were designed for a submerged speed of 7¾ knots. It is believed that the French Admiralty contemplate the building of submarines of 1,000 tons displacement.



SUBMARINE *Kobben*, SUPPLIED TO THE NORWEGIAN NAVY.

Telegraph Traffic and Movements of Cable Ships.—The Indo-European Telegraph Co.'s lines were down between Odessa and Kertch on the 14th inst., but were repaired on the same day. The cable between Constantinople and Odessa also stopped working on the 14th inst. On the 16th inst. the cable between Lagos and Kotonou was interrupted. The *via* Hanekin, Batoum, and Tao routes were repaired on the same day. The Compagnie Français des Cables Télégraphique has just finished with repairs in the West Indies, but now has to give attention to its section between Australia and New Caledonia, which broke down on the 18th inst. The Eastern & South African Telegraph Co. suffered interruption to their cables between Madagascar and Reunion, and Reunion and Mauritius, on the 19th inst., which isolates the island of Reunion. On the 20th inst. the cable between Lagos and Kotonou was restored. Our last advices *re* the c.s. *Mackay-Bennett* were that she was engaged at Havre on the section running from there to Waterville.

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LOCAL NOTES

Belfast: *Cavehill and Whitewell Tramways.*—An arbitration commenced in London on Friday to determine the price to be paid by the Belfast Corporation for the Cavehill and Whitewell Tramways Co. Mr. Lynden Macassey is arbitrator. A few years ago the Corporation decided to purchase these lines at the price of £60,000, but the Bill was rejected in Parliament, as the majority of the ratepayers considered the price excessive. The press are excluded from the inquiry now being held.

Blyth: *Tramways.*—The Ashington Council have asked the Blyth, Newbiggin, Bedlington, and North Seaton Councils to attend a conference, with a view to the promotion of a tramway scheme for the district.

Gravesend: *Tramways.*—It is stated that a private firm has proposed to connect the tramways systems at Dartford and Gravesend, thus making it possible to travel from London to Gravesend by electric car.

Leeds: *Coronation Illumination.*—The City Council is recommended to make a fixed charge of 7s. 6d. to cover the cost of inspecting and connecting Coronation illumination installations. This charge is to include supply of current for a week.

London: *County Council: Tramways.*—At the meeting on Tuesday the proposal to remove the horse tramways in Liverpool Road was referred back. During the course of the discussion the Chairman of the Highways Committee said that the tramway receipts showed a tendency to decline, being now 10·35d. per car mile, against 12·16d. in the early years of the service.

Bethnal Green: Electricity Supply.—After another heated discussion the Council have decided not to enter into an agreement with the Shoreditch Borough Council for a supply of electricity in bulk, but will negotiate with a view to the Shoreditch Council supplying individual consumers in Bethnal Green.

Hampstead: Tramways.—On condition that the L.C.C. withdraws the proposal to construct tramways from Finchley Road to Chalk Farm, from Maida Vale to Upper Avenue Road, and from Marylebone Road to Swiss Cottage, together with the clauses requiring the Hampstead Council to contribute towards the cost of street widenings for the Edgware Road tramways, no opposition is to be made to the other proposed tramways in Hampstead.

Islington: Shop Lighting.—Mr. Albert Gay, the Borough Electrical Engineer, has called the attention of his Committee to the displacement of electric lamps outside shops in the main thoroughfares by gas, and suggests that some action should be taken to meet this competition.

Marylebone: Supply of Electrical Vehicles.—At the last meeting of the Council, Councillor Duncan Watson referred to the recent scheme for supplying energy to electrical vehicles at ½d. per unit as "an impudent advertisement on the part of some of the Council's officials." The Chairman of the Electric Supply Committee stated that nothing had come of the proposal.

Scarborough: *Suspension of Tramways.*—The Corporation have resolved to apply to the Board of Trade for an order determining the powers of the Scarborough Tramways Co., on the ground that the tramways have been discontinued for a period of three calendar months.

Trowbridge: *Electric Lighting.*—A contract has been signed with a Bristol company for the erection of an electric generating station. The company to be formed will be a non-statutory concern, and the agreement provides for the Council's support in the event of a Provisional Order being applied for. In the meantime, the Council give their consent to the breaking up of the roads for the purposes of the undertaking. Further, the Council has the right to purchase at the end of 21 years or every subsequent seven years.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Brighton.—A 300-kw. three-phase induction motor-generator is required (see an advertisement on another page).

Dover.—A loan of £2,000 is to be taken up for plant extensions to supply St. Margaret's Bay district.

Ealing.—An inquiry was held this week concerning a loan of £20,000 for electrical extensions.

Edinburgh.—Tenders are invited by March 7th for switchboard extension. (See an advertisement on another page.)

Halifax.—A water-cooling tower is required for the Electricity Works. Particulars from the Borough Electrical Engineer, and tenders by February 28th.

India.—The Calcutta Electric Supply Corporation, Salisbury House, London Wall, require four electrically driven centrifugal pumps. Specifications from Messrs. Kennedy & Jenkin, 17 Victoria Street, London, S.W.

Kettering.—It is proposed to extend the plant at the power station at an estimated cost of £13,100.

London: *Stepney.*—The Finance Committee of the L.C.C. recommend a loan of £3,060.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Tenders are invited for the wiring of the Trade School for Girls, Belvedere Place, S.E. (See an advertisement on another page.)

It is proposed to rebuild and enlarge Gresham College, Basinghall Street.

PROVINCES.

Aberdeen.—Additions to factory of Messrs. G. Mellis & Son, Ltd., in Russell Road. Additions to Engineering Works in Ashgrove Road. Architect, George Watt. New church and hall at Mounthooley.

Belfast.—New hospital, Templemore Avenue.

Edinburgh.—Tenders are invited for the electric lighting of 41, Lauriston Place. Clerk to School Board, Castle Terrace.

Fifeshire.—New school at Wemyss.

Glasgow.—Electric lighting of Cathcart Street School.

Guildford.—The question of electric lighting of the Guardians' premises has been referred to a Committee.

Horsham.—Electric lighting at Workhouse.

Liverpool.—Home for sick nurses at Mill Road Infirmary.

Manchester.—Municipal School in Atherton Street.

North Berwick.—Convalescent Home. Borough Surveyor.

Paisley.—New school in Renfrew Road.

Perth.—New Infirmary.

Plymouth.—Completion of St. George's Church.

Rhondda.—New school at Tylorstown.

Wigan.—Elementary school at Goldborne.

Worksop.—New church.

MISCELLANEOUS

Acton.—Tenders are invited for a twelve months' supply of house fuse-boxes, low-tension cables, lead-covered cables, and steel conduits. Particulars from the Town Clerk, and tenders by February 28th.

Bristol.—Tenders are invited for arc-lamp carbons, globes, joint and fuse boxes, meters, &c. (See an advertisement on another page.)

Great Central Railway Co.—Tenders are invited for various stores, including electric light materials. Particulars from the Stores Superintendent, Gorton, Manchester, and tenders by March 7th.

Hornsey.—The Council require a supply of meters, distribution, joint and fuse boxes, cable, &c. Particulars from the Borough Electrical Engineer, and tenders by March 6th.

Ilford.—Tenders are invited for arc-lamp carbons, cables, incandescent lamps, joint-boxes, and meters. Particulars from the Electrical Engineer, and tenders by February 28th.

London: *Fulham.*—The Council invite tenders by March 1st for a year's supply of electrical stores.

Hackney.—The Electricity Committee recommend the installation of two water-tube boilers, pump, pipework, &c., at an estimated cost of £4,300.

Marylebone.—The date for receiving tenders for stores has been extended until March 15th. Particulars were given in our last issue. (See an advertisement on another page.)

Russia.—The *Board of Trade Journal*, quoting from the "Official Messenger," states that arrangements have been made for the erection of five wireless telegraph stations in 1911, namely, two in the Far East and one each at Reval, Taganrog, and Novorossisk.

A project is under discussion for the construction of an electric tramway forty-six miles long from Moscow to Troitsko-Sergievskiy, at an estimated cost of £918,000.

In the proposed Budget for 1911 a large sum is included for radio-telegraph apparatus.

Nottingham.—The Tramways Committee anticipate an expenditure of £42,906 in the coming financial year on tramway track reconstruction.

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South Africa.—It is stated that the encouragement given by the Durban Council to domestic uses of electricity has created a demand for electric ovens.

Twickenham.—The Council invite tenders for lighting the whole or a portion of their streets by electricity. Particulars from the Surveyor, Town Hall.

TENDERS RECEIVED AND ACCEPTED

Dublin.—Messrs. Wm. Coates & Sons, Leinster Street, Dublin, have secured the contract for the electric lighting of the whole of the new and old buildings at the Richmond Asylum. Over 2,000 lights are to be installed.

Fleetwood.—The tender of Messrs, Dick, Kerr & Co. for a new balancer booster set at £165 has been accepted.

Grimsby.—The tender of Messrs. J. Beckitt & Co. for the electric lighting of the Municipal Hall, Victoria Street, has been accepted at £24 3s.

Horsham.—A contract has been placed with Messrs. Chamberlain & Hookham, Ltd., for a twelve months' supply of 12-ampere meters.

London: *L.C.C.*—The following tenders were received for the electric lighting of the Wandsworth fire station:—A. Hawkins & Sons, £157 10s.; Malcolm & Allan, Ltd., £174; W. J. Fryer & Co., £190 10s. The lowest tender is recommended for acceptance.

The following tenders have been received for the overhead electrical equipment of the Old Kent Road Stores Depôt:—Johnson & Phillips, £219 17s.; G. E. Taylor & Co., £233 4s.; Clough, Smith & Co., Ltd., £265 9s.; Dick, Kerr & Co., Ltd., £274; and E. Lawrance & Sons, £340. The tender of the first-named is recommended for acceptance.

Hammersmith.—Messrs. Cowans, Ltd., are to supply 20 additional switchboard panels at £16 6s. per panel.

A contract is to be entered into with the Premier Accumulator Co., Ltd., for maintaining the battery at the electricity works at £45 per annum for ten years.

Four transformers are to be hired from the British Electric Transformer Co. for one year in connection with the Shepherd's Bush Exhibition, at the charge of £135.

Wolverhampton.—The tender of the British Electric Transformer Co., Ltd., for two 300-kw. transformers at £456 has been accepted.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 10s. to £57 15s. per ton (last week, £57 12s. 6d. to £57 17s. 6d.).

Bankruptcies.—J. Perkins, 30A Ebrington Street, Plymouth, has been adjudicated bankrupt.

The first meeting of creditors in the bankruptcy of George Barker, electrical engineer, of Leeds and Harrogate, will be held, on March 3rd, at 11 a.m., at the Courts of Justice, Clifford Street, York.

J. W. Barnett, electrical engineer, 25 Waterloo Road, Burslem, trading as Barnett and Hyde, has been adjudicated bankrupt.

A receiving order has been made against George Barker, electrical engineer, Wood Grove, Roundhay, Leeds, and John Street, Harrogate.

A receiving order has been entered against V. G. Burkit, electrical engineer, 38 Park Row, Bristol.

Liquidations.—A meeting of the Contraflo Condenser Co., Ltd., will be held at 3 and 5, Crown Court, Old Broad Street, London, E.C., on March 6th, at 12 noon, to hear the liquidator's account of the winding-up. A similar meeting of the Contraflo Continental Patents Co., Ltd., will be held on the same day at 12.15 p.m.

A meeting of the Yorkshire District Light Railways Syndicate, Ltd., will be held on March 7th, at 4 Central Bank Chambers, Leeds, at 12 noon, to hear the liquidator's account of the winding-up.

Coronation Illuminations.—Siemens Brothers' Dynamo Works, Ltd., remind their friends of the necessity of applying early for designs for special Coronation-illumination schemes. Orders and inquiries can only be dealt with in strict rotation. Although they are prepared to quote for complete schemes, the firm will, in accordance with their usual practice, sublet the actual wiring and erection to contractors to whom they will be pleased to send copies of the new list mentioned in another column.

APPOINTMENTS AND PERSONAL NOTES

After some opposition a proposal to increase the salary of Mr. T. Roles, City Electrical Engineer at Bradford, from £600 to £700 per annum as from April 1st next, with two subsequent yearly increases of £50 each, has been passed by the Corporation.

A solid silver rose-bowl on an ebony plinth has been presented to Alderman F. Larard in appreciation of his many years' connection with the Hull Tramways undertaking.

Mr. H. Ranson, of Falkirk, has been appointed Borough Electrical Engineer at Falkirk at a salary of £200 per annum. Mr. Ranson is at present Assistant Electrical Engineer to the Scottish Electric Power Co., at Falkirk.

Mr. J. W. Oake, Chairman of the Bermondsey Lighting Committee, has resigned. It will be remembered that at the last meeting of the Council Mr. Oake's son was nominated for the post of third engineer-in-charge at the Bermondsey Electricity Works, but the recommendation was referred back.

A charge engineer is required at the Avonmouth sub-station of the Bristol Electricity Department (see an advertisement on another page).

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

City of Buenos Aires Tramways (1904).—A balance dividend of 1s. 3d. per share is recommended for 1910, transferring £3,800 to general amortisation fund, and carrying forward £65.

Dundee & Broughty Ferry Tramways Co.—Interim dividend of 6 per cent. on the preference shares.

Dublin & Lucan Electric Railway Co.—Dividend of 5 per cent. on the preference shares, carrying £521 forward.

City of Buenos Ayres Tramway Co. (1904).—The net revenue for 1910, consisting of annuity payable by the Anglo-Argentine Tramways Co., amounted to £65,865. A dividend of 5s. per share is recommended, transfering £3,800 to General Amortisation Fund, and carrying £65 forward.

Smithfield Markets Electric Supply Co.—There was a net profit of £1,445 15s. for 1910, of which £1,000 are transferred to sinking fund for redemption of debenture stock, and the balance carried forward.

Mansfield & District Tramways.—The net profit for 1910 was £2,483. A dividend of 3 per cent. is recommended, transferring £1,200 to depreciation, and carrying forward £447.

London United Tramways.—The net revenue for 1910, after meeting debenture interest was £30,814, of which £30,000 are transferred to renewals and contingencies fund, and the balance carried forward. The net revenue increased by £7,788. During the year over 3,500 rail joints have been cast welded, practically the whole of the rolling stock has been completely overhauled, and sixty cars have been equipped with covered tops. In addition, new chain-grate stokers have been installed at the power station.

Oxford Electric Co.—Dividend on ordinary shares at the rate of 4¼ per cent. for December half-year, making 7¼ per cent. for the year.

Anglo-Argentine Tramways Co.—The net revenue for 1910 was £65,865, and after paying a dividend of 5s. per share for the year, £3,800 have been transferred to general amortisation fund and £65 carried forward.

Bath Electric Tramways Co.—At the annual meeting last week it was stated that the Company's net revenue had increased by £2,236. It is proposed to issue debentures in order to extend the tramways to Saltford and in other directions.

Dublin United Tramways Co.—Mr. W. M. Murphy presided at the half-yearly meeting in Dublin last week, and specially referred to the question of track renewal, for which no less than £12,000 had been set aside that half-year. He said it was to their interest to maintain the undertaking in as perfect a condition as possible, as in the unlikely event of the local authorities wishing to purchase, the "then value" of the undertaking would be greater than was represented by the capital account of the company, and, moreover, they were entitled to 30 per cent. for goodwill. The large number of accidents on the company's lines was commented upon by one shareholder, but the Chairman replied that, in comparison with other companies, they were not paying excessively for insurance.

Liverpool Overhead Railway Co.—The net balance available for dividends for the December half-year is £11,672, and dividends of 5 per cent. on the preference shares and 1½ per cent. on the ordinary shares are recommended. The number of

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passengers carried was 5,391,300, compared with 5,215,551 in the corresponding period last year.

Yorkshire (West Riding) Electric Trams.—After meeting all charges, but not declaring any dividend on the ordinary shares for 1910, there is a balance of £2,000.

British Electric Transformer Co.—There was a net profit of £12,187 for 1910, and a dividend of 6 per cent. for the year is declared on the ordinary shares.

City of London Electric Lighting Co.—After placing £45,000 to reserve, and £4,000 to dividend equalisation fund, a dividend at the rate of 7 per cent. per annum is declared upon the ordinary shares, carrying forward £27,000.

National Telephone Co.—There is an available balance of £430,840 14s. for the December half-year, and after meeting the first, second, and third preference share dividend and 6 per cent. per annum on the preferred stock, a dividend of 6 per cent. per annum is recommended on the deferred stock. The sum of £200,000 is to be transferred to reserve and £2,091 carried forward.

London Electric Supply Corporation.—The net balance available for 1910 is £39,272, and a dividend of 2 per cent. is declared upon the ordinary shares, transferring £5,000 to reserve, and carrying forward £3,660. A new contract for the supply of power to the London, Brighton, & South Coast Railway Co. up to 30,000,000 units has been entered into for 14 years, and 14,000 h.p. of additional plant have been ordered.

Northampton Electric Light & Power Co.—A dividend of 6 per cent. has been declared upon the ordinary shares for 1910, carrying forward £1,572.

St. James & Pall Mall Electric Light Co.—At the annual meeting last week it was stated that the agreement with the London Electric Supply Co. to manage the portion of that company's business in the St. James & Pall Mall Co.'s area had worked satisfactorily.

Bournemouth & Poole Electricity Supply Co.—A final dividend at the rate of 6 per cent. per annum for the December half-year, making 5½ per cent. for the year, has been declared.

Kensington & Knightsbridge Electric Lighting Co.—The net revenue for 1910 is £8,875, and a dividend at the rate of 10 per cent. per annum is recommended for the half-year, making 9 per cent. for the year. The balance carried forward is £1,500.

Bastian Meter Co.—The accounts for 1910 allow of a 3¾ per cent. dividend on the ordinary shares, carrying forward £646.

Westminster Electric Supply Co.—After allowing for depreciation, sinking fund, &c., the net balance for 1910 is £40,936. A dividend at the rate of 10 per cent. per annum is recommended on the ordinary shares.

South Metropolitan Electric Light & Power Co.—The net profit for 1910 was £10,546. After meeting the first and second preference dividends, carrying £2,000 to depreciation, and writing £800 off balance of Crystal Palace account, the sum of £1,242 is carried forward.

Charing Cross, West End, & City Electricity Supply Co.—The accounts of the West End undertaking for 1910 show a profit of £19,954, after allowing for the interim dividend on the ordinary shares. A final dividend for the second half of the year, making 5 per cent. for the year, is recommended, carrying forward £9,954, against £5,163 last year. The City undertaking shows a balance of £23,576, after meeting the preference dividend, compared with £13,288 last year.

Underground Electric Railways Company of London.—The accounts for the second half of 1910 shows a surplus of £26,428, and after paying interest at the rate of 1 per cent. on the 6 per cent. income bonds, a balance of £262 is carried forward. Seven of the eight new Parsons' turbines are now working at Lot's Road, and two sets of storage batteries, each of 5,000 ampere hours capacity, and a 1,500 kw. turbo-alternator have been installed during the past six months. The output during the half-year was 66,038,900 units, against 62,500,000 units during the corresponding period of 1909.

NEW COMPANIES

NATIONAL HYDRO-ELECTRIC COMPANY OF MONTREAL.—This company has been formed in Canada with a capital of £250,000.

NORTH LANCASHIRE TRAMWAYS POWER & CONSTRUCTION SYNDICATE: Registered by Milner & Bickford, 10 Moorgate Street, E.C. Capital, £10,000. Constructors of tramways, railways, &c.

LESKOLE & CO.: Palace Works, Enfield. Capital £1,000. Consulting, advisory, or superintending electrical and mechanical engineers.

CARBORUNDUM.—Registered by Treherne, Higgins & Co., 7 Bloomsbury Square, W.C. Capital, £10,000. To adopt agreement with the Carborundum Co. (U.S.A.).

JOHN HIND & SONS, 9 Ulster Chambers, Belfast. Capital, £5,000. To acquire electrical and general engineering business of John Hind, jun.

ELECTRIC HIRING SYNDICATE, Bank Buildings, Kingsway, London. Capital, £1,000. First directors, J. L. Nicholson and R. Borlase Matthews.

CARNET & PEARN.—Registered by Jordan & Sons, 1 Chancery Lane, London, W.C. Capital, £4,000. Electrical engineers and contractors.

PORLOCK & DISTRICT ELECTRIC SUPPLY CO., West Cottage, Porlock. Capital £2,500. Electric supply in Porlock and elsewhere.

Institution of Electrical Engineers: Students' Section.—The annual dinner of the Students' Section was held on Saturday, under the chairmanship of Mr. E. W. Moss, at the Trocadero Restaurant, London, and was most successful. The toast of the Institution was proposed by Mr. A. J. Paterson, vice-chairman of the Students' Section, and was responded to by Mr. S. Z. de Ferranti, President of the Institution. Referring to educational matters, Mr. Ferranti said that there was a tendency to set the standard of knowledge too high, and the standard of application too low. Knowledge was too often obtained to reach the standard and to pass examinations, and the application of it neglected. When anything new was learned, the student should think how to apply the new fact. There were unfortunately many teachers with immense knowledge, but who were bad teachers because they did not appreciate the importance of this application. In proposing the toast of the Students' Section, Mr. W. H. Patchell emphasised the necessity for learning foreign languages and for business training. He also referred to the importance of a sound knowledge of mechanical details. Too many failures of electrical apparatus were due to bad mechanical construction. Mr. E. W. Moss replied, referring to a possible visit of the Students' Section to Norway and Sweden, and asking that the Council of the Institution should have abstracts printed of the students' papers. Prof. S. P. Thompson, replying for the colleges, upheld Mr. Ferranti's views on educational methods, and pointed out how the application of odd facts in science often led to great advances, instancing the case of the peculiarity of erbium in giving a line spectrum, which was applied with such success in the incandescent gas mantle. Responding for the guests, Major O'Meara said that administration in technical questions should be conducted by technical men, and urged the students to aim at becoming administrators.



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ELECTRICAL ENGINEERING

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SUMMARY

Our monthly supplement on Electrical Engineering in Mines is included in this issue. It opens with an article giving the main features of the report of the Home Office Committee on Electricity in Mines and the proposed new special rules. Reports are given of the adjourned discussion on Messrs. Dixon & Baxter's Paper before the Institution of Mechanical Engineers, describing the electrical coal hoists at Clydebank, and of a discussion by a branch of the Association of Mining Electrical Engineers on three-phase haulage motors. The verdict of the jury, to the effect that the cause of the Hulton Colliery explosion was not electrical, is announced. Other short articles contain a summary of Electrical Mining Patents for February, and descriptions of a transformer for mining bells and some oil-immersed motor starters.

The whole of the printing machinery employed in the production of the *Illustrated London News* and the *Sketch* has been converted to electric drive. Push-button control with solenoid-operated switchgear is adopted for all the larger machines, and the installation possesses several features of especial interest. (Page 107.)

At a meeting of the Illuminating Engineering Society on Feb. 16th, the subject of school lighting was discussed. Some figures of the cost of school lighting were given by Mr. C. A. Baker, of the London County Council, and figures of illumination in various London schools were given by Mr. J. S. Dow. It was shown that the intensity of lighting in German schools is greater than in England, where the average for desks is about 2 ft.-candles. In Germany about 8 ft.-candles is the average. (Page 108.)

A Paper by the late Mr. J. R. Barr, discussed on February 14th by the Glasgow Section of the Institution of Electrical Engineers, explains the conditions essential to parallel running. The author considered that dampers are unnecessary if the natural period of oscillation of the alternator is greater than 1·4 times the period of the impressed engine impulses. (Page 109.)

The subject of gas *versus* electricity was discussed at a meeting of the Dublin Section of the Institution of Electrical Engineers. Some striking examples of the economy effected by the adoption of electric lighting and power were given. (Page 111.)

A sub-committee of the Works Committee of the Holborn Borough Council have drawn up a new scheme for the lighting of the borough, and propose to invite tenders from both the electric lighting and gas companies. (Page 110.)

Among the specifications published by the Patent Office on Thursday was one by the British Thomson-Houston Co. for a process of manufacturing tungsten filaments. The filaments are drawn down from rods of powdered tungsten which have been sintered at a very high temperature, and then allowed to cool very gradually to render them ductile.—Apparatus for the automatic acceleration, switching off, and braking of traction motors according to a predetermined speed-

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distance curve is described by W. Wittek.—A patent for a belt for train-lighting dynamos expires on Saturday after the full life of fourteen years. (Page 112.)

AT the meeting of the National Telephone Co. last week it was stated that certain differences have arisen between the company and the Postmaster-General which may necessitate arbitration. The company have hopes, however, that arbitration will not be necessary in regard to the valuation of the greater portion of their undertaking. (Page 113.)

THE provisional programme of the convention of the Incorporated Municipal Electrical Association, to be held at Brighton in June, has been issued. (Page 112.)

THE annual dinner of the Manchester Local Section of the Institution of Electrical Engineers was held last week. (Page 113.)

THE Hendon Council have decided to take over the trolley omnibus system which has been running experimentally.—Swansea Corporation contemplate purchasing the local tramways undertaking.—Mr. Stephen Sellon puts the value of the Cavehill and Whitewell tramways at £37,357, and Mr. H. A. Cutler, the Belfast City Surveyor, at £19,371. Arbitration for the purchase of the line is still proceeding.—Halifax Tramways Committee intend to call the attention of the Municipal Tramways Association to the objectionable Standing Order 22.—Mr. Bromley Holmes, Consulting Engineer to the Liverpool Corporation, is in favour of extending the rateable value system of charging.—The adoption of Edison battery tramcars is contemplated in Melbourne. (Page 113.)

A 1,000-KW. turbo-generator is required at Aberdeen; 500-kw. generating set at Eccles; barometric jet condenser at Middleton; two 200-kw. Diesel engine sets at Reigate; cables at Watford and Partick, and two generating sets at Kettering. It is proposed to spend £60,000 upon a new system of generation at Stoke-on-Trent; loans for electric lighting have been sanctioned at St. Pancras, Stepney, and Woolwich; Greenock Corporation are taking up a loan of £22,000, and an interesting scheme for the utilisation of waste heat is under consideration at West Hartlepool. Tramway materials are required at Colchester and Nottingham. (Page 114.)

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., declare a dividend of 15 per cent.; Notting Hill Electric Lighting Co., 6 per cent. and a bonus of 2 per cent.; the Waste Heat Company, 8 per cent.; Chelsea Electricity Supply Co., 5 per cent. The Welsbach Company is to be reconstructed. (Page 116.)

ARRANGEMENTS FOR THE WEEK

THURSDAY, MARCH 2ND.

Rontgen Society.

8.15 p.m. At 20 Hanover Square, London. "Some Experiments with a 10,000-volt Storage Battery," by A. A. Campbell Swinton.

SATURDAY, MARCH 4TH.

Junior Institution of Engineers.

3 p.m. Visit to the L.C.C. generating station, Greenwich.

MONDAY, MARCH 6TH.

Institution of Electrical Engineers: Newcastle Section.

7.30 p.m. At Armstrong College. "The Laying and Maintenance of Transmission Cables," by C. Vernier.

Royal Society of Arts.

8 p.m. Cantor Lecture I.: "Applications of Electric Heating," by Prof. J. A. Fleming, F.R.S.

TUESDAY, MARCH 7TH.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At Municipal School of Technology. "The Development of the Diesel Oil Engine," by W. Cooper.

WEDNESDAY, MARCH 8TH.

Institution of Electrical Engineers: Birmingham Section.

7.30 p.m. At the University. "The Non-Salient Pole Turbo-Alternator and its Characteristics," by S. P. Smith.

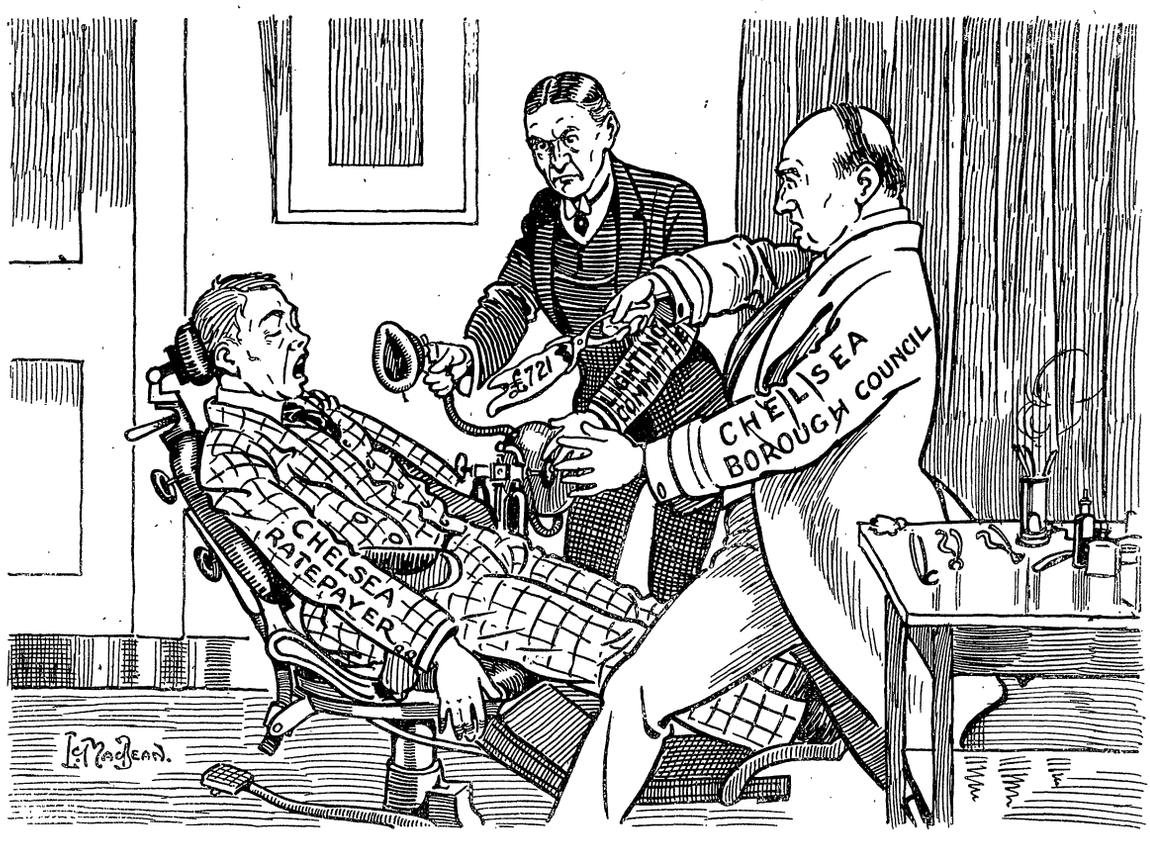
THURSDAY, MARCH 9TH.

Institution of Electrical Engineers.

8 p.m. "The Laying and Maintenance of Transmission Cables," by C. Vernier.

Institution of Electrical Engineers: Dublin Section.

8.20 p.m. At Royal College of Science.



"GIVING HIM GAS."

As stated in our last issue, the Chelsea Borough Council, at the instance of the Lighting Committee, have made a contract with the Gas Co. for street lighting for another seven years, although the price paid by the ratepayers will be £103 per year higher than that quoted by the Electric Lighting Co.

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ELECTRIC DRIVING AT A LONDON PRINTING OFFICE

WITHIN the last two months the whole of the printing machinery employed in the production of the well-known London weekly journals, the *Illustrated London News* and the *Sketch*, has been converted to electric drive. The works have, in fact, been completely reorganised, under the direction of Mr. E. H. Rudd, the general manager of the printing department, and his comprehensive scheme was only rendered possible by the adoption of electric drive. Mr. Rudd has had the assistance of the firm's consulting engineer, Mr. Frank Broadbent, in connection with the electrical portion of the work. The change-over has been effected gradually, so as not to interfere with the regular printing work, and the steam plant is now dismantled. Two horizontal compound engines and two beam engines with their boilers have been displaced, and the release of the valuable space occupied by these for a much-needed extension of the printing plant was an important consideration in determining the proprietors to effect the change. Apart from this, however, a very considerable economy in working expenses will undoubtedly be effected, and the removal of a large amount of shafting will considerably improve the appearance of the rooms and the safety and convenience of working.

The building is situated in Milford Lane off the Strand, and is divided into two portions. The lighting and power

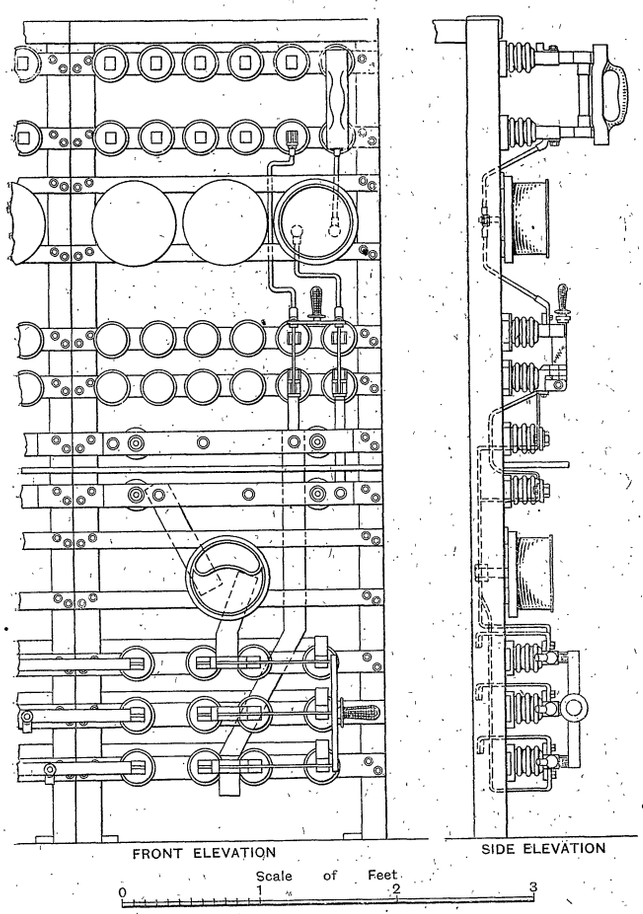


FIG. 1.—SKELETON-PATTERN POWER SWITCHBOARD.

installation is correspondingly divided into two parts, and either section can be supplied from the mains of one or other of two supply companies, the Metropolitan Electric Supply Co. and the Charing Cross, West End & City Electricity Co. Each section is supplied alternately from one of the two companies, a week at a time, in order that they shall share equally the total consumption, but provision is made for switching both sections on to one supply in case of emergency. Each service is three-wire, 200 volts D.C., with 0·5 sq. in. outers. Aron three-wire meters are employed, provided with Merz maximum-demand attachments, which record the maximum demands averaged over half-hour intervals.

The main power switchboard, constructed by Spagnoletti, Ltd., is erected in a separate chamber, together with the lighting boards for the two sections, one on each side. As shown in Fig. 1, it consists of a skeleton steel frame about six feet square, and the fuses, switches, &c., are mounted on porcelain insulators bolted to the steel bars, the switch pivots, connections, fuse blades, &c., being cemented into the insulators. All the connections on the board are of copper strip, and there is no necessity for any space at the back. Eight circuits are provided for, two for 200 amperes and six for 100 amperes. Each circuit has an ammeter, switch-handle cartridge fuses, and a double-pole switch. The leads from this board to the distributing boards on the various floors are heavily braided, armoured, single-core cables, carried along the brick walls. The two 100-volt lighting boards are connected on each side of the three-wire system.

The power distributing boxes on the various floors are of cast-iron, and the armouring of the cables is bonded to them. They have double lids, and only one pole can be exposed at a time. An ammeter is provided at each distributing box with a multiple-contact switch, connected to shunts in all the circuits, so that the current taken by any motor can be

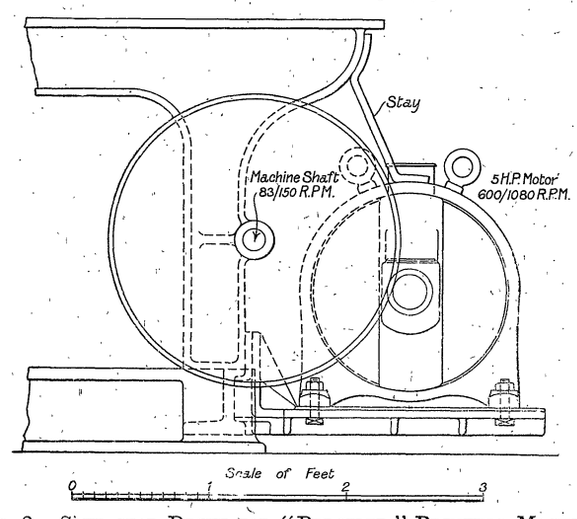


FIG. 2.—SPUR-GEAR DRIVE FOR "PERCELER" PRINTING MACHINE.

measured without interfering with the circuit. From these boxes, armoured twin-core rubber cables are run to the controlling switchgear for the individual motors; the connection between controller and motor is by vulcanised rubber cable in steel conduit. To allow for adjustment of the motor the gland on the motor case is connected to the conduit by a short length of flexible steel tube.

The motors and switchgear were supplied by Messrs. Electromotors, Ltd. (Openshaw, Manchester), to the specifications of Mr. Broadbent. Four large two-feeder "Perceler" flat-bed printing machines are each driven by a shunt motor with spur-gearing bolted up to the machine as illustrated in Fig. 2. A stay is provided to take the upward thrust. The motors are interpole machines with a very wide range of speed obtained by shunt regulation, and are very heavily compounded. The control gear for these large machines is enclosed in a glass-fronted cast-iron box, and is worked from push-buttons on the side of the machine. It consists of a solenoid-operated starter with a separate solenoid main switch and a double-pole manually-operated switch. The shunt-regulating resistance is in a separate box, and as the motors are heavily compounded and the machines rarely run at the highest speeds, there is no provision for ensuring that all the field resistance is out on starting up. Should the machines be set for the highest speed, the motors would practically start up as series motors. During running, the load on the motor fluctuates between 12 and 20 h.p. The machines are stopped by breaking the circuit of the main-switch solenoid and not by short-circuiting it. The control is of Messrs. Marryat and Place's make.

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Other smaller two-feeder and single-feeder flat-bed machines are driven by smaller motors. Besides the four motors referred to, twelve of 7½ h.p., twelve of 5 h.p., and six smaller ones are installed. Most of the larger ones are driving presses. Spur-gearing with "Unica" pinions is employed in most cases, but there are a few instances of belt drive with jockey pulleys. All the machines have push-button control as described. The folding and stitching machine shafts are controlled by a single solenoid starting switch, brought into action by closing the manually-operated double-pole main switch. The motors for the folders are, in some cases, hung from the ceiling, or supported on brackets from the wall in order to save space, and belt drive has been provided in these cases. Speed regulation is effected in all cases by shunt field control, the use of interpoles and compound windings again making it unnecessary to provide for full field on starting.

In the case of the stitching machines, a very neat arrangement has been produced by mounting them on a platform with belt drive from a line shaft underneath. Among the other machines in use are two large guillotines, three motor-dynamos in the electrotyping room, and a group of bevelling, roughing, and planing machines, &c., in the foundry, driven from line shafting and a single 7½ h.p. motor. The control of these motors is semi-automatic, as in the case of the folders, and a no-voltage release on a switch at the distributing box of this floor protects all the motors against restarting after a stoppage of supply.

Besides the above machines, there are two Cottrell sheet-feed rotary machines, driven by 10 h.p. motors, and equipped with Kohler push-button control. Four push-button stations are provided, one on either side of the delivery end, one at the side of the press, and one underneath, so that the operator can inch the press round when plating the cylinder. Two more of these machines are now being erected, and a further two will be installed shortly. New plant is also to be installed in the foundry; this comprises two new baths, one for electrotyping and one for nickel-steel electros, and a motor-generator capable of supplying 1,600 amperes.

The Chapman Electric Neutraliser is installed in connection with the rotaries and other machines. The object of this device is to dispel the static charge produced on the paper during printing, which causes the sheets to stick to one another and to the machine, and in dry atmospheres produces "offset," bad register, and low working speeds. The "Neutraliser" consists of a small motor with slip-rings to supply an alternating current to a high-voltage transformer, one terminal of the secondary of which is connected by rubber-insulated cable to a series of needle-points placed just above the sheet as it enters and leaves the press. A brush discharge is produced, and this apparently causes the paper to loose its charge. One transformer will supply a number of machines. The sole agent for this device in this country is Mr. John Robertson (Wardrobe Chambers, Queen Victoria Street, E.C.).

A Waygood electric lift with drum-drive for carrying the sheets from the printing rooms to the folding rooms is being erected. This will be a 1½-ton lift, with automatic control from push-buttons at the different floors. Another lift, originally driven from the main shafting with fast and loose pulley gear, is being provided with electric drive by belting the gear up to a motor.

The wiring for the lighting is carried out in solid-drawn screwed conduit, and the pipes are run into the cast-iron switch and ceiling-rose boxes to ensure continuity. All the lights are plain flexible pendants, with enamelled metal shades. There are about 350 lights in all; those along the middle of the rooms and over the machines are 50 c.p., and 32 c.p. along the side benches. Tantalum lamps are employed on account of the excessive vibration due to the machines. A special arrangement has been provided in the compositors' room. Here there is a general illumination by a few 100-c.p. Siemens "Onewatt" drawn tungsten filament lamps, hung high up and provided with white translucent shades, supplemented by 50-c.p. Tantalum lamps, with dark enamelled shades directly over each compositor's desk. The switches are placed alongside each row of desks on the wall, no switch-holders being used. The contractors for the power equipment were Messrs. Electromotors, Ltd., and for the lighting, Messrs. Pinching & Walton.

In conclusion, we should like to express our indebtedness to Mr. E. H. Rudd, General Manager of the Printing Department of The Illustrated London News & Sketch, Ltd., for giving us facilities to inspect the plant, and to Mr. Frank Broadbent for kindly conducting our representative over the premises, and explaining the various features of the installation.

SCHOOL LIGHTING

At a meeting of the Illuminating Engineering Society on Feb. 16th the subject of "School Illumination" was discussed, both from the point of view of natural and artificial lighting. Dr. James Kerr, Medical Officer to the London County Council, and a number of other gentlemen, dealt with natural lighting, and Dr. N. Bishop Harman, Oculist to the London County Council's Education Department, dealt with the subject from the point of view of artificial illumination. The uses of gas and electricity were discussed, and Dr. Bishop Harman expressed preference for 25 volts rather than low candle-power metal filament lamp made for high voltages. He mentioned two hospitals, in one of which the voltage has been reduced to 25, and with metal filament lamps the effect is perfect in flexibility and softness, whilst in the other 240 volts are used and the lighting is hard and wasteful. He also mentioned some experiments with opal shades on 16-c.p. carbon lamps. One shade tried subtended 110° and had a vertical depth of 3⅛ in. This, however, did not cover the lamp, and the filament was exposed to the teacher's eyes. The other was an 80° shade 5 in. deep. It completely screened the filament and increased the light below the lamp by one-third. He recommended that lamps should be hung slightly in front, and to the left of the students' desks at intervals of not less than 6 ft. and not more than 9 ft. with 16-c.p. lamps and 90° shades. One row of lamps could light two rows of desks in this manner, and a very good lighting effect was produced. His experience of reflected lighting, where continuous and detailed work was required, was unfavourable. The system was adopted in the new Anatomical Laboratories at Cambridge fifteen years ago, but it had been superseded by ordinary glow lamps.

Mr. J. S. Dow gave the results of some investigations which he has been carrying out in a number of schools. In the elementary schools illumination on the desks both by electricity and gas was found to be approximately 2 candle feet, and he suggested this being specified as a minimum for this purpose. The average blackboard illumination was somewhat higher. Figures which he had obtained from Germany show that the standard school illumination there is considerably higher, namely, about 8 candle feet. The glare from blackboards was referred to, and the suggestion made that a strip of tubolite along the top would be the best solution.

Mr. C. A. Baker, Electrical Engineer to the London County Council, referred to the difficulty of laying down a standard of illumination, as so many class-rooms are used for different purposes, for which it was necessary to have a different standard of illumination. During the last five years the London County Council have had six colleges, eighteen elementary schools, four secondary schools, and two special schools wired for electric lighting, and 50-c.p. lamps have been adopted. A school to accommodate 900 children costs £300 to wire, the total candle-power being 7,500, which works out to 10·2d. per c.p. installed and 7¾ c.p. per child. All the lamp ends are frosted, and a globe 14 in. by 7 in. is used. It was not usual in wiring ordinary schools, he said, to be able to select the positions for the lamps in quite so methodical a manner as was supposed by many people, the desks being often rushed in at the last moment, and the various points fixed as near as possible before in such positions as could be judged to be most suitable from information given by those interested. He drew attention to the higher standard of illumination necessary in trade schools as compared with elementary schools, and the following figures of the Arts Crafts Schools of the London County Council were given as the illumination on the work tables :—Wood-carving, 30 candle feet; architecture, 7; silversmiths, 4·5; art, 6·5; book-binding, 8; and compositors, 4 to 9.

The discussion will be continued on March 14th.

The Conference between Municipal Engineers and Contractors.—We are informed that after four meetings of the conference between the representatives of the Incorporated Municipal Electrical Association and the Electrical Contractors' Association (Incorporated), it was finally decided that owing to the impossibility of agreement regarding the contentious matter discussed, that the conference be suspended until further notice, and that each side be free to take any action they may think desirable, subject to the resolutions agreed upon. It was further resolved to recommend that a Standing Joint Committee of four on each side be appointed to try and adjust matters of dispute that might arise.

Electrical Trades Benevolent Institution.—It has been decided again to hold a festival dinner of the Electrical Trades Benevolent Institution, and that this shall take place on April 26th, 1911, at the Hotel Cecil. The association has recently had several cases to deal with, and it is sincerely hoped that the electrical trade generally will give it their very full support, so as to enable it to carry out, not only the granting of temporary relief, but to place it in such a position as will enable it to grant pensions to its qualified members or their widows.

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

REPORT OF THE SPECIAL COMMITTEE ON THE USE OF ELECTRICITY IN MINES.

IN their report to the Home Secretary, the Special Departmental Committee appointed to inquire into the working of the existing special rules for the use of electricity in mines, point out that the conditions have altered considerably since the rules came into force some five years ago, and that they need revision. Whereas the early installations were all direct-current plant, the tendency now is to adopt the three-phase system, and this the Committee consider to be a change in the right direction. After receiving evidence from a large number of representative witnesses, the Committee have drawn up a proposed new code of rules which, they suggest, should apply to metalliferous mines as well as coal mines. The rules relate to apparatus below ground only, with the exception of the switchgear at the pit-head controlling the underground distribution system.

The Committee point out that the number of fatal accidents due to the use of electricity in mines in any one year has never been more than 1·54 per cent. of the total number of fatal accidents in mines, and that most of these electrical accidents are preventible. They consider that electricity should be excluded where outbursts of inflammable gas are very frequent, and the first of the proposed new rules reads as follows:—"The use of electricity is prohibited in any part of a mine where, on account of the risk of explosion of gas or coal-dust, such use would be dangerous to life." In the event of any disagreement as to whether there is danger or not, the question will be referred to arbitration under the Coal Mines Regulation Act. Where inflammable gas, though not normally present, may occur in quantity sufficient to be indicative of danger, certain special precautions, referred to later, are called for. Another new rule prohibits the use of inflammable material in the construction of any room or box containing electrical apparatus, unless the apparatus is so constructed as to obviate the risk of fire.

Whereas the existing rules specify that the local inspector must be notified within three months *after* the introduction of electric power into a mine, the proposed rules provide that notification of the intended introduction of apparatus, and even of the installation of additional plant, must be made, and that the work can only be proceeded with if the inspector does not object within one month. Further, an annual return giving the size and type of apparatus and the circumstances of its use is required, and, as before, a plan of the plant is to be kept up to date. Provision is also made in the new rules for the exhibition of notices prohibiting the handling of plant by other than an "authorised person," directions as to procedure in case of fire, &c.

The Committee do not consider it advisable for the Home Office to approve officially certain types or designs of apparatus, or to issue certificates of competency after examination to persons in charge of plant in mines, but they have specified a number of requirements as regards the design and maintenance of the apparatus. The proposed substitute for Rule 11, requiring the presence in the mine of a "competent" person, specifies that the "electrician," together with the necessary assistants, shall be appointed in writing by the manager, and shall "be competent for the work that he is set to do." No further definition, however, is given as to the "competency" required. Nobody except such an authorised person or a competent person acting under his immediate supervision is to undertake any work where technical knowledge or experience is required in order to avoid danger. The duties and responsibilities of the "electrician" are clearly set forth. He is to make periodical examinations of apparatus, and to test frequently the continuity of the earthing system and all apparatus which is new or has been moved from one part of a mine to another before it is put into service. A log-book is to be kept, and a suggested form for the daily log-sheet is included in the Committee's report. This relates to insulation, reports of routine and special tests, accidents, cases of open sparking, &c., and is to be signed by the electrician and the manager. Certain special precautions and duties with regard to the maintenance of switchgear, machinery, &c., for which the electrician is to be responsible, are also clearly enumerated in the rules. The Committee state, however, in the report that the "electrician" is necessarily under the orders of the mine manager, who is also finally responsible under the Coal Mines Regulation Act, and suggest that the examination for a colliery manager's certificate should require a more extensive knowledge of electrical work than at present. They consider, for example, that the manager should know a good cable-joint from a bad one, and that he should be able to criticise intelligently the maintenance of the electrical plant. Although the "electrician" is directly responsible for the condition of the plant, it is evident that the Committee desire that the main responsibility should rest on the manager himself, but this division of the responsibility raises a debatable question.

With regard to choice of system, the Committee consider that an alternating-current system using high pressure for transmission, high or medium pressures for large motors, and low pressures for small motors and lighting, is safer, more reliable and probably cheaper to instal than a system with medium pressure throughout. Stress is laid upon the necessity for good mechanical construction of machinery, switchgear, and cables, and several new rules in connection with earthing and insulation are proposed.

Whereas earthing is now specified only in the case of cable sheaths and armourings *other* than trailing cables, switch-cases, and machine frames *other* than portable motors, and then only when the pressure exceeds 250 volts, a new rule covers all apparatus at pressures above 250 volts D.-C. and 125 volts A.-C., including trailing cables, joint-boxes, instrument covers, all lampholders unless protected by a fire-proof insulating material, and all machines *including* portable motors. It is further specified that they shall be earthed by connection to an earthing system at the surface of the mine, and that all earth conductors other than the metallic covering of cables shall have a conductivity at all parts and at all joints at least equal to that of the largest conductor supplying the apparatus it is desired to earth. In the case of cables, the metallic covering is to have a conductivity at least equal to 50 per cent. of that of the largest conductor in the cable.

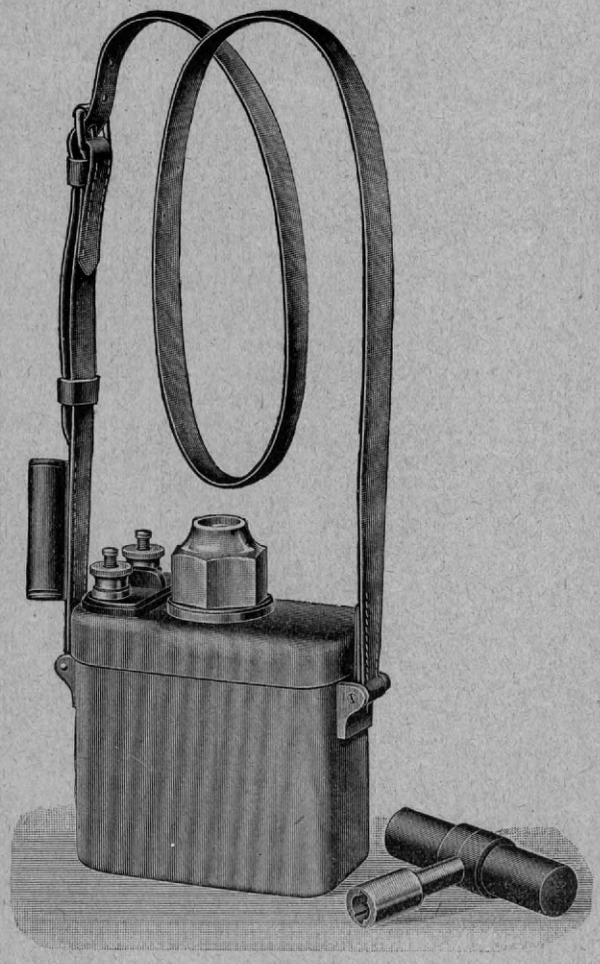
The rule relating to the insulation of a system permits as before the earthing of the neutral point of a three-phase system and the mid-voltage point of any other system both at one point only. The outer conductor of a two-wire concentric system must be earthed. In all cases this earthing is also to be done by connection to an earthing system at the surface of the mine. Means are to be provided for indicating any leakage, but the limit of 1/1,000th of the maximum supply current is not now prescribed. An important new requirement relates to cutting off pressure automatically in the event of a fault or leakage, and the Committee now seek to make this compulsory. This recommendation, if adopted,

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will, of course, entail considerable alterations to existing switchgear.

As is the case at present, high pressures are limited to stationary machines of over 20 h.p. Switchgear, according to the proposed rules, is to be constructed so that the lodgment of dirt or coal-dust on or close to live parts is prevented, and all live parts even at low pressures are to be protected so as to prevent accidental contact by persons. The new rules prescribe that switchgear for cutting off the supply shall be provided at the surface within 200 yards of the pit-head, and that telephonic communication be provided between the shaft-bottom or main distributing centre and this point, an authorised person being available within easy reach of the latter. In a concentric system the switchgear must be so arranged that the continuity of the earthed outer is never broken.

With regard to cables, the proposed rules provide that all multiple-core or concentric cables, other than flexible trailing cables, shall have a metallic sheath where the pressure exceeds 250 volts, where the roadway conveying the cables is also used for haulage, or where there is risk of igniting gas or coal-dust. Single-core cables need not have this sheath, but must either be enclosed in a pipe containing all the conductors of a circuit or must be secured to insulators by readily breakable material. All sheathing or armouring is, of course, to be electrically continuous throughout, and is to be earthed to the earthing system by a connection of not less conductivity than the same length of the armouring. The sheathing is to be protected against corrosion where necessary. Flexible cables for portable apparatus are to be multiple-core, and, if armoured, the armouring is not to be the only earth conductor, but an additional earth wire is to be provided. Proper connectors are to be used. The lampholders of portable lamps are not to be in connection with the guard or other metal-work.

The special precautions referred to above as being required where inflammable gas may occur are, first, the use of motors, cables, apparatus, and signalling instruments especially constructed to obviate the risk of "open sparking." The current is to be switched off immediately sparking occurs or while examination or adjustment disclosing parts liable to spark is being made. Secondly, every electric lamp is to be enclosed in an air-tight fitting, with an hermetically-sealed globe. Thirdly, a safety lamp is to be provided near each motor, and should any indication of fire-damp be given, the attendant must switch off current and report the matter.

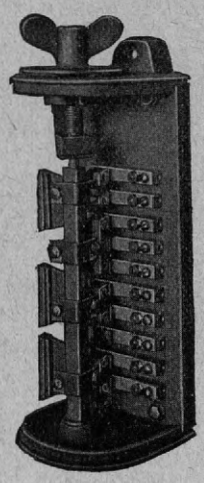
The rule relating to shot-firing prohibits the use of current from lighting power circuits for this purpose in any circumstances. The pressure for signalling circuits is limited to 25 volts. Electric relighting apparatus is to be subject to substantially the same regulations as at present, except that its use is prohibited in any part of a mine to which the special precautions apply, namely, where inflammable gas may occur in dangerous quantities. Haulage by electric locomotives on the overhead trolley-wire system is, according to the proposed rules, prohibited in any part of a coal mine, but may be used in mines other than coal mines with the consent of the Home Secretary and subject to any conditions as may be prescribed. Storage-battery locomotives may be used in any mine subject to the consent of the Home Secretary.

Exemption from the requirements of any of the rules can be obtained from the Home Secretary on the ground of emergency or special circumstances, and special exemption from strict compliance with the rules providing for the use of cables with earthed metallic sheathing at or below medium pressure (650 volts), can be obtained if it can be shown that there is no risk of igniting gas, coal-dust, or other inflammable material.

In a memorandum accompanying the proposed rules, several practical points which may arise in the carrying out of the rules are alluded to. It is suggested that the periodical tests of insulation should be made with an ohm-meter giving preferably double the working pressure of the system. A portable testing transformer giving double the normal pressure of the system should also be available in the mine where an A.-C. system is employed. It is stated to be desirable to connect the earthed point of a system to the earthing system, and not to a separate earth-plate. The neutral of a three-phase system should be earthed in any case, but the mid-point of a D.-C. system only if the cables have a metallic sheathing. Such earthing is recommended, however, together with the use of automatic leakage cut-outs, as being the simplest way of indicating a fault. Commenting on the rule as regards connection of all frames, armouring, &c., to an earth-plate at the surface, it is stated that two earth-plates placed 20 or 30 ft. apart and connected together are far better than a single larger plate. A cast-iron plate with pro-

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D D O Switch, Cover Removed.



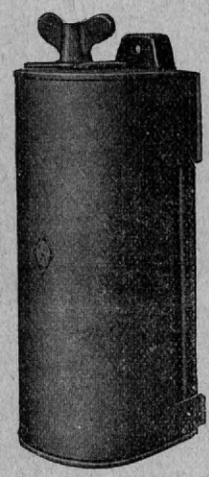
THREE-PHASE CONTROL GEAR

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D D O Switch.

jecting forks placed in an upright position and packed hard on each side with broken coke is recommended. The connection should be riveted along the plate, and afterwards soldered along the edges to preserve the contact surface from corrosion. It is noted that the earthing of apparatus is not required for pressures lower than 250 volts D.-C. or 125 volts A.-C., and it is suggested that the pressure for lighting in A.-C. installations should be 50 volts or less. The use of auto-transformers is objected to on account of the risk of the lampholders becoming charged to the primary pressure. For higher voltages than the above limiting pressures, it is suggested that a special earth wire should be provided for earthing each lampholder, or that the lamp and holder should be enclosed in an outer globe, such as is used in battery-rooms, and known as an "acid-proof" fitting. Referring to earth connections, it is stated that a good earth connection should be regarded as of even greater importance than a good connection in the supply circuit.

With regard to the use of high pressures, it is suggested that it is better to transform down for motors of 50 h.p. and under when the supply is at 3,000 volts, and if the supply is at a higher pressure it is recommended to transform down for motors of 100 h.p. or less. Small lighting transformers may be run in solid with insulating compound, while large transformers should be oil-immersed. The secondary circuits should be earthed at one point to avoid risk of the pressure rising to a high value by contact with the primary. Where this is undesirable, as in local lighting circuits, an earth-shield between the windings is recommended. Referring to the construction of switchgear, it is stated that this should be dust-proof, moisture-proof, and so designed as to "prevent open sparking," but no mention is made, either in this case or when referring to motors, of the possibility of securing a flame-proof construction by the adoption of plate-protection or of wide flanges. It is noticeable that the so-called "gas-tight" construction is very properly not insisted upon. To ensure that there shall not be open sparking in the event of a fault in a cable, it is recommended that the metallic sheath nearest the conductors should be air-tight as is a lead sheath, or should be enclosed by another sheath, as when armouring is put over an inner copper sheath with a moderately thick bedding of jute or other material between. In both cases the object is to prevent the arc from penetrating to the outside of the cable before the current is cut off. Wire armouring is preferred to tape armouring, and double to single armouring. It is pointed out that the ends of armoured cable should be finished off by securing the armouring to a spigot or to a gland screwed into the switch-box or cable-dividing box. Cable boxes should be supported on a brickwork base in a recess by the roadside, and bonding of the metallic sheaths inside or outside the box is necessary. Armouring is said to be undesirable for trailing cables. It is recommended that a plug should make the earth connection before the supply connection, but though it is stated that the current should not be on when the plug is being inserted or withdrawn, the use of plugs and sockets automatically interlocked with the switch to prevent this occurring is not referred to. Finally, with regard to the special precautions for places where inflammable gas may occur, it is pointed out that these can hardly be considered "special" requirements, as armoured cables and the best type of switchgear and motors are desirable in any case.

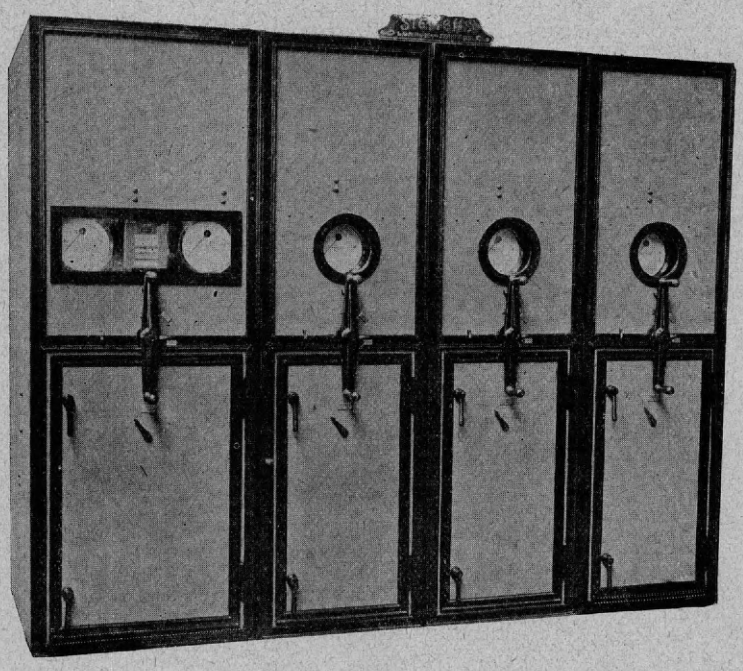
It may be mentioned that in reply to a question in the House of Commons last month, the Home Secretary stated that it would not be necessary to introduce legislation to establish the revised rules, and that he would consider whether steps could be taken at once to bring them into force under the procedure provided by the Mines Regulation Acts.

The Whitehaven Colliery Disaster.—The reports by Mr. R. A. S. Redmayne and Mr. S. Pope on the explosion and fire at the Wellington Pit of the Whitehaven Colliery, in which 136 lives were lost, have been published. The explosion is attributed to the ignition of firedamp and coal-dust; the cause of ignition is not known, but is stated to have been probably due to a defective safety lamp. No electrical plant was used in the pit. Mr. Redmayne suggests that miners working in the neighbourhood of goaves where the roof consists of a bed of hard rock which does not readily fall or bend should be provided with electric lamps instead of oil safety lamps.

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ELECTRICALLY OPERATED COAL HOISTS

THE Paper by Mr. Walter Dixon and Mr. J. H. Baxter on "Modern Electrical Dock Equipment," with special reference to electrically-operated coal hoists, was further discussed at the Institution of Mechanical Engineers on Friday, February 17th. We abstracted the Paper and previous discussion in ELECTRICAL ENGINEERING IN MINES for February 2nd.

Mr. WALTER PITT (Messrs. Stothert & Pitt) expressed the opinion that an electric generating station at a dock was a more useful general servant than a hydraulic station, on account of its greater flexibility in transmission of power, and also the various uses to which electrical power could be put, compared with hydraulic power.

Mr. ROGER T. SMITH (electrical engineer, Great Western Railway) advocated the use of belt conveyors in preference to hoists, and pointed out that they needed much smaller motors. A small clay conveyor of the belt type, which his company was using in Cornwall, had shipped 10½ tons per kw.-hour, as against 7 tons per kw.-hour with the Rothesay hoists. He mentioned that the Great Western Railway Co. had ordered twenty-eight "Clyde" electrical capstans on account of their great economy. The maximum demand on the generating station, compared with the slipping rope capstan, was decreased 50 per cent., and the energy by 30 per cent., but much more important was the saving in the cost of ropes.

Mr. C. S. MEIK had come to the conclusion that the capital cost for both types of plant was practically the same; that the cost of power with full load was the same, but on a variable load the electrical machinery had the advantage; that in working and maintenance, hydraulic machinery had the advantage.

Mr. C. J. HOBBS (Hydraulic Engineering Co.) remarked on the full-load condition not having been realised at Clydebank, and objected to the selection of hydraulic machinery for comparisons, which was anything but modern. The hydraulic capstan was not remarkably economical, but it withstood rough usage better than the more delicate electric capstan.

Mr. E. G. BREWER advocated the use of high-capacity coal waggons in conjunction with gravity loading.

Mr. MORRISON expressed the opinion that the authors had done away with the flexibility which was a feature of electric driving by giving each hoist a separate generator, and pointed out that it was necessary to run the flywheel even if only one hoist were being used.

Mr. E. KILBURN SCOTT preferred batteries and boosters to flywheels; and, regarding the question of running flywheel in a vacuum, compared the much greater effect of the vacuum in the case of speeds such as of the Brennan gyroscopes.

Mr. J. A. F. ASPINALL (Lancashire and Yorkshire Railway Co.) had a great deal of both classes of machinery, electrical plant being put in when the load was very variable. He did not think that the authors had had sufficient experience yet to really say that the electrical plant was more economical with regard to maintenance than hydraulic machinery. Electrical appliances which would adjust themselves absolutely to the load would probably show some points in economy, which might compensate for the greater cost of maintenance if this latter were found to exist.

The PRESIDENT (Mr. E. B. Ellington) thought that the matter would have to come up for further discussion in a year or two. The variety of opinions certainly showed that the question of which would be the power of the future for docks had not been finally settled.

Mr. WALTER DIXON and Mr. G. H. BAXTER both replied briefly.

THREE-PHASE HAULAGE MOTORS

A DISCUSSION on three-phase motors for haulage in mines was opened by Mr. J. Simpson at a meeting of the North of England branch of the Association of Mining Electrical Engineers on February 8th. The author briefly considered the points to be noticed in drawing up specifications of such machines. From considerations of weights, speeds, gradients, and distances, the h.p. required is easily calculated, and some 25 to 30 per cent. should be added for rolling friction and contingencies. The motor speed is settled in relation to the gearing and diameter of the drums, having in mind the frequency of the circuit. The speaker recommended wound rotors and an air gap at 1/500th the diameter of the rotor, and advised that maximum efficiency should be sought at ¾ the rated load, and an overload capacity of 2½ times full load specified. He favoured tunnel windings with gun-metal or bronze slip-rings with brushes only on the upper half. A model specification was given based on a 70° F. temperature rise after six hours on full load, or 90° F. after 15 minutes at 50 per cent. overload.

DISCUSSION.

The discussion was opened by Mr. Baxter, who considered that 400 r.p.m. was the best speed for haulage motors. He criticised several points in Mr. Simpson's proposed specification, such as the air-gap being given as a definite fraction of the diameter, irrespective of the weight of the motor and the proportions of the shaft. Mr. Clatworthy asked for opinions regarding the method of bringing out the connection to the star point of the winding. Mr. Park and Mr. Ralph, in connection with air-gaps, favoured adjustable bearings, and some discussion ensued on the relative advantages of split and solid bearings. Mr. Moley raised the question of controllers, and the general opinion was in favour of the drum type. Mr. Simpson in his reply said that in his experience speeds above 400 r.p.m. resulted in objectionable vibration. He considered that much lower speeds should be employed in haulage than in pumping work. He had had trouble with former-wound coils, and much preferred tunnel construction. Large air-gaps were particularly important in haulage motors, as the reversal and backlash of the gear caused excessive wear on the bearings. He much preferred metallic to liquid controllers. He was in favour of bringing out the central point of the windings.

THE PRETORIA PIT EXPLOSION

THE inquest on the 344 victims of the explosion at the Hulton Colliery on December 21st was concluded on February 13th, after lasting twenty-seven days. The jury found that the explosion was due to an accidental ignition of gas and coal-dust on the conveyor face in the North Plodder mine, and state that, while the cause of ignition is unknown, it was probably due to a defective or overheated lamp. They add that there was no evidence to prove that the explosion was due to the non-observance of any statutory obligation, but criticise the ventilation of certain headings. Referring to the electrical plant, the jury call attention to the need of skilled supervision, and suggest that switches in places where gas occurs should both break under oil and be enclosed in gas-tight boxes. (The latter suggestion is founded upon mistaken ideas, but it may be presumed that a flame-tight case would meet their desires.) More thorough reporting of ventilation is urged, as well as full investigation into the dangers incident to coal-dust and as to the character of safety lamps. In his summing up, the coroner criticised very severely the reports available on the ventilation. He pointed out that the experts called on behalf of the Miners' Federation supported the view that the conveyor switch caused the explosion, whereas the experts for the colliery company and the Home Office excluded it as a probable cause.

The Home Office inquiry into the cause of the explosion was opened at Westhoughton on February 20th by Mr. R. A. S. Redmayne, H.M. Chief Inspector of Mines. Mr. Tonge, general manager of the Hulton Collieries, has given evidence with regard to the ventilation and the electrical plant, stating, with regard to the latter, that the switchgear was examined daily by a competent electrical engineer. In places where gas was liable to occur, oil immersed and fully protected switches were used, as required by the Special Rules, and he was absolutely sure that the electrical plant had nothing to do with the explosion. He had come to the conclusion that the explosion started near the top of the No. 2 jig in the North Plodder mine, and not at the conveyor face, as suggested by the jury at the inquest. The cause was, he thought, a broken lamp at a fall.

ELECTRICAL MINING PATENTS OF FEBRUARY

AMONG the patent specifications published during the past month of interest to mining electrical engineers, was No. 29,789 of 1909, by E. Gottschalck, of Berlin, for a miner's electric safety lamp. This consists of an accumulator lamp provided with a reflector of glass or porcelain, which is broken if the lamp receives a mechanical shock sufficient to break the lens or lamp. A strip of metallic powder, burnt or deposited on to the back of the reflector, is connected in the lamp circuit, and thus the current is cut off if the reflector is broken.

Specification No. 1,383 of 1910, by Mavor & Coulson, Ltd., and M. Dempster, describes the use of a flexible cable extending from the head to the foot of an inclined working to prevent a coal-cutter from travelling down the incline in the event of the haulage gear failing. The cable can be wound on a drum on the machine, which may be caused to prevent or regulate the downward travel of the machine.

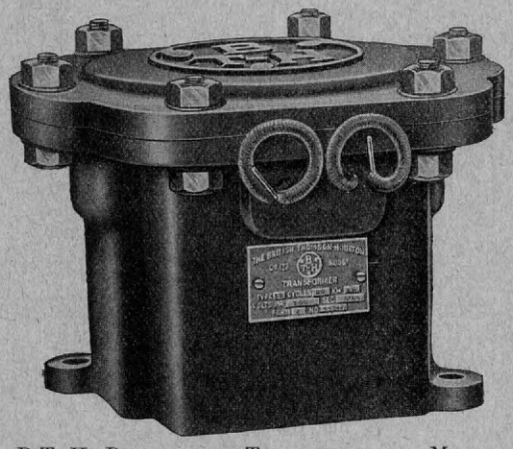
A specification by the British Thomson-Houston Co. and E. B. Wedmore (No. 6,292 of 1910) relates to protective systems for D.C. distribution networks in which the series wound trip coil depends for its operation upon the difference in current between the positive and negative mains feeding the faulty section, and covers the use of shunt windings to render this device more sensitive.

A miner's electric safety lamp with a magnetic lock is described in Specification No. 12,368 of 1910, by P. L. Trin, of Paris. The lock comprises two caps screwed in reverse directions, and a pin passing through both caps and resting on a stop the movement of which is controlled by an electro-magnet.

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A TRANSFORMER FOR MINING BELLS

IN view of the troubles sometimes experienced with primary batteries, the British Thomson-Houston Co., Ltd., have brought out the special pattern of transformer illustrated here for the purpose. The transformer is mounted in a strong explosion-proof cast-iron box, having a bolted-down cover with a wide machined joint designed to withstand 140 lb. pressure per square inch. Double-pole fuses of the cartridge type are mounted inside the box and connected in series with the primary coil. The coils are kept apart by a metallic



B.T.-H. Bell-ringing Transformer for Mines.

separator connected to the case to avoid any possible leakage from primary to secondary. The leads are brought out of the box through sealed insulating bushings. The transformer is wound for a normal voltage of 500 at 50 cycles on the primary and 20 volts on the secondary. By an arrangement of clearly marked tappings, inside the case, the secondary voltage may be changed to approximately 17, 15, or 13 volts. The primary may be used on any voltage up to 600 at 50 cycles, the secondary voltages being proportionately increased. The winding is so designed that the secondary coil may be left short-circuited for five minutes without damaging the transformers. The iron loss does not exceed 8 watts.

OIL-IMMERSED MOTOR-STARTERS

A NEW pattern of totally enclosed oil-immersed starter of the star-delta type for squirrel-cage motors has been brought out by George Ellison (17 and 18 Warstone Lane, Birmingham). These are made in two sizes with contacts for currents up to 50 and 100 amperes respectively, and are fitted with a slow-motion device that prevents the operator putting the starter into the running position unless he has first held it in the starting position a certain length of time to allow the motor to get up speed. It is also impossible to leave the starter in the starting position unless held there by hand. They are fitted with a no-voltage release, which, besides giving protection against failure of supply, can be used for stopping the motor from a distance by emergency switches in the no-voltage coil circuit. The overload releases can be fitted with adjustable time lags. In the standard pattern two overload releases and one no-voltage release are provided, all acting on the retaining hook, and the connections are so arranged that the overload coils are not in circuit until the running position has been attained. The releases are adjustable from full load to 60 per cent. overload. In this type two handles are fitted, one for working the starter, and the other, a small one, for tripping. The latter can also be turned in the opposite direction for holding down the releases and preventing them tripping when the starter is being thrown into the running position. This arrangement is, however, not necessary when time lags are fitted. Fuses can be substituted for the releases if desired. These are contained in a separate chamber, the cover of which is interlocked with the starter so that the fuses are not accessible unless the starter is in the "off" position. The fuses are arranged not to be in circuit in the starting position.

Royal Commission on Accidents in Mines.—This Commission, which is quite apart from the Special Committee on the use of Electricity in mines, has practically concluded its labours, and it is stated that the miners' representatives in the House of Commons will press for a new Mines Act this year, based on the recommendations in the report of the Commission.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during February.

Feb. 2nd.—Monthly supplement on Electrical Engineering in Mines, opening with an abstract of a Paper on electric power in collieries by Mr. J. Miller, expressing a preference for three-phase working, and emphasising the advantages of the bar type of coal-cutter. A report is also given of a Paper recently read before the Institution of Mechanical Engineers describing the electrical coal hoists at Clydebank. Other articles include a description of the electrical equipments of an eastern tin mine and a New Zealand coal mine. A report of a Paper on mining switchgear is also given, and the electrical mining patents published during the month are reviewed.

Feb. 9th.—An article comparing the prices of aluminium and copper cables. Report of a discussion on high-tension transmission. Illustrated description of a three-phase goods locomotive. Report of a discussion on transformer sub-stations.

Feb. 16th.—Literary supplement, with reviews and list of recommended books in all branches of electrical engineering. Announcement of the publication of the report of the Home Office Committee on electricity in mines. Description of a new voltage regulator.

Feb. 23rd.—Some particulars of an electric pumping station. Notes on a new alternating-current starter and aluminium three-core cables. Illustrated description of the new power station at the Midland Railway Works, Derby, with particulars of the new Willans' "Disc and Drum" turbine.

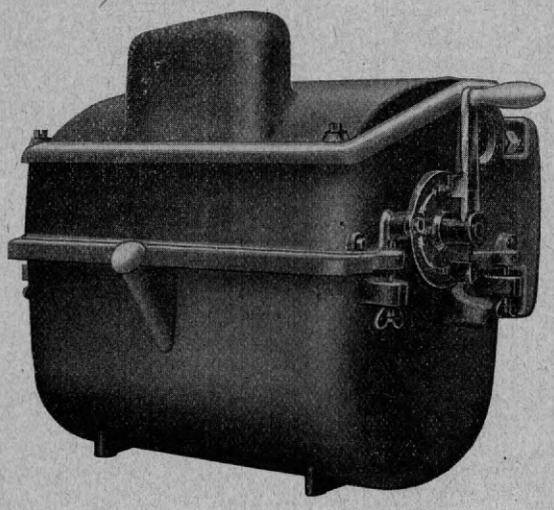


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Sheet No. 186 gives further details and lists of prices, and will be forwarded upon application.

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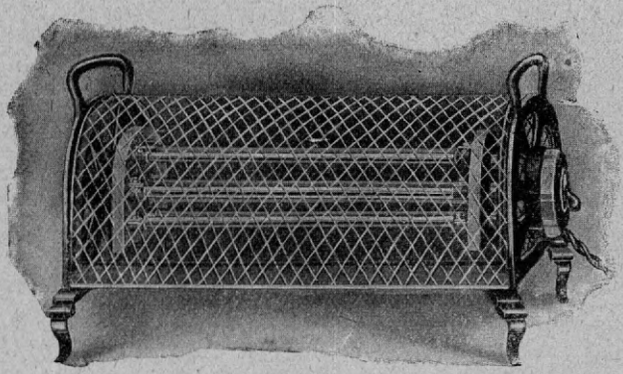
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PARALLEL WORKING OF ALTERNATORS

THE Paper on the above subject, prepared by the late Mr. J. R. Barr, for the Glasgow Section of the Institution of Electrical Engineers, was discussed at a meeting of the Section on February 14th. The author points out that the engine governor usually maintains the speed up to full load within from 3 to 6 per cent. of the no-load speed, but must not be so sensitive as to respond to the regular speed oscillations of reciprocating engines. On account of this and friction, there must be a certain change in speed before the throttle valve operates. Consequently, when several alternators are working in parallel, they may be unequally loaded, as the load, and consequently the speed, of any one may vary between certain limits without affecting its governor. The possible difference of loading will be the greater, the smaller the percentage speed drop of the governor, and the wider the limits of speed variation for a given position of the governor. A large governor drop is therefore an advantage in so far as parallel running is concerned, but involves a corresponding variation in frequency. Where this must be the same for all loads it is necessary to alter the sensitiveness of the governor as the load varies, either by hand or automatically. For lighting plants hand regulation is quite sufficient, but for power plants automatic regulation in the form of a relay controlled from the switchboard is essential.

After explaining the phase displacement and consequent synchronising currents resulting from the acceleration or slowing down of the affected alternator before its governor comes into play, the author shows how these currents produce a free oscillation about the synchronous position due to the momentum of the rotating system, and how these oscillations are damped by eddy and local currents in the armature conductors, pole-shoes, amortisseurs, or field-coils, with the result that the alternator ultimately settles down. The periodic time of the free oscillation is shown to vary directly as the square root of the moment of inertia and inversely as the ratio of short-circuit current to normal full-load current. For steady running, the time of swing should be long, and therefore it will be of advantage to design an alternator for a high reactance so as to decrease the above ratio. Machines with inferior regulating properties are therefore well suited for parallel working. Where only free oscillations exist, no trouble will be experienced; thus turbo-alternators having uniform driving torque have given practically no trouble when operated in parallel.

The author then points out that the variation of speed produced by the irregular turning moment of a reciprocating engine may be considered as forced oscillations impressed upon the alternator-field system, and shows how to deduce the consequent phase displacement. This is directly proportional to the coefficient of speed variation or cyclic irregularity and inversely proportional to the number of cycles per revolution. The synchronising torque magnifies this displacement, however, which in turn produces a larger synchronising torque, and to obtain the final value the author applies the method described by Dr. E. Rosenberg, in a Paper before the Institution (see ELECTRICAL ENGINEERING, February 4th, 1909, p. 110). This brings in a "reaction coefficient," q, equal to the ratio of the synchronising torque caused by the phase displacement to the variable oscillating torque due to the prime mover. The final value of the synchronising torque is expressed by $qT/1-q$, where T represents the initial value of the variable oscillating torque obtained from the diagram of crank effort. If $q=1$, resonance occurs, and the final oscillations would be infinite, and this happens when the period of the oscillating torque is equal to the period of a free oscillation. Even when q approaches unity, oscillations started by any small speed variation may increase to such an extent that parallel running is impossible. Although it is desirable to keep the initial displacement small, stable running does not depend so much upon this as upon the value of q.

In actual machines, however, the free oscillations are damped to a more or less extent by the presence of a third torque, due to the eddy and local currents referred to above, which are produced by the oscillations themselves. When amortisseur coils are fitted into the pole-shoes the damping torque will be high. With solid pole-shoes, the higher resistance of the iron will reduce the damping torque. With laminated pole-shoes the torque will be still further diminished, but as the laminations do not permit of large damping currents, the action will go deeper and will be visible in the field coils. The author then shows how to take into account this damping torque, which can be determined experimentally by running the machine as an induction motor and loading on a suitable brake. The slip corresponding to any particular load is measured, and the ratio of brake torque to slip will be the same as the ratio between damping torque and oscillating speed. In spite of the influence of the damping torque the natural period of the alternator should, in general, be at least 1·4 times the period of the impulses impressed by the prime mover. If this condition holds, dampers are quite unnecessary, but when the flywheel effect is such as to give nearly the critical value for parallel working, then the use of dampers may save tons of flywheel. In general, it may be said that dampers should always be used when the natural period is less than 1·4 times the period of the impressed impulses.

In practice a number of machines of different types and speeds may have to run in parallel, and in such cases it is not only necessary to avoid equality between the natural frequency of each machine and the impulses of its own engine, but also with the impulses from the other engines. The prevailing type of engine in this country runs at such a high speed that most of the difficulties are avoided, but in the case of alternators driven by slow-speed engines the possibility of trouble from resonance should be investigated.

The author concludes with some notes on the permissible values of phase displacement and cyclic irregularity, and on the necessary size of flywheels. In medium-speed sets the size of flywheel necessary for mechanical reasons will generally be ample. In a slow-speed engine with a fixed flywheel effect, the critical value can be avoided by increasing the radial depth of air-gap so as to increase the apparent impedance of the armature, and therefore the value of the short-circuit current. Such a procedure may, however, endanger the regulating properties of the alternator.

Before reading Mr. Barr's Paper, Prof. F. G. BAILY referred to the author's short career. He was born in 1885, and served his apprenticeship with Bruce Peebles & Co., Edinburgh, thereafter spending a year at the Leith Power Station. He attended evening and later day classes at the Heriot Watt College, Edinburgh, and then joined the Electrical Construction Co. at Wolverhampton. When only twenty years of age he was sent to East Africa to erect a consignment of plant, and was successful in carrying out the work satisfactorily, although he unfortunately contracted malarial fever, which returned periodically after his return. Since then he has been assistant lecturer of electrical engineering at the Heriot-Watt College. In 1908 Mr. Barr published a book on the "Elements of Direct-current Engineering," and has just completed another work on "Alternating-current Machinery."

Mr. J. S. NICHOLSON (Glasgow University), after referring to the author's earnestness of purpose and keenness for work and to the excellence of his book on direct-current machinery, exhibited some curves of turning moment obtained from the Glasgow Corporation three-crank reciprocating engines, and emphasised the necessity for a careful consideration of the turning-moment diagram before making assumptions regarding the sine curve which may be substituted for the irregular oscillating torque referred to in the Paper. In reply to a question by Mr. Day, Mr. Nicholson said that the displacement, with two of the alternators running in parallel, would be only 1¼ electrical degrees. The usual allowance was plus or minus 3 degrees.

Cumberland Branch of the Association of Mining Electrical Engineers.—Mr. W. Maurice, President of the Association, paid a visit to this branch on February 18th, and gave an address at the meeting at Whitehaven. He outlined briefly the ground the Association was intended to cover, and emphasised that although it was open to all in any way connected with the applications of electricity to mining, it was primarily intended for the interests of the craftsman. There were now ten branches and nearly 1,000 members. He referred to the way in which the growing application of modern engineering methods to mining had drawn a new class of man into the mining industry, and it was this that had led to the foundation of their Association. The installation of electrical machinery in mines had developed into an economic necessity, and had been forced upon mine owners by the increased cost of mining coal, a substantial portion of which has been caused by legislation designed for the protection of the workers. Labour legislation had since 1842 added some £26,000,000, or at least 2s. per ton to the cost of mining coal. The use of electricity enabled the mine owner to meet a portion of these extra costs, but also aided the worker by increasing the number of workable properties. It also made underground work less arduous. There had been an outcry about the dangers of electricity in mines. It was true that there were dangers, but they were more than counterbalanced by the way the application of electricity had lessened other risks. Much was being done to lessen such risks as there were, and at no distant date the use of electricity in mines would be as safe as is humanly possible. Mr. Maurice outlined the organisation of the Association, and also referred to the arrangements for the examination scheme.

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VARIABLE SPEED INDUCTION MOTORS

THE induction motor has hitherto been mainly used for constant-speed work, but its inherent good qualities are causing increased attention to be paid to rendering it suitable also for cases where variable speed is essential.

A ready way of doing this is to arrange the stator windings so that the numbers of poles can be varied, while the rotor is provided with the squirrel-cage type of winding. A two to one speed variation can be obtained with a single winding on the stator, and a simple throw-over switch for re-connecting the winding from one number of poles to the other. By using two windings on the stator, each arranged for a two to one speed variation, four speeds can be obtained. For example, if one winding is arranged for four and eight poles, and the other for six and 12 poles, then with a 50-cycle supply synchronous speeds of 1,500, 1,000, 750, and

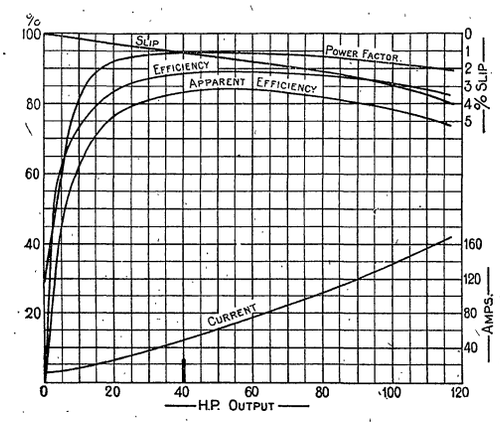


FIG. 1.—CURVES FOR HIGHEST SPEED (4 POLES).

500 r.p.m. are available. As these speeds are obtained without the use of any resistances external to the motor windings, such machines can be designed to operate with high efficiencies.

The British Thomson-Houston Co., Ltd., of Rugby, have recently built several such motors for variable-speed drive, and Figs. 1, 2, and 3 show characteristics obtained from actual tests on a three-speed machine with two windings on the stator, one for four or eight poles, and the other for 12 poles. On a 50-cycle circuit the synchronous speeds were 1,500,

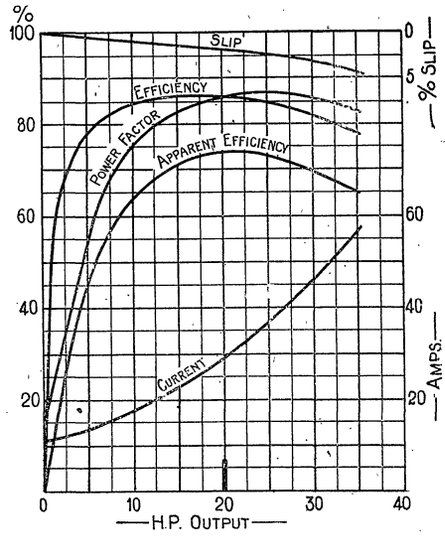


FIG. 2.—CURVES FOR MEDIUM SPEED (8 POLES).

750, and 500 r.p.m., the corresponding full-load speeds being 1,485, 735, and 490 r.p.m. The horse-power ratings corresponding to these speeds were 40, 20, and 14 respectively.

Another machine was arranged for synchronous speeds of 500 and 375 r.p.m. on a 25-cycle circuit, with winding for six and eight poles respectively in the stator slots. A throw-over switch was mounted on the frame for changing over.

While the above type of machine, having several definite speeds, meets the requirements in most cases, it is, however, desirable occasionally to have a machine suitable for operating at any speed from the maximum down to 15 per cent. or 20 per cent. above zero speed. To use an ordinary slip-ring motor with resistances inserted in the rotor circuit to give the total speed variation required is very inefficient. Much more efficient working can be obtained by building the motor with a changeable pole stator winding, and also a changeable pole rotor winding. A straight two to one ratio requires only a single winding on the stator and a single winding on the rotor. A simple throw-over switch on the stator is all that is necessary to change the speed from full speed to half speed, and at both these speeds a highly efficient machine is obtained. To obtain any speed between full speed and half speed and zero speed, it is necessary to insert resistance in the rotor circuit, but it will be readily seen that the losses in reducing the speed of this type of

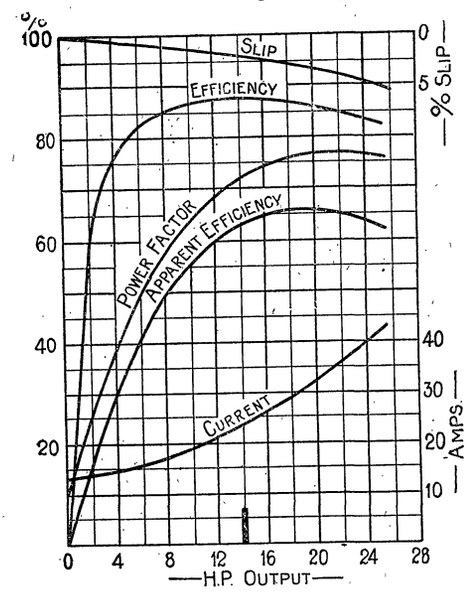


FIG. 3.—CURVES FOR LOWEST SPEED (12 POLES).

machine down to, say, 25 per cent. of maximum speed are much less than if resistance had to be introduced to take care of the complete reduction in speed from full speed down to 25 per cent. of same.

In a motor of this class recently built at Rugby by the British Thomson-Houston Co., Ltd., the rotor was wound six-phase with six slip-rings. No other switching device except the usual controller was necessary in the rotor circuit. The machine in question was built with windings arranged for eight and 16 poles to give synchronous speeds of 600 and 300 r.p.m. respectively on a 40-cycle circuit, the output at these speeds being 15 and 7½ h.p. respectively. A 40 per cent. speed reduction below maximum and the same below half speed was required. The starting characteristics of this machine are similar to those of an ordinary slip-ring motor.

LIGHTING IN THE BOROUGH OF HOLBORN

AS was pointed out in our article on the lighting of Holborn (see ELECTRICAL ENGINEERING, February 16th, page 81), the present gas contracts expire on March 25th, and as no decision has yet been come to with regard to the improved lighting, an arrangement has been come to with the Gas Company for continuing after March 25th on terms of a month's notice.

At the same meeting of the Council a sub-committee of the Works Committee brought up a new scheme for the lighting of the Borough, and recommended that tenders be invited both for electricity or gas. The scheme proposes the use of forty-eight 1,500 c.p. lamps in High Holborn and New Oxford Street; twenty-eight 1,800 c.p. lamps in Kingsway and the High Holborn crossing at Southampton Row; twenty 600 c.p. lamps in Tottenham Court Road; four hundred and five 400 c.p. lamps in seventeen streets; forty-eight 300 c.p. lamps, thirty-seven 180 c.p. lamps, and 1,390 90 c.p. lamps in the remaining streets, the total candle-power amounting to 404,160.

When this report was brought up, it was found that it had not been before the Works Committee, according to the Standing Orders, and after a few minutes' discussion it was referred back in order that the Works Committee should consider a report upon it.

Metal Filament Lamp Tests.—The Westminster Testing Laboratory (York Mansions, York Street, Westminster) inform us that they have completed a series of life tests of fifteen makes of metal filament lamps. Full results are contained in a bound volume, on sale by the Laboratory at the price of £2 12s. 6d. for the first copy and £1 1s. for additional copies.

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GAS v. ELECTRICITY IN DUBLIN

THE above subject was discussed by the Dublin section of the Institution of Electrical Engineers on February 9th. Mr. W. TATLOW said that the price of gas in Dublin had recently been reduced, but that the illuminating quality had also been reduced, so that the cost of lighting was now actually greater. The calorific value was now 486 B.Th.U. per cu. ft. For heating, taking gas at 3s. per 1,000 cu. ft., coke at 20s. per ton, and electricity at 1¼d. per unit, the relative number of B.Th.U. obtainable for one penny were: gas, 13,475; coke, 130,700; electricity, 2,720. With electricity, however, the heat could be much more efficiently utilised. As regards lighting, a Dublin hospital had recently replaced incandescent gas burners by 250 35-watt metal filament lamps, and 18 18-watt carbon filament pilot lamps. The relative annual costs were: gas, £155, and electricity £137. Gas cost 3s. 4d. per 1,000 cu. ft., and electricity 3½d. per unit. In another hospital where flat flame burners were replaced by 127 17-watt metal filament lamps and 21 16-watt carbon pilot lamps, the annual gas bill was £240, and the electricity bill is now only £150. A five-foot incandescent burner in Dublin cost 16s. 8d. per 1,000 hours, and a 55-watt metal filament lamp, burning for a similar period, 20s. 8d. There was no gas burner in existence which could compete with a 17-watt metal filament lamp. With regard to power, where a gas engine was running fully loaded all day, it was questionable whether any saving could be made with electricity at 1¼d. and gas at 3s., but where the engine was at times only partially loaded, a considerable saving could be made. Where one large engine was replaced by several motors and the shafting divided up into groups, the saving was very large indeed.

Mr. G. ARCHER (Chief Assistant Engineer, Dublin Corporation) said that flat flame burners in a certain church had been replaced by metal filament lamps of approximately the same candle power. In this case gas cost £20 per annum and electricity only £6 7s. per annum. A large railway engineering shop had used both steam and gas engines, and were now using electric motors only, and were saving something between 30 per cent. and 50 per cent. They found that the steam-engines, when new, were cheaper to run, but after a few years' work the cost rose enormously. Regarding public lighting, they were using 100 c.p. Osrams with very satisfactory results. They obtained an average life of over 1,500 hours.

Mr. W. J. U. SOWTER (Electrical Engineer, Bray) mentioned that in Bray they had not reduced the price of gas, although they had reduced the quality. Although they had no electric power load in Bray, their output was now higher than ever it was before, despite the economy of the metal filament lamp. He could give numerous instances where pounds had been saved by throwing out gas, and he was looking forward to the time when cooking by electricity would be as cheap, or cheaper, than with gas.

Messrs. R. N. Tweedy, G. F. Pilditch, and Wainwright also spoke.

Verband deutscher Elektrotechniker.—The annual meeting of the Verband deutscher Elektrotechniker, the German equivalent of the Institution of Electrical Engineers, will be held this year in Munich during the first fortnight in June. The Elektrotechnische Verein of Munich is arranging to hold an exhibition during that period of domestic, industrial, and agricultural applications of electricity.

The Institution of Electrical Engineers.—The following donations and gifts have been received recently: £200 to the Benevolent Fund from the executors of the late Mr. Gustav Byng, and £21 to the Building Fund from Sir David Salomons. The latter has also presented to the Museum of the Institution a complete Electric Balance by Professor D. E. Hughes, a Door Contact and Bell by Sir Charles Wheatstone, and a Hughes Microphone Model, probably the first ever made. These and other historic electrical apparatus will be on view in the course of a few weeks in a room set aside for the purpose in the basement of the new building.

Obituary.—It is with great regret that we have to record the death, on Wednesday last week, of Mr. Joseph Wetzler, news of which came to hand too late for our last issue. Mr. Wetzler was associated for a very large number of years with electrical journalism in America, first editing the *Electrical World*, and then transferring his services to the old *Electrical Engineer*, which he edited in conjunction with Mr. T. C. Martin until 1898, when that journal was amalgamated with the *Electrical World* of New York. After the amalgamation, Mr. Wetzler started and developed the Electrical Engineer Institute of Correspondence Instruction, and has been settled in this country for several years. His death at the early age of forty-seven will be read of with feelings of regret by the very large circle of friends by whom he was greatly esteemed.

We also regret to hear of the death of Mr. J. McDermott, Managing Director of the Lancashire Electrical Engineering Co., Ltd. Mr. McDermott, who was fifty-three years of age, has been intimately associated with the Electrical Contractors' Association, of which he was a Past President. He was a member of the Conference which met to endeavour to come to an agreement on the wiring question.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

BOILER FEED PUMPS.—The Sun Patent Evaporator Co., Ltd., have sent up a pamphlet describing their patent turbo-pump with renewable liner, specially adapted for boiler feed purposes, with water at any temperature. These can be worked in combination with an ejector which delivers the water to the pump, and avoids the necessity for a first stage of suction impellers. The pump requires no priming, and troubles due to air being carried with the water into the boiler are avoided.

ELECTRIC FURNACES.—A pamphlet from Messrs. Verdon Cutts & Hoult (Town Hall Chambers, 87 Fargate, Sheffield), entitled "Electric Furnaces," dilates upon the advantages of electrical steel manufacture, and gives particulars of an "Electro-Bessemer" process, where the electrical refining is carried out in the same vessel that forms the converter in the ordinary way, avoiding intermediate pouring. Attention is also drawn to the firm's electric welding plants for various classes of work, arc metal-cutting outfits, electrically-heated forges, annealing furnaces, and laboratory furnaces.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

METAL FILAMENT LAMPS.—The accompanying illustration is reproduced from, but does not do justice to, a new show card which Mr. J. Conway Price has just designed for the "Z" Electric Lamp Co., whose lamps, we are informed, are



entirely made, even to the extraction of the metal, in this country. The card, which is effectively printed in eight colours, is 21 in. by 15 in., and the name and address of any agent can be added.

MOTOR STARTERS AND LIFTING MAGNETS.—The second of the series of leaflets published by the Adams Manufacturing Co., Ltd., of Bedford, and describing the latest developments in "Igranic" switchgear, contains prices with illustrations and brief particulars of stator starters for single-phase motors, heavy lifting magnets for engineering works, an automatic change-over switch for switching on an auxiliary supply on the failure of the main supply, and other apparatus.

CONDUIT TUBES AND FITTINGS.—As we go to press we have received the revised "Geekoduct" conduit and accessories list of the General Electric Co. (67 Queen Victoria Street, E.C.). This is particularly complete, and comprises a full range of close-joint brazed and seamless plain conduits of light gauge and heavier gauges in threaded conduit of the welded brazed and seamless varieties, all manufactured at the company's own works at Witton, Birmingham.

The Russian Westinghouse Company.—According to a Reuter telegram from St. Petersburg, the offices of the Westinghouse Company there have been searched by the police, and all the books and documents relating to the St. Petersburg electric tramways have been seized.

The Rating of Electric Automobiles.—An important point to owners of electric cars was raised at the Marylebone Police Court on Monday, when Mr. J. M. Gatti (a director of the Charing Cross, West End, and City Electricity Supply Company) was summoned for keeping a car without a licence. It appears that Mr. Gatti objects to the Treasury regulations, which do not lay down a method of assessing the horse-power of cars other than driven by engines with cylinders, but assume for taxing purposes a minimum of 12 h.p. He contended that his car was sold to him as being of 4½ h.p., and he had originally paid a two-guinea duty. He explained that he had since paid the four-guinea duty under protest, but had refused to pay the Council a "compromise fine." The summons was eventually withdrawn on the understanding that Mr. Gatti's position was in no way prejudiced.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published February 23rd, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

30,262/09. **Traction Motor Control.** W. WITTEK (Vienna). Automatic gear is described which, when it is switched into circuit, controls the acceleration of the motors according to a predetermined speed-current curve, and also automatically cuts off current and applies the brakes at the correct times in order to follow a predetermined speed-distance diagram. The motor controller is actuated by the movement over contacts of the pointers of an ammeter and a speedometer. Sixteen figures.

66/10. **Storage Batteries.** V. DE KARAVODINE and S. B. APOSTOLOFF (London). Plates are made up with a mixture of lead sulphate and ammonia, which sets hard. The plates are formed in an alkaline bath of ammonium sulphate and ammonia. It is stated that the product is hard, highly porous and conductive, and adheres firmly to the grid.

2,237/10. **Driving of Textile Machinery.** MASCHINENFABRIK OERLIKON (Zürich). An improved automatic mechanism for ring-spinning and twisting frames is described. This not only regulates the speed of the motor in accordance with the different periods of winding the cop, but imparts to the spindles for each stroke of the ring-rail (and more particularly for each stroke during the building of the base of the cop) a variable speed uniformly distributed over the whole length of the layer of thread corresponding at any instant to the diameter of the cop and to the tension of the thread. Six figures.

2,759/10. **Drawn Tungsten Filaments.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*). Tungsten powder with a small percentage of carbon is made into a paste with an amalgam binder of bismuth, cadmium, and mercury. This is extruded under pressure through a 40-mil die, and cut into rods about 3 feet long. After baking in a vacuum, the rods are partially sintered in hydrogen. The final sintering is done at a temperature approaching the melting-point of the metal in an atmosphere of hydrogen and nitrogen, and the current through the rods is reduced very gradually during several hours. It has been found that this very gradual cooling results in the tungsten rod being very ductile even at ordinary room temperatures without the necessity for the prolonged mechanical working described in a previous specification. (See ELECTRICAL ENGINEERING, February 16th, 1911, p. 84.)

4,736/10. **Induction Motor.** ELECTRIC CONSTRUCTION Co., LTD., and N. PENSABENE. This patent covers a polyphase induction motor with a self-contained starting resistance and cut-out device, which rotates with the rotor. Coils of resistance strip are wound on edge on the surface of a drum and are connected with the different phases of the rotor, and brushes are arranged so as to be capable of being slid along the surface of the drum so as to cut out the resistance gradually. The brushes preferably rotate with the drum. In an alternative design the brushes slide on rings connected to resistance coils situated within the drum. Four figures.

17,278/10. **Arc Lamp Carbons.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) Carbons for flame arc lamps have cores containing about 35 per cent. titanium carbide, 30 per cent. calcium or barium flouride, 15 per cent. cryolite, and 20 per cent. carbon. Such carbons are particularly suitable for the positive electrodes in lamps in which the positive is situated below the negative electrode. A coreless carbon containing these chemicals can also be used.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free. Names in italics indicate communicators of inventions from abroad. Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: WILLIAMS and STEVENSON [Suspension and connection device] 3,361/10; JOHNSON & PHILLIPS and BROCKIE [Magazine lamps] 4,885/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: VANDERVELL [Cable armouring] 11,978/10.

Dynamos, Motors and Transformers: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Carbon brushes] 3,336/10; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke-Ges.*) [Regulation of power-factor of machines] 10,913/10; BLATHY [Machines] 12,594/10; ALLGEMEINE ELEKTRICITÄTS-GES. [motor control] 15,426/10.

Electric Ignition: MASON [Sparking plugs] 3,161/10; R. BOSCH, 27,168/10.

Electrometallurgy and Electrochemistry: JOHNSON (*Chemische Fabrik Griesheim Elektron*) [Production of long arcs] 5,934/10; PRESSER [Electric welding] 14,859/10; THOMSON [Furnaces] 15,167-8/10; BADISCHE ANILIN & SODA FABRIK [Manufacture of nitrides] 16,368/10.

Heating and Cooking: COOPER (*Boelling*) [Cooking vessel] 17,538/10.

Incandescent Lamps: LICHTWERKE-GES. [Filament supports] 27,710/10.

Instruments and Meters: HANDCOCK and DYKES [Meter system] 3,294/10; LANDI [Electrical speed indicator] 6,256/10; ALLGEMEINE ELEKTRICITÄTS-GES. [Maximum demand meter] 20,446/10.

Switchgear, Fuses, and Fittings: CHILDS and HILL [Controllers] 3,098/10; ASHTON [Lamps on A.-C. systems] 3,518/10; MASCHINENFABRIK OERLIKON [Governors for electrically driven machines] 4,950/10; BARNARD and EDWARDS [Motor controllers] 6,535/10; ADAMS MANUFACTURING Co. (*Cutler Hammer Manufacturing Co., U.S.A.*) [Remote control circuit-breakers] 8,225/10, and [Motor controllers] 11,184/10; DAVIS and SIEBE, GORMAN & Co. [Plug connectors] 8,977/10; GILLIATT and EXCESS INDICATOR Co. [Overload indicators] 18,742/10; MIDGLEY and VANDERVELL [Lamp fittings] 18,916/10; DRUSEIDT [Combined fuse-box and switch] 19,930/10; DENNY and FLOOD [Automatic tumbler switches] 26,737/10; KALAMBA [Plug connectors] 27,248/10.

Traction: COMPAGNIE DE SIGNAUX ELECTRIQUES POUR CHEMINS DE FER [Control of points and signals] 3,199/10.

Miscellaneous: PRATSCHKER [Electric typewriters] 4,359/10; W. WATSON & SONS [Stereoscopic radiographs] 4,506/10; AUB [Electromedical apparatus] 15,634/10; RUTHENBURG [Magnetic separators] 21,031/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: KULKA [Oil-cooled transformers] 2,241/11.

Electric Ignition: BROC [Distributers] 28,590/10.

Switchgear: TRAUS [Lamp switches] 2,520/11; GROB [Regulators] 2,719/11.

Telegraphy, &c.: FESSENDEN [Wireless signalling] 11,154/10 and 2,617/11; SIEMENS & HALSKE A.-G. [Telephone exchanges] 22,013/10; LANGE [Wireless aerials] 2,242/11; FISHER [Signalling] 2,686/11.

Amendment

4,357/10. **Disc Coal-cutter.** F. A. SCOTT and D. MILLER. A disclaiming note has been added to this specification which was abstracted in ELECTRICAL ENGINEERING IN MINES, February 2nd, 1911. The patent covers an improved haulage gear which reduces the height of the machine in that the rope passes at the side of the machine and not below it for forward travel.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

5,789 of March 4th, 1897. **Train-Lighting.** E. J. PRESTON and A. B. GILL. This patent covers a link belt for driving a dynamo from the train axle. It is of vulcanised fibre, and is provided with friction pieces of leather or canvas. Alternatively, it may be constructed with alternate links of leather and vulcanised fibre, the former projecting beyond the latter.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*). [Automatic cutting-out of faulty sections of distributing systems] 24,180/04.

Dynamos, &c.: W. L. HILDBURGH [Brushes and slip rings for unipolar machines] 22,971/05.

Electric Ignition: ELECTRIC IGNITION Co. and F. H. HALL [H.T. double-armature magnets] 23,058/05.

Electrometallurgy and Electrochemistry: I. J. BRONN [Resistance furnaces] 24,235/02; A. SCHNELLER [Sterilising water by ozone] 24,379/03; J. MILLWARD and W. E. TILLSON [Recovery of tin from scrap] 22,630/05.

Switchgear, &c.: O. L. PEARD [Non-arcing fuse] 19,847/00; F. BRANDT [Accumulator emergency lighting for theatres] 24,369/04.

Telephony, &c.: J. A. GAMBLE [Telephone memorandum] 24,055/03.

Traction: WESTINGHOUSE BRAKE Co. and J. CLOUD [Electromagnetic valve for vacuum brakes] 22,291/01; J. CLOUD [Air-valve for vacuum brakes] 24,352/04.

Miscellaneous: B. SCHWERIN [Electrical drying of peat] 22,301/01; K. A. GUTKNECHT [Electro-pneumatic dispatch apparatus] 24,276/03.

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THE BRIGHTON CONVENTION OF THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION

THE preliminary programme of the Convention, which is to be held from June 27th to 30th, with Brighton as its headquarters, has now been issued. On Tuesday, June 27th, the Convention is to be opened by his Worship the Mayor of Brighton, Councillor C. Thomas Stanford, at the Royal Pavilion, and Mr. J. Christie, Engineer and Manager, Brighton Electrical Department, will give his Presidential Address, which will be followed by papers and discussions. After luncheon at the Grand Hotel, visits will be paid to works, and a reception and conversazione will be held in the evening at the Royal Pavilion by invitation of the Mayor and Mayoress. On Wednesday, June 28th, the party will travel by special train to Portsmouth, and meet in the Lecture Hall, Municipal College, to hear an address of welcome by the Mayor of Portsmouth, Alderman F. Scott Foster, followed by papers and discussions. Luncheon will be partaken of at the Esplanade Hotel, and visits to works and H.M. Dockyard will be paid in the afternoon. After an evening cruise in the Solent, the return will be made to Brighton by special train. On Thursday, June 29th, papers will be discussed at the Banqueting Room, Royal Pavilion, and visits to works are arranged for the afternoon, after which the annual dinner will be held at the Dome. Friday, June 30th, will be devoted to the annual general meeting for the election of officers and council, and a motor-car run to Arundel. The headquarters will be the Grand Hotel, Brighton, where rooms should be booked at once. Application for accommodation must be made to the hotel. Ladies accompanying the party will receive invitations to the Mayor's reception on Tuesday. On Wednesday arrangements will be made for them to visit places of interest in Portsmouth. On Thursday afternoon a tramway trip will be arranged, and ladies may attend the annual dinner in the evening. Special arrangements are being made for reduced fares, and the Brighton Corporation Golf Links and those of the Southdown Golf Club will be available.

THE MANCHESTER SECTION DINNER

ABOUT 120 members and guests gathered at the Midland Hotel, Manchester, last Friday, on the occasion of the annual dinner of the Manchester Section of the Institution of Electrical Engineers. Mr. J. S. Peck (British Westinghouse Co.), Chairman of the Section, took the chair.

Mr. S. Z. de Ferranti, responding to the toast of the Institution of Electrical Engineers, proposed by Sir T. Thornhill Shann, J.P., referred to the Northern Society of Electrical Engineers, which was not only the predecessor of the present Manchester Section, but also had the distinction of first drawing the attention of the Institution to the importance of provincial organisation. Mr. Ferranti forecasted new activities on the part of the Council which would tend towards the assistance of all sections of the Institution; the Institution should have a care for every interest represented in its ranks. Mr. J. S. Peck, who also responded to the toast, referred to the relations existing between the Council of the Institution and the local sections, and said that since he had sat on the Council the London body had exhibited the greatest desire to do all in their power to develop the local sections and to assist them in every way. Every member of the electrical profession should be a member of the I.E.E.; it was the only organised body that was fighting for the furtherance of electrical interests, and those who were not members were benefiting by the Institution's activities without paying their way.

Mr. W. Cramp, in a light and humorous speech, proposed the toast of The Visitors. This was responded to by Councillor S. W. Royse, J.P., who anticipated that in the very near future there would not be a single cotton-mill that was not electrically driven. The speaker also referred to the present controversy between the Manchester Electricity and Gas Committees; as a member of the former, he complimented Mr. S. L. Pearce on the policy he had pursued, and assured him that as long as he continued on that policy he was certain of their support.

NATIONAL TELEPHONE TRANSFER

AT the half-yearly meeting on Thursday Mr. George Franklin, the Chairman, referring to the position of the Company in relation to the transfer of their undertaking to the State, said that the Company's officers were engaged upon an inventory of the plant upon which the Company's claim would ultimately be founded. As this inventory was being checked by Post Office officials, there were strong hopes that arbitration would not have to be resorted to in order to determine the price to be paid by the Government so far as the main portion of their undertaking was concerned. A difference had arisen, however, with regard to a certain quantity of land, plant and buildings in competitive exchange areas which the Postmaster-General objected to having to purchase, and the Company had also been notified that certain plant had not been constructed in accordance with the specification of the Post Office, as required by the agreement to purchase. The Board had entirely dissented from the Postmaster-General's views with regard to the first objection, and had commenced proceedings before the Railway and Canal Commissioners. As to the second objection, he thought it was likely to result in a very small matter indeed.

LOCAL NOTES

Aberdeen: *Street Lighting.*—An experiment in street lighting by means of metal filament lamps is being carried on in Albyn Place, the lamps being suspended from the span wires of the tramway system. Hitherto this thoroughfare has been lighted by gas, the approximate candle power of each lamp being 40 c.p. Three 400 c.p., two 200 c.p., two 100 c.p., and a number of 50 c.p. lamps have been installed. The experimental lighting will be carried on for one month.

Power Supply.—A contract has been arranged for the supply of electric power to the Great North of Scotland Railway Co. for five years.

Belfast: *Cavehill and Whitewell Tramways.*—The arbitration to determine the price to be paid by the Corporation for the Cavehill and Whitewell tramways has been continued in London during the week. Mr. Stephen Sellon, on behalf of the Company, estimates the value at £37,357, whilst Mr. H. A. Cutler, the Belfast City Surveyor, puts the value at £19,371. There seems to be some difference of opinion as to whether the lines are purchasable on the basis of a "going concern" or not.

Edinburgh: *Tramway Extensions.*—The Tramways Committee are again considering some proposals from companies to extend the tramway system by electric traction.

Halifax: *Tramways Extensions Abandoned.*—The Corporation have decided to abandon the proposed tramways to Mytholmroyd and Sowerby Bridge, which are included in their Bill now before Parliament. In doing so, they propose to call the attention of the Municipal Tramways Association to Standing Order No. 22 of the House of Parliament, which gives a local authority the right to veto any proposed tramway within its area. The Tramways Committee of the Halifax Corporation reiterate the point that has so frequently been made by tramway companies that this Standing Order is a great bar to tramway progress.

Hendon: *Trolley Omnibuses.*—The Council have decided to adopt the system of trolley omnibuses, which has been run experimentally by the Metropolitan Electric Tramways, Ltd., for some months. The agreement is for three years, and if at the end of that time the scheme is found to be unsatisfactory the Company will remove everything at their own cost.

Hull: *Tramway Profits.*—The tramway accounts for 1910-11 will allow of £12,000 being transferred to relief of rates, the net profits being £13,966. There is some difference of opinion among the members of the Tramways Committee as to the wisdom of transferring such a large sum, but a proposal to do so was carried.

Leicester: *Tramways.*—The report upon the tramways for the year to December 31st shows a net balance of £13,734, against £10,669 in the previous year. The tramway power station, which also supplies electricity for power purposes, has 1,880 h.p. of motors connected.

Liverpool: *Power Plant.*—Mr. A. Bromley Holmes, Consulting Engineer to the Electricity Department, has issued a report upon the generating stations and plant. He proposes to make improvements at Lister Drive No. 1 power station by replacing gradually four of the present 700 kw. sets by two turbo-alternators of from 2,500 to 3,000 kw., and correspondingly to increase the condensing arrangements. It is also proposed to put down motor-generators to enable the direct current supply for the auxiliary plant for the No. 2 station to be worked from the turbo-alternators. It is only necessary, however, to deal with the latter proposal in the current year, it not being thought necessary to install any new turbines until the autumn of 1912. By this arrangement it is anticipated that not only will the costs be reduced, but the output will be increased by more than 3,000 kw. without additional boilers or buildings.

Charges for Supply.—Mr. Holmes has also reported upon the charges for electrical energy in Liverpool, and is unable to recommend any drastic alterations in the present tariffs, although he is in favour of extending the rateable value

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system of charging as much as possible. The reduced output due to metal filament lamps suggests that an increase in the charge for lighting would be justifiable, but as the use of radiators is extending, and a demand for cooking and other domestic services is commencing, Mr. Holmes does not think it would be wise, from a business point of view, to raise the prices at the present time.

London: *L.C.C. Tramways.*—A new electric tramway service from London Bridge to Deptford was inaugurated on Thursday. The length of line is 2¼ miles, and it is to be extended to Greenwich, a total distance of 4 miles.

Loughborough: *Street Lighting.*—It is intended to proceed definitely with the scheme for the conversion of 155 posts, which are on the route of existing mains, from gas to electric lighting.

Sheffield: *New Tramcar Shed.*—The new tramcar shed in Shoreham Street, with accommodation for 96 cars, was opened last week. The cost of the sheds has been £27,500. Being near the centre of the city, a great deal of "waste mileage" will be saved.

Sunderland: *Tramway Receipts.*—It is anticipated that the net profit on the tramways to March 31st will be £3,668 after repaying £10,350 in respect of capital.

Swansea: *Proposed Tramway Purchase.*—It is stated that the Tramways Company have been asked to submit suggested terms as a basis for agreement by which the Corporation might acquire the tramways.

Torquay: *Paignton Tramways.*—Orders have been placed for rails, additional cars, and overhead equipment for extending the tramways to Paignton.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Aberdeen.—A 1,000 kw. continuous current turbo-generator with surface condenser and air pump is required. Particulars from City Electrical Engineer, and tenders by March 9th.

Australia.—The Melbourne Council invite tenders for a battery with boosters and switchboards. Particulars from Messrs. McIlwraith, McEacharn & Co., Billiter Square Buildings, E.C., and tenders by May 8th.

Tenders are invited by the Postmaster-General, Adelaide, by April 19th, for five motor-generators and a switchboard. Particulars, &c., at 72 Victoria Street, Westminster, S.W.

Canada.—An estimate of £226,000 has been submitted to the Ontario Legislature for expenditure by the Government Hydro-Electric Commission in order to complete the Niagara transmission lines.

Eccles.—Tenders are invited by March 20th for a 500 K.V.A. reciprocating engine, single-phase generating set and exciter. Particulars from the Borough Electrical Engineer.

Greenock.—A loan of £22,000 for electrical extensions has been granted subject to the condition that £1,500 per annum is set aside from revenue for reserve.

Kettering.—Tenders are invited for a 350-kw. generating set and a 450-kw. mixed pressure turbo-D.C. generating set with condensing plant. (See an advertisement on another page.)

London: *St. Pancras.*—The Finance Committee of the L.C.C. recommend sanction to a loan of £3,977 for electrical extensions.

Stepney.—The Finance Committee of the L.C.C. recommend sanction to loans amounting to £13,000 for electrical extensions.

Woolwich.—The Finance Committee of the L.C.C. recommend sanction to a loan of £2,000 for electrical purposes.

Middleton.—Tenders are invited by March 8th for a barometric jet condenser. Particulars from the Electrical Engineer.

Northampton.—The Northampton Electric Light & Power Co. is extending its generating plant.

Reigate.—Tenders are invited for two 200 kw. Diesel engine single-phase sets with exciters, pumps, &c.; also for main switchboard. (See an advertisement on another page.)

Scotland.—The Uphall Lighting Committee of the Linlithgow County Council have applied for a loan of £2,000 for electric lighting extensions.

South Africa.—According to the *British and South African Export Gazette*, an electric lighting scheme is being undertaken by the Klerksdorp Municipality.

South Shields.—A Local Government Board inquiry was held last week concerning a loan of £8,960 for extensions to the generating plant. The chief opponents are the North Eastern Railway Co. and Messrs. Smith's Dock Co., who, as large ratepayers, urge that the Corporation can purchase their current more cheaply from the Cleveland & Durham Electric Power Co. than they can generate for themselves. The inquiry was opened a few months back, and adjourned in order to see if an arrangement could be come to. The Corporation, however, acting under expert advice, are of the opinion that it will not be in the interests of the Borough to abandon the proposed scheme of extensions and accept the terms offered by the power company.

Stoke-on-Trent.—The scheme of the Electricity Committee for an expenditure of £60,000 upon the nucleus of a new system of electricity supply for the whole of the Federated area has been referred back. A deputation has been visiting London, Liverpool, Manchester, and Birmingham, and are convinced that it would be cheaper to rearrange the whole of the present equipment at the expenditure mentioned above rather than to spend £20,000, which sum will be necessary to improve the existing plants. If a new system is adopted, Mr. C. H. Yeaman recommends the use of 6,500 volts at 50 cycles, and that to commence with a 1,000-kw. and 1,500-kw. turbo-generator be installed at one of the existing works with trunk mains to connect the other works, together with the necessary sub-station plant.

Watford.—Tenders are invited by March 7th for high and low tension paper insulated cables.

West Hartlepool.—A Local Government Board inquiry was held last week concerning an application for £32,100 for extensions of the municipal electricity undertaking. The proposal is to erect a new generating station, as reported in our columns a short time ago, and to use waste heat from the furnaces of the Seaton Carew Iron Co. Among the opponents to the scheme are the Cleveland and Durham Electric Power Co., who have made an offer which the Corporation contend is equivalent to the exclusive control of the northern part of the town, which includes the docks. The inquiry has been adjourned, owing to the uncertainty of counsel being free to resume within the next few days.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

Aberystwyth.—Isolation Hospital.

Derby.—New Court House.

Elland.—New Secondary School. Tenders are invited for electrical fittings. L. Clegg, Hollywell Green, Halifax.

Glasgow.—Shops and offices in St. Vincent Street.

London.—Buildings in Union Street, Southwark.

Middlesbrough.—Electric Theatre in Newport Road.

Morley.—New Music Hall.

Rochdale.—Considerable alterations at Town Hall.

Swansea.—Electric Theatre, Oxford Street. Messrs. Berens & Franks.—Printing Works, Sydney Street. T. Morgan.—Six houses, Westfa Road. C. Williams.

MISCELLANEOUS

Buenos Aires.—It is stated that a concession for a new tramway from the Tigre to Buenos Aires Port is to be granted to a new company to be formed by the Buenos Aires Port & City Tramway Co.

Chili.—The Chili Electric Tramways and Lighting Co., Ltd., is to undertake extensions of its systems.

Colchester.—Tenders are invited by March 31st for electric lighting fittings, electrical equipment for tramcars, overhead equipment, &c. Particulars from the General Manager.

Dublin.—The Electricity Committee invite tenders for the supply of arc lamp carbons (see an advertisement on another page).

Manchester.—Tramway extensions are to be carried out in the Chorlton district.

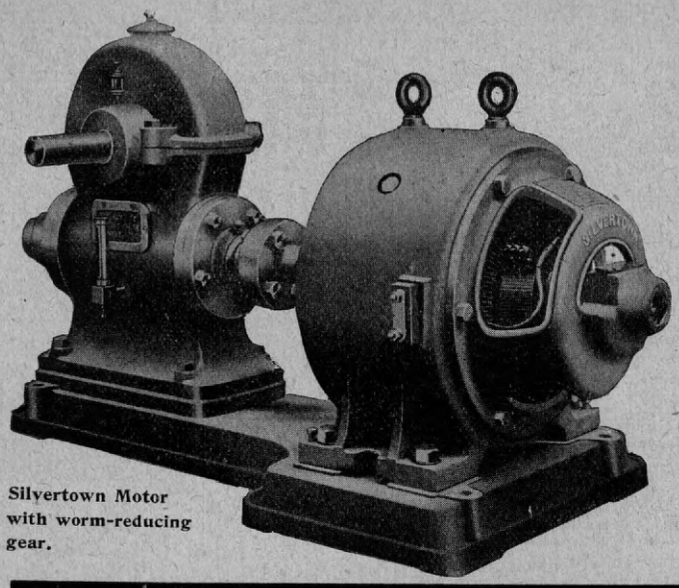
Morley.—The Light Railway Commissioners held an inquiry last week into an application by the Corporation for powers to construct a light railway. There was no opposition.

Nottingham.—Tenders are invited for overhead line materials, electrical sundries, &c. Particulars from the Town Clerk, and tenders by March 11th.

Partick.—Tenders are invited by March 6th for cables, cut-outs, meters, incandescent lamps, arc-lamp carbons, &c. Particulars from the Borough Engineer.

Southend.—Electricity is to be substituted for gas lighting on the pier.

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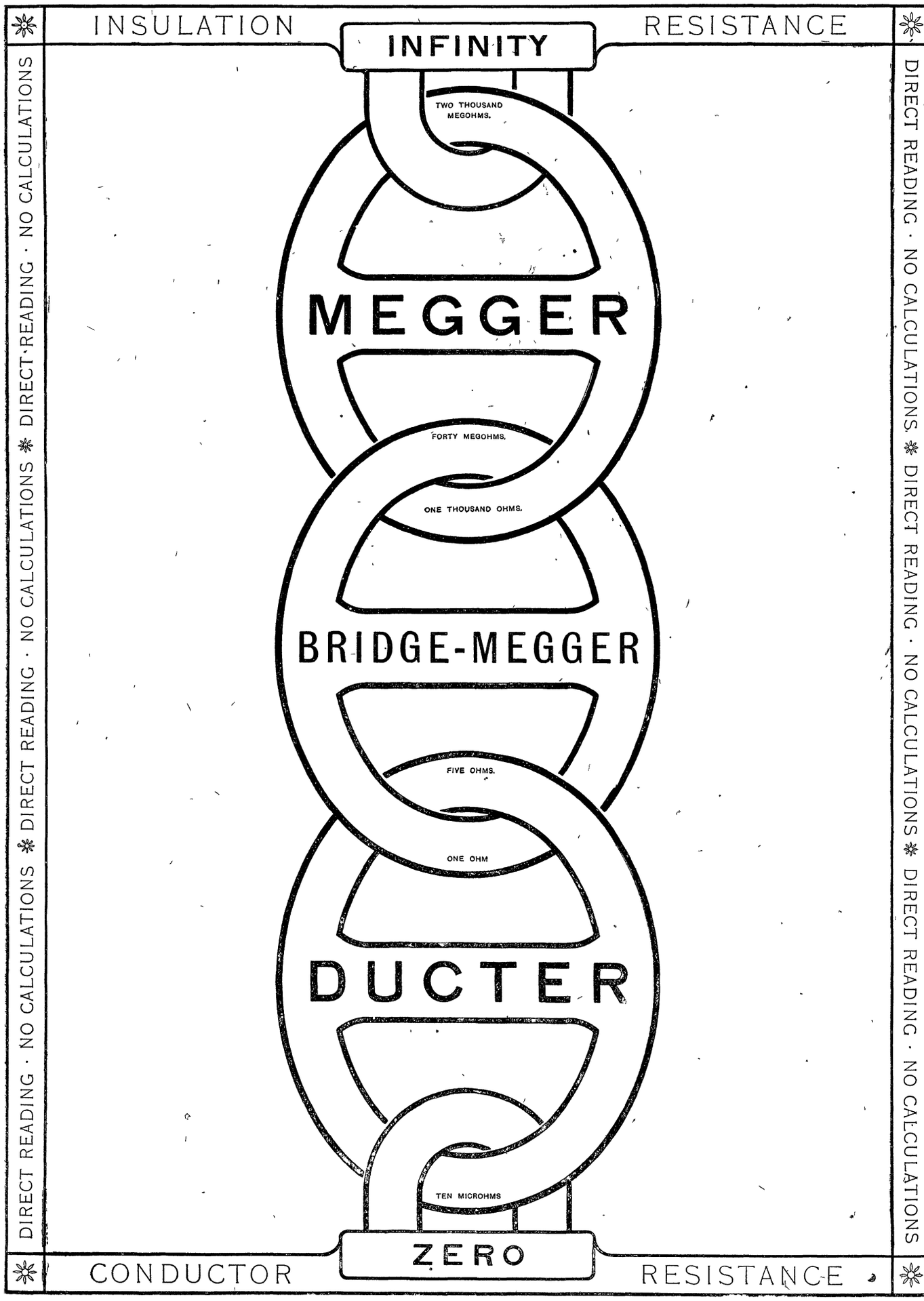
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APPOINTMENTS AND PERSONAL NOTES

A Principal and Organiser of the Science and Technological Department is wanted for the Crawford Municipal Technical Institute, Cork. Salary £400 per annum. (See an advertisement on another page.)

Mr. W. Wallace, of Stoke-on-Trent, has been appointed Technical Assistant at the Stoke Electricity Works at a salary of £78 per annum, rising to £91.

The salary of Mr. C. A. Baker, Principal Electrical Assistant in the Chief Engineer's Department of the L.C.C., is to be increased from £500 to £550, and to £600 next year.

The salary of Mr. E. Ridley, Electrical and Mechanical Engineer at the chief station of the L.C.C. Fire Brigade, is to be increased to £450 per annum, with two further annual increases of £25.

The salary of Mr. J. Welling, Permanent Way Engineer to the L.C.C. Tramways, is to be increased from £550 to £575 per annum.

The salary of Mr. E. W. Dickinson, Superintendent of Greenwich sub-station, is to be increased from £450 to £475 per annum.

The salary of Mr. E. L. Pope, Resident Electrical Superintendent, Southern Section L.C.C. Tramways, is to be increased from £425 to £450; and that of Mr. T. L. Horn, Resident Electrical Superintendent, Northern Section, from £375 to £400 per annum.

An assistant lecturer in the Electrical Engineering Department of the University of Bristol is required for about five months, at a salary of £3 per week. Apply, Dean of the Faculty, Merchant Venturers' Technical College, Bristol.

The Leicester Electricity Committee have appointed Mr. T. R. Smith, Tramways Engineer, to be Engineer and Manager of the Electricity Department, in addition to his present duties, with an increase in salary from £500 to £600 per annum. Mr. J. E. M. Stewart, Chief Assistant Engineer of the Electric Lighting Department, is to be Assistant Engineer of the Electricity Department at a salary of £350 per annum.

The salary of Mr. G. T. Dickens, Stores Superintendent, L.C.C. Tramways, is to be increased from £300 to £325 per annum, and a similar increase is to be granted to Mr. A. Terry, District Traffic Superintendent Southern Section, L.C.C. Tramways.

Mr. W. Buchanan, formerly Chief Designer to the Electric Construction Co., and recently senior lecturer at Faraday House, London, has been appointed Professor of Electrotechnics at the School of Mines (Transvaal University), Johannesburg. The salary is £1,000 per annum, and Mr. Buchanan will be allowed to engage in consulting work.

Mr. W. Bolton Shaw, formerly Electrical Engineer to the Hulton Colliery Co., Ltd., and more recently connected with Messrs. John Musgrave & Sons, Ltd., as chief turbine designer, is now in practice as a consulting engineer and has opened an office in Irene Chambers, 25 Market Street, Manchester.

A draughtsman acquainted with electrical work is required. (See an advertisement on another page.)

The Acton Electricity Undertaking.—A short discussion took place in the House of Commons on Tuesday upon the motion for the second reading of the Metropolitan Electric Supply Company's Bill, which seeks to acquire the Acton electricity undertaking. Mr. Parker, the Member for Halifax, and Mr. Pointer, Member for the Attercliffe Division of Sheffield, argued that the Council's undertaking is just on the borderline of success, and that to transfer it now would be against the best interests of the ratepayers. Further, the whole matter had been done at the bidding of one or two persons on the Council. Mr. Tennant, on behalf of the Board of Trade, said that there should be no objection to the Bill being read a second time, and sent to a Committee to be dealt with. Eventually the Bill was read a second time by a majority of 15.

Proposed Gathering of Old Ferranti Men.—A notice reached us too late for insertion in our last issue that old Ferranti men propose to hold a dinner in the near future, at which Mr. S. Z. de Ferranti will be the guest of the evening. We understand that a committee has been formed to bring the matter to the notice of their former colleagues. The committee includes the names of Messrs. A. B. Anderson, C. P. Sparks, W. H. Kolle, Chas. Day, G. del Rivo, G. W. Partridge, A. E. Hadley, and Haydn Harrison. The date of the proposed gathering is not yet fixed, but it is intended that it shall take place during Mr. Ferranti's term of office as President of the I.E.E. Ferranti men who see this paragraph are asked to bring the matter to the notice of others with whom they are acquainted, and to send their names to Mr. W. E. Warrilow, Selwyn Avenue, Watford, who is acting as Hon. Sec., and who will be pleased to forward full particulars.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night was £57 5s. to £57 10s. per ton (last week, £57 10s. to £57 15s.).

Royal Appointment.—Messrs. A. P. Lundberg & Sons, 477 to 487 Liverpool Road, Islington, N., have received the honour of an Appointment as Electrical Accessories Manufacturers to H.M. King George V. The firm held a similar appointment to his late Majesty King Edward VII.

Chillingworth Gear Cases.—We are informed that R. Chillingworth, of Nurnberg, has made arrangements for the sale of the Chillingworth patent pressed steel gear cases in the United Kingdom, and for export therefrom, to be handled by the British Thomson-Houston Co., Ltd., exclusively. All inquiries hitherto sent to R. Chillingworth at Nurnberg, or to his representatives in the United Kingdom, should in future be referred to the British Thomson-Houston Co., Ltd., Rugby, or to their branch offices.

"EOA" Specialities.—The extension of the business of the Electric & Ordnance Accessories Co., Ltd., in Lancashire and Yorkshire has necessitated the doubling of the office accommodation at 196 Deansgate, Manchester. Mr. J. Booker is the company's representative.

Plant for Sale.—The Electricity Committee of the Walsall Corporation have a quantity of steam and electrical plant for sale. (See an advertisement on another page.)

Bankruptcies.—The liabilities in the bankruptcy of V. G. Birkett, electrical engineer, 38 Park Row, Bristol, are put at £214, with a deficiency of £113. The public examination is to-morrow, March 3rd.

The last day for receiving proofs in the bankruptcy of J. W. Barnet, electrical engineer, 25 Waterloo Road, Burslem, is March 9th. The trustee is F. T. Halcomb, King Street, Newcastle, Staffs.

The trustee in the bankruptcy of J. D. Morton, electrical engineer, Nettleton Road, Mirfield, Yorks, has been released.

Telegraph Traffic.—There is no news with regard to the French West India system, and the New Caledonia cable is still down. No doubt the steamer of the Pacific Cable Board will be chartered if possible to put this section in order. The cable between Zante and Corfu of the Eastern Telegraph Co. failed on the 26th ult. The El Arich route has continued down for a longer period than usual, as repairs were only effected on 27th ult., the line having to be overhauled in two or three places. The *via* Hanekine route was down on the 22nd ult. between Constantinople and Ismid. On the 25th ult., the Indo-European Telegraph Co. effected the restoration of their route, but it again broke between Kertch and Soukhoum Kale.

The Telephone System.—A Conference of Municipal Authorities, convened by the Glasgow Corporation, was held in London on Monday, when the proposed abolition of the limited service system of charging for telephones was protested against. The deputation afterwards waited upon the Postmaster-General, who said he was willing to arrange for a public inquiry after the National Telephone Company's business had been taken over and the Post Office had fixed their rates for telephone service.

Wireless Telegraph Notes.—A *Central News* cable from San Francisco states that wireless communication has been established between that city and Chosi Shimosa on the Japanese coast, a distance of 5,700 miles. The messages were passed with one relay, for which purpose a steamer of the Pacific Mail Co. was used.

A wireless telegraph installation has just been completed at the Rosyth naval base.

At the coming Imperial Conference, reference will be made to the linking up of the colonies by wireless telegraphy. It is suggested that Canada and New Zealand could communicate with each other by means of a powerful intermediate station on one of the South Pacific islands. The Admiralty are said to be particularly interested in the scheme.

As a result of the successful experiments with wireless apparatus on submarines, several boats are to be fitted with apparatus which has been especially designed for the purpose.

Wireless telegraph communication has been established in Russia between Nicolaievsk-on-Amur and Kamchatka, a distance of 800 miles. During the winter months there is no postal service to the latter.



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COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Notting Hill Electric Lighting Co.—The net profit for 1910 was £12,905, after providing for depreciation, renewal, and reserve fund, &c. A bonus of 2 per cent. is declared upon the preference shares, and a dividend of 6 per cent. with a bonus of 2 per cent. on the ordinary shares, together with a distribution of £5 per share on the founders' shares. A scheme for rearranging the capital of the company has been formulated.

London Electric Railway Co.—An issue of £1,250,000 4 per cent. preference stock is to be made at 83.

Welsbach Incandescent Gas Light Co.—A provisional agreement has been entered into with the Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft) of Berlin to promote a new company in England to acquire the present English Welsbach Company. The purchase price is to be £440,000, made up as follows: £100,000 in cash, £240,000 in 4½ per cent. debentures, and £100,000 in new shares.

Yorkshire Electric Power Co.—At the half-yearly meeting last week Mr. A. G. Lupton, chairman of the company, had a good deal to say with regard to the obstruction of local authorities towards the extension of electric power supply by power companies.

Newcastle-upon-Tyne Electric Supply Co.—A dividend of 4 per cent. for 1910 on the ordinary shares.

London Electric Supply Corporation.—At the annual meeting last week Mr. R. Stewart Bain, Managing Director, after referring to the new contract with the L.B. & S.C. Railway for 17 years, stated that the London Electric Railway Company's Bill, and also that of the Metropolitan District Railway Co., would be strenuously opposed, as they affected nearly all the supply undertakings in London. The Bills in question provide for the supply of electrical energy from the Lot's Road power station to all the tube railways in London.

Chelsea Electricity Supply Co.—The accounts for 1910 show a net profit of £38,897, after placing £12,782 to renewals and depreciation, and writing £1,089 off cost of extinction of founders' shares. A final dividend on the ordinary shares, making 5 per cent. per annum, is declared, carrying forward £2,298.

Companies Struck off Register.—The names of the following have been struck off the Register of Joint Stock Companies: General Electric Inspection Co., International Telescriptor Syndicate, Simplified Underground Conductor Co., and Telephonic Bell Push Syndicate.

County of London Electric Supply Co.—Dividend at the rate of 6 per cent. per annum for the half-year on the ordinary shares, making 5 per cent. for 1910. Depreciation has been credited with £20,000.

The Waste Heat & Gas Electrical Generating Stations.—After transferring £7,000 to reserve, there is a balance of £18,518, and a dividend of 8 per cent. per annum for 1910 is recommended, carrying forward £6,048.

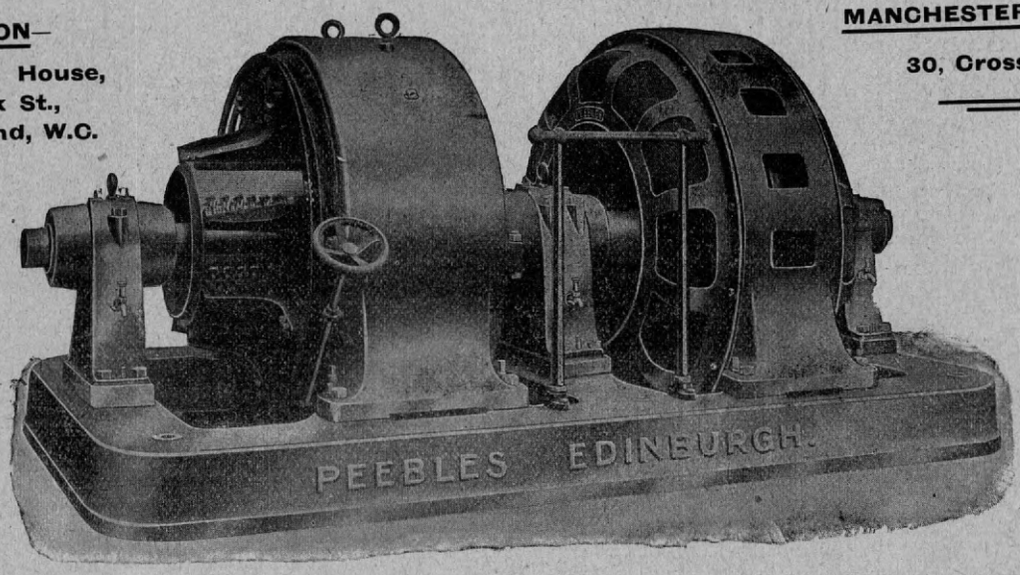
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Chartered Patent Agent.
Queen Anne's Chambers, 30, Broadway, Westminster, London, S.W.

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SUMMARY

Details are given of a 2,000-k.v.a. turbo-alternator which the Electric Construction Co. have recently supplied to the Corporation of Wolverhampton. (Page 119.)

An interpole motor with the field system carried on ball bearings so as to provide a simple means of measuring the torque has been constructed for the new Technical Institute, Dundee. A search coil on the armature is connected to slip-rings and a special timing device. (Page 120.)

Our monthly article on new electrical supplies and accessories contains illustrated descriptions of some special accessories designed in accordance with the Home Office rules and recommendations for factories. A new enclosed three-pole circuit-breaker is also described, and illustrations are given of some new forms of electric heater. (Page 121.)

A new paralleling volt-meter for alternating current has been introduced under the name of the "Paller." (Page 122.)

At a meeting of the Röntgen Society last week, Mr. A. A. Campbell Swinton made some interesting experiments with a 10,000-volt storage battery consisting of 4,800 Planté cells. (Page 123.)

Steam consumption tests of a 6,000-kw. Brown-Boveri turbo-alternator at the Dunston power-house of the Newcastle-upon-Tyne Electric Supply Co. have given figures as low as 11·8 lb. per kw.-hour on full load. (Page 123.)

The Papers on high-tension transmission by Mr. W. G. Taylor and Messrs. R. Borlase Matthews and C. T. Wilkinson have been further discussed at the Institution of Electrical Engineers in London. Mr. C. P. Sparks thought that pressures higher than 20,000 volts would be required in this country, but he did not favour the high-tension direct-current system. Mr. W. B. Woodhouse urged that the Institution should take up the question of wayleaves. The use of steel poles of tubular construction was advocated by Mr. E. J. Fox, and Mr. A. Jacob called attention to the extended use of aluminium for overhead conductors. Mr. E. H. Rayner referred to the safeguard afforded by the corona discharge if the line were worked just below the critical pressure. The practice of transmission systems in California was described by Mr. F. V. T. Lee. (Page 124.)

An interesting Paper by Mr. A. G. Collis, read before the South Wales Institute of Engineers, contained some oscillograph records of current and pressure at the moment of breaking circuit by various forms of switch and circuit breaker. A number of well-known authorities on switchgear contributed to the discussion. (Page 125.)

Certain suggestions for uniformity in symbols formulated by the unofficial Conference of the International Electrotechnical Commission at Brussels are published. (Page 126.)

Mr. W. W. Frith, in a recent Paper before the Newcastle Local Section of the Institution of Electrical Engineers, discussed the phase differences between synchronous motors and generators. (Page 127.)

Some new electrical effects have recently been introduced into the Drury Lane pantomime. (Page 129.)

Among the specifications published by the Patent Office on Thursday last was one by the British Thomson-Houston Co. for a process of manufacturing carbon brushes and electrodes of great density and high conductivity. The carbon is impregnated with pitch, and then fired at a high temperature. An improved feeding mechanism for a magazine flame arc lamp is covered by Johnson & Phillips, Ltd. The arc is not extinguished on changing over to a fresh pair of carbons. Felten & Guilleaume Lahmeyer-Werke

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A.-G. have abandoned a patent covering the introduction of phosphorous nitride into lamp bulbs to prevent disintegration of the filaments. (Page 128.)

AT an extraordinary general meeting on Thursday, the scheme for forming a new English Welsbach Co., in which the German Welsbach Co. will have the controlling interest, was passed. Some interest is created as to the future of the metal filament lamp which the English Welsbach Co. now sells. (Page 129.)

IN an address delivered at the Municipal Technical School, Birmingham, Mr. M. Railing emphasised the importance of a broad training for engineers, including commercial and business knowledge, and spoke in support of a protective tariff to protect home industries. (Page 129.)

THE Chairman of the Hull Tramways Committee has resigned as a protest against allocating large sums from the profits for relief of rates.—At Sheffield the amount transferred from tramway profits to relief of rates has been reduced by over £3,000.—An unsuccessful attempt has been made to get the Westinghouse Company struck off the list of tenderers to the Manchester Corporation.—The Board of Trade have been asked to appoint an arbitrator to decide the difference between the Manchester Tramways Committee and its employees. (Page 130.)

A 1,500-KW. generating set is required at Burnley; 1,000-kw. turbo-alternator, &c., at Rotherham; a battery and booster at Norwich; feeders at Kendal; and electrical supplies at Bolton. Additional plant is also to be installed at Rochdale; and the following loans are to be taken up: Dublin, £128,000; Felixstowe, £2,935; Ipswich, £17,000; Leek, £4,000; Liverpool, £25,000; and Bermondsey, £5,000. (Page 131.)

A 15 PER CENT. dividend is recommended by Messrs. W. T. Henley's Telegraph Works Co., Ltd.; 5 per cent. by the Metropolitan Electric Supply Co.; 6 per cent. by the County of London Electric Supply Co.; and 8s. per share by the City of London Electric Lighting Co. (Page 131.)

THE British Radio-Telegraph & Telephone Co. do not intend to appeal in the Marconi patent case. (Page 132.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, MARCH 9TH.

Institution of Electrical Engineers.

8 p.m. "The Laying and Maintenance of Transmission Cables," by C. Vernier.

Institution of Electrical Engineers: Dublin Section.

8.20 p.m. At Royal College of Science.

FRIDAY, MARCH 10TH.

Physical Society.

8 p.m. At Imperial College of Science. (1) "Note on an Electrical Trevelyan Rocker," by Dr. W. H. Eccles. (2) "Notes on the Tilted Gold Leaf Electroscope," by Dr. G. W. C. Kaye.

SATURDAY, MARCH 11TH.

Birmingham and District Electric Club.

7 p.m. At 49 Newhall Street, Birmingham. "Small Electric Lighting Plants," by C. Bell Walker.

MONDAY, MARCH 13TH.

Royal Society of Arts.

8 p.m. Cantor Lecture II.: "Applications of Electric Heating," by Prof. J. A. Fleming, F.R.S.

TUESDAY, MARCH 14TH.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "Electricity Meters," by H. A. Ratcliff and A. E. Moore.

Institution of Electrical Engineers: Glasgow Section.

8 p.m. At 207 Bath Street, Glasgow.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. Resumed discussion on "School Lighting."

Institution of Civil Engineers.

8 p.m. At 25 Great George Street, Westminster. "The Electrification of a Portion of the Suburban System of the L.B. & S.C. Railway."

WEDNESDAY, MARCH 15TH.

Association of Mining Electrical Engineers.

7.30 p.m. *Newcastle Branch.* At Milburn House, Newcastle. (1) "Oils for Transformers and Switches," by G. W. Humphrey. (2) "Conditions Specially Relative to Small Colliery Installations," by T. Thomson.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At Victoria Embankment. "Exhaust Steam Turbines," by R. C. Plowman and E. F. Hetherington.



WELSBACH-AUR LAMP—I wonder where I come in: perhaps cousin Osram will ask me to join him and the others, same as he did that Dutch boy Phil. (*See page* 129.)

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A NEW DESIGN OF TURBO-ALTERNATOR

A LARGE new three-phase turbo-alternator has recently been constructed by the Electric Construction Co., Ltd., to the order of the Wolverhampton Corporation. The machine presents several interesting features of design, particularly in the construction of the rotor centre and in the scheme of ventilation, and is designed to give 2,000 K.V.A. at 0·85 power factor, 6,600 volts, 50 periods, 1,500 r.p.m.; it has also to give 3,000 K.V.A. continuously without excessive heating. Photographs showing the general appearance of the stator and rotor are given in Figs. 1 and 2, and full details of the construction can be seen in Fig. 3.

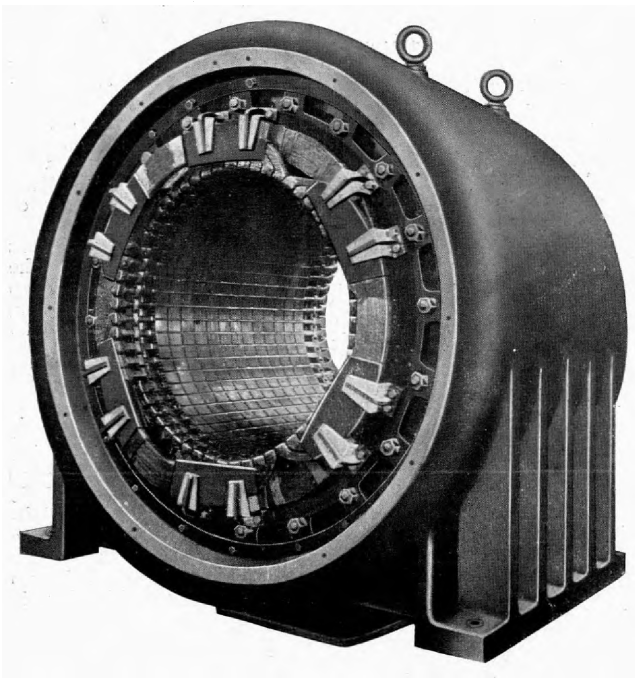


Fig. 1.—View of Stator with End Shields Removed.

The most important feature of the machine is its rotor construction, the centre being made from a solid block of steel. As will be seen from the figures, the rotor winding consists of four coils per pole distributed in slots parallel to the pole axis. This arrangement obviates the necessity for deforming the coils, as is usually the case with former wound coils when placed in radial slots. The end connections of the coils are also embedded in slots which lie in planes at right angles to the shaft. The end connections of the outside coil of each pole are held in position by gun-metal brackets. The stator winding is of the "bow" type, the coils lying in two different planes. This type of winding lends itself to a very rigid method of clamping, as will be seen from Fig. 3.

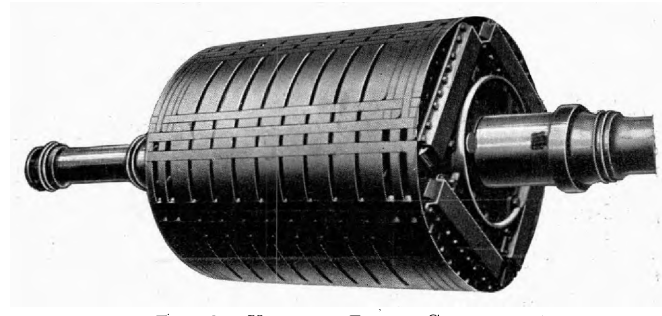


Fig. 2.—View of Rotor Complete.

The machine is arranged for forced ventilation. The inlet pipes are at each end of the machine, and each

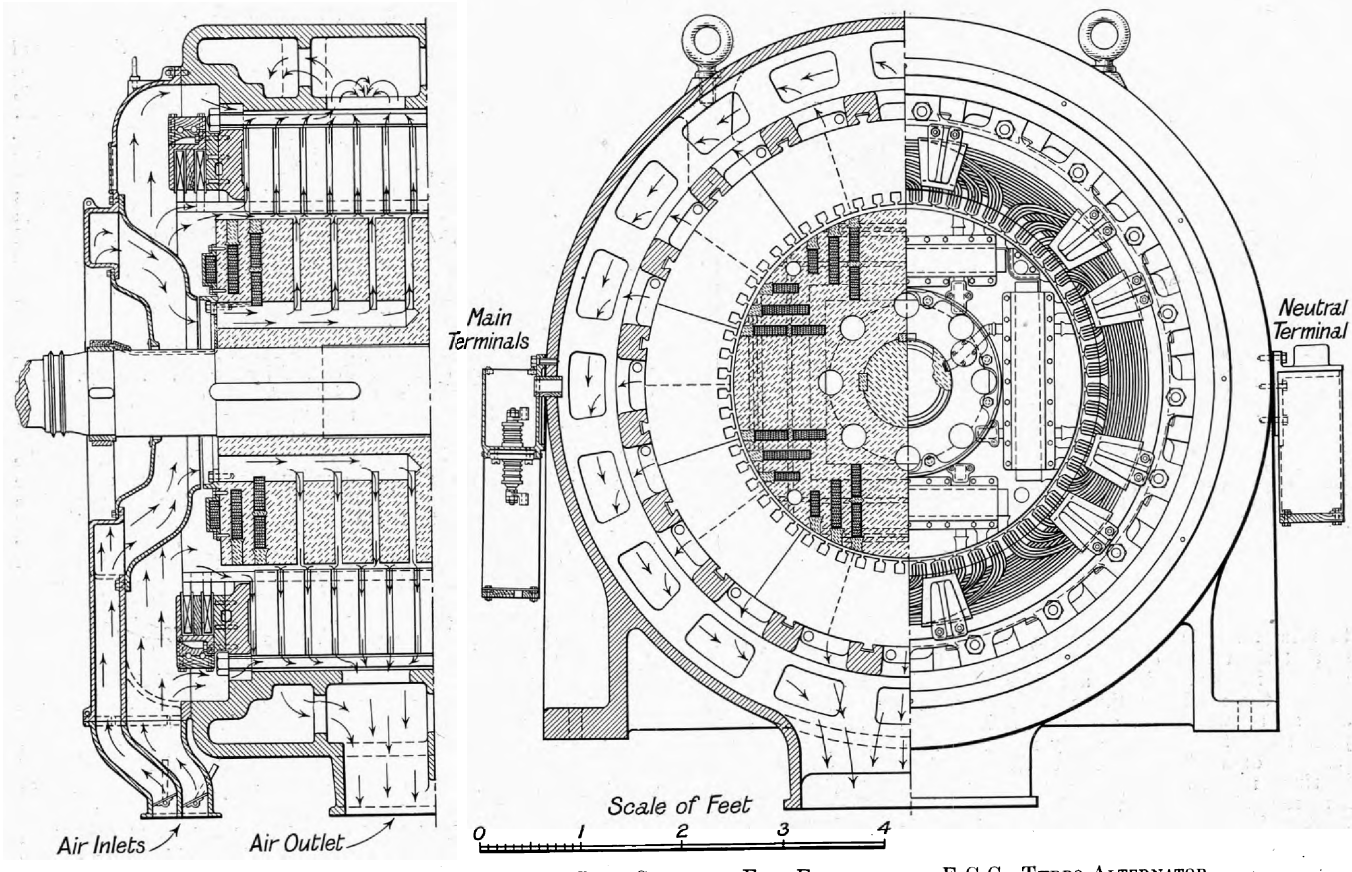


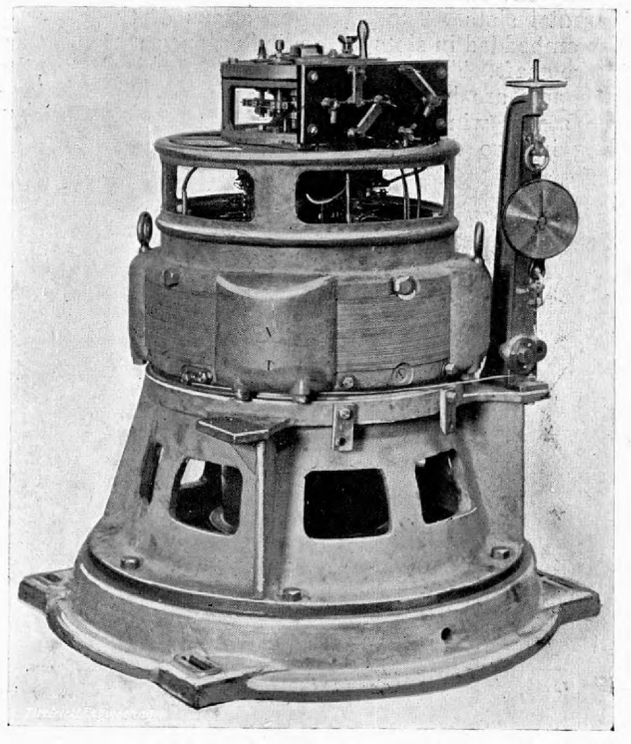
Fig. 3.—Half Longitudinal Section and Part Sectional End Elevation of E.C.C. Turbo-Alternator.

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is subdivided into two different channels, one taking the air into an annular chamber, which delivers it through round longitudinal holes in the rotor and thence to the stator by means of suitable radial air ducts. The other channel is mainly intended to convey the air for cooling the stator windings. The air passing through these two channels meets at the back of the machine, cooling the iron and coming away through the outlet pipe below the stator. Each of the channels contains an air valve, which allows of proper regulation, so that extravagant expenditure of power for ventilation purposes may be avoided. The quantity of air passing through the machine under the heaviest condition of load is estimated to be 10,000 cubic feet per minute.

MACHINES FOR EDUCATIONAL PURPOSES

At the invitation of the J.-L. Manufacturing Co., Ltd., of Southall, Middlesex, we have inspected a machine of novel construction, built by them for experimental purposes to the requirements of Mr. R. D. Archibald, of the new Technical Institute, Dundee. The machine is a four-pole, 400-volt, compound-wound variable-speed D.C. motor, provided with interpoles, and designed for a continuous output of 10 b.h.p. at from 300 to 1,000 r.p.m. As shown in the illustration, it stands on a heavy cast-iron circular bedplate, and is arranged vertically with the pulley below to render the commutator, brushgear, and all connections easily accessible. The base is a casting in the form of a truncated cone supporting the laminated yoke and poles on a ball race, which takes both weight and side stresses. The field system, therefore, is free



10-h.p. Interpole Motor.

to rotate, but is attached to a spring balance by a steel cord so that the torque can be measured. This cord lies in a groove so that its centre is at a radius of 1·05 ft. from the centre line of the machine; this measurement is equal to $33/10\pi$ ft., and so allows of easy determination of the h.p. The main poles and interpoles are easily removable from the yoke for the purpose of exchanging coils. The armature revolves on ball bearings round a steel spindle, firmly secured to the bedplate. A search coil spanning the winding pitch is provided in the armature and is connected to slip rings. This coil is to enable investigations of the field form to be made, either with an oscillograph or by plotting a curve from instantaneous readings. The latter are obtainable by means of a contact-maker and a variable timing arrangement by which both the time of contact and the position of the coil at time of contact are variable through the whole range. The commutator is provided with box-type brush-holders, with provision for using varying widths of carbons. All parts of the machine are easily accessible. The armature may be removed without disturbing the field, and provision is made for removing the ball bearings intact. Similarly, the entire field brushgear and base may be removed without disturbing the armature. Special attention has been given to the terminal arrangements. The armature, shunt field, series field, and interpoles have their ends joined up to a terminal slab, and the connections required are made by links. We understand that this machine will be regularly employed for driving a generator. Under test as a motor with a load of 10 b.h.p. at its lowest speed of 300 r.p.m., the efficiency proved to be 86 per cent. The company have also supplied a special motor-generator for the Dundee Institute. This comprises two series-wound machines, both of which may be used as generators or motors as required. One machine has a field system carried in ball-bearing pedestals and fitted with a torque lever and spring balance, as in the case above. Removable covers with radiating gills and covers of the ordinary ventilated pattern are also provided, so that the effect of various degrees of enclosure on the rating may be studied.

Having inspected the above machine, our representative was conducted over the works by Mr. T. L. Reed Cooper, the managing director, and the admirable card system of shop records and storekeeping in use was explained. An increasing business is being done by the firm in motor-generators for cinematograph projectors; the laminated field, ball bearings, and flexible couplings employed are claimed to result in machines of smaller size and higher efficiency than those of other makes. A number of variable-speed motors, with and without interpoles, were also in hand. The firm employ, in certain cases, the patent Lundell brush for resistance commutation, in which the brush consists of two parts inclined so as practically to meet at the surface of the commutator. The leading brush is of high-conductivity carbon, while the rear brush is of high-resistance carbon. In a new box-type brush-holder for single carbons, there are two springs, a coiled spring to exert the main pressure, and a short, flexible strip spring to take up irregularities in the commutator, &c. This combination is claimed to eliminate chattering.

Siemens Bros.' Supply Department.—The Supplies Department of Messrs. Siemens Bros. Dynamo Works, Ltd. (39 Upper Thames Street, E.C.) held a highly successful smoking concert last Friday at Stone's Restaurant, Ludgate Circus. The concert was largely attended by members of the staff and their friends. The programme was well selected and very entertaining, and a most enjoyable evening was spent by those present.

Tramways & Light Railways Association.—At the annual general meeting on February 17th, the following were elected Vice-Presidents:—Lord Arthur Butler, Mr. Harmood-Banner, M.P., Mr. J. M. Henderson, M.P., and Councillor Jas. H. Rogers, Chairman, Newcastle-on-Tyne Tramways Committee. To fill vacancies on the Council the following were elected:—Mr. R. L. Acland, Manager, Chesterfield Corporation Tramways; Mr. W. Clough, Manager, Bury Corporation Tramways; Mr. C. H. Dade, Secretary, British Electrical Federation, Ltd.; Alderman Wm. Ivey, West Ham Corporation Tramways; and Mr. John Kennedy, Parliamentary Agent. A deputation from the Association waited upon the President of the Board of Trade on February 16th, and discussed certain points in relation to reform of tramway legislation.

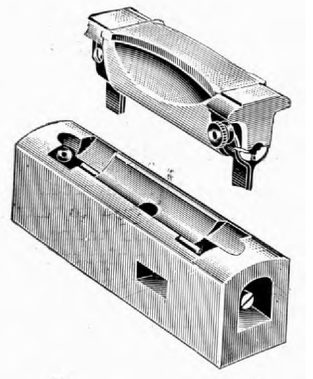
Electric Smelting in Norway.—The following information, supplied for the *Board of Trade Journal* by Mr. E. F. Gray, H.M. Consul at Christiania, is of interest. A company has been formed, under the name of the "Stavanger Electro-Staalverk A/s," with a capital of £25,000, for the purpose of utilising scrap iron and steel from broken-up vessels, workshops, &c., for the electrical production of high-quality steel. Works are to be erected near Stavanger, in Ryfylke, where the company has secured water-power to the value of 10,000 h.p. In view of the increasing import—now amounting to about 10,000 tons per annum—into Stavanger of tin plates for the fish canning industry, the establishment of tin-plate rolling works may be considered later. The annual output of the steel works is estimated at 1,400 tons of high grade steel billets, and 600 tons of cast steel. The Tinfos paper mills have turned over the electric iron ore smelting undertaking at Notodden to a newly-formed company named the "Tinfos Jernverk, A/s," Notodden, with a capital of about £55,500. A new undertaking for the electrical smelting of iron, known as the "A/s Arendals, Fossekompagni," has been established at Arendal, with a capital of £233,300. It is stated to own the Böile Foss, near Arendal, a waterfall capable of affording 30,000 h.p. The company will use the Swedish Grönwall process, and has also acquired ore deposits near Arendal. The Ilen Smelting Works, of Trondhjem, have commenced using a furnace of 1,000 h.p., chiefly for copper smelting, with an estimated capacity of 2,000 tons per annum. A 3,000-h.p. furnace for iron smelting, capable of producing 9,000 tons per annum, is expected to start work shortly. A consignment of 25 tons of pure copper produced by electric smelting has recently been exported from the Birtavarra mines near Lyngör. The "A/s Kristianssands Nikkelraffineringsverk," Christiansand, is about to undertake the electric smelting and refining of nickel and copper.

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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

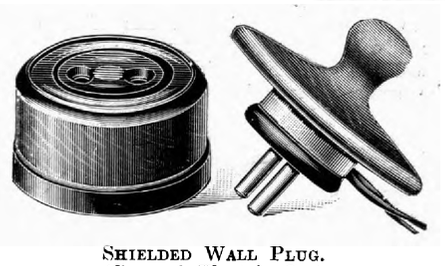
Switchgear.

A new catalogue of accessories, specially designed in accordance with the rules and recommendations of the Home Office under the Factory Acts, and thus embodying the results of the experience of H.M. Electrical Inspector of Factories in the investigation of causes of accidents, has just been issued by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.) with the attractive inscription on the cover, "Shield your workpeople by using G.E.C. 'Home Office' shock-proof accessories." These rules and recommendations allow for two methods of protection :—providing parts liable to be touched with shields, handles, or covers of insulating material, and

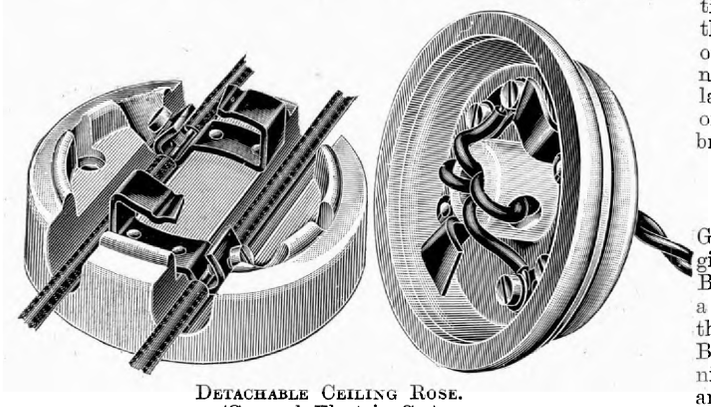


Protected Fuse-holder with China Base.
(General Electric Co.)

efficiently "earthing" all such parts that do not carry current. Believing the first to be a better method, the General Electric Co. have devoted special attention thereto, but where constructional or other difficulties have prevented the adoption of the insulating, earthing facilities have been provided. One of the features of the list is the shielded fuse-holder illustrated here. Besides in the china-base form, these fuse-holders are also utilised in a type of complete fuseboard, which embodies H.M. Inspector's suggestion that terminals of fuseboards and 'bus-bars should be recessed or ranged so that they cannot be inadvertently touched by the operator.



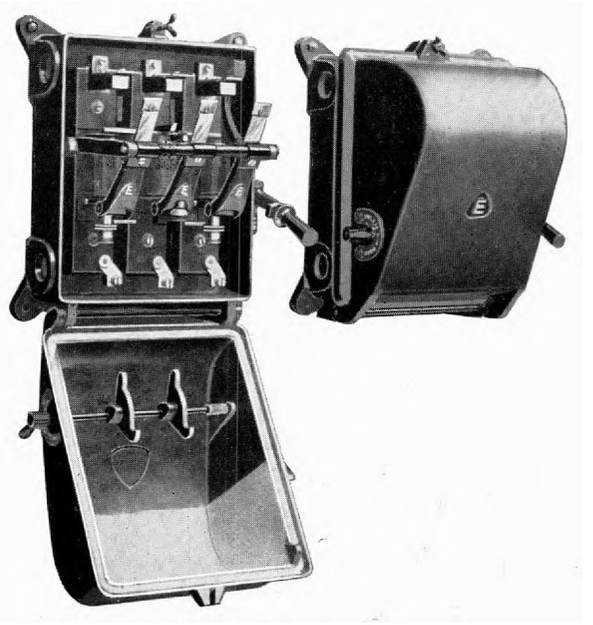
Shielded Wall Plug.
(General Electric Co.)



Detachable Ceiling Rose.
(General Electric Co.)

Another figure illustrates one of the series of shielded wall-plugs, with the wires entering at the side so that the hand cannot touch the flexible when inserting or withdrawing the plug. Attention should also be drawn to the detachable ceiling rose shown in the third illustration, which permits of all work being done away from the ceiling, and the cover with its contacts then clipped into place. The terminals are such that no cutting of the main cables is required. Further special apparatus includes standard, bench and portable lamps, principally of insulating material, and with no metal parts exposed.

Among the pieces of apparatus for alternating current motor control recently introduced by George Ellison (Victoria Works, 17 and 18 Warstone Lane, Birmingham) is the three-pole totally enclosed circuit-breaker illustrated here. This is known as the "mill" type, and although primarily intended for motor circuits, can, of course, be used for house service or other work. There are considerable advantages in the use of this class of circuit in place of a plain switch and fuses for three-phase motors in the saving of time and labour replacing fuses, and the possibility of no-voltage as well as overload protection, and the use of the apparatus as an



Mill Type Three-pole A.-C. Circuit Breaker
(George Ellison).

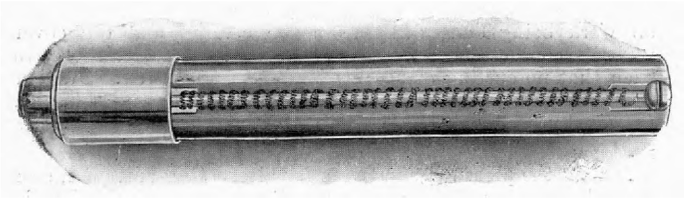
emergency switch by intercepting the no-voltage release circuit. The breaker is at present made in two three-pole sizes for 50 and 100 amperes, but single- and double-pole patterns will soon also be on the market. They are quite watertight, and the cover is hinged and interlocked, so that it cannot be opened if the breaker is closed, and the breaker cannot be closed if the cover is open. There are two handles, one on the right for closing the breaker and a small one on the left for tripping the breaker, or, by turning in the opposite direction, for holding down by hand the overload releases to prevent them operating *until* the motor has got up to speed. The overload releases can be set to operate at any load between normal full load and 80 per cent. overload. Adjustable time-lags or retarders can be fitted if the load is a fluctuating one subject to heavy peaks of short duration that open the breaker unnecessarily.

Electric Heating.

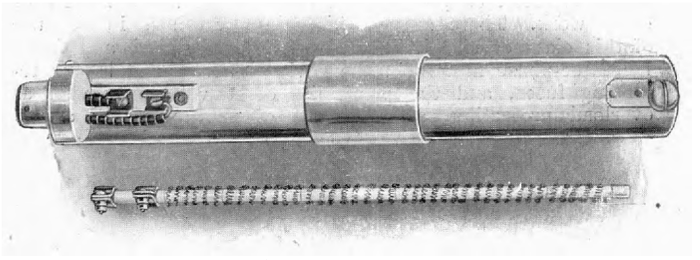
We are now able, through the courtesy of Messrs. Drake & Gorham, Ltd. (66 Victoria Street, Westminster, S.W.), to give an illustration of the new vertical or "lantern" form of Bastian Quartzlite heater, to which we briefly referred on a previous occasion. The heating elements are similar to those in the now well-known horizontal or rat-trap form of Bastian Quartzlite heater. The heater is of good appearance, nickel plated all over except for the black handle and base, and is by no means expensive. Messrs. Drake & Gorham are also putting on the market a new form of Quartzlite element, which can be employed to replace radiator lamps in radiators fitted with ordinary lamp-holders. The heating element is rather different from the older pattern, and has both terminals at one end, with a wire leading up inside the quartz tube and a spiral of resistance wire outside the tube. Only the actual glower ever wants renewing, and this is

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lower in cost than the ordinary lamp of the same capacity (250 watts). The arrangement of the reflector and the direct

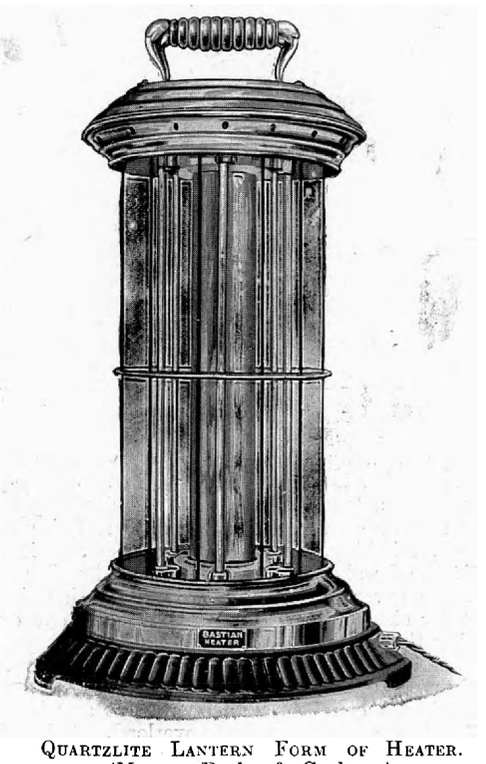


New "Quartzlite Exchange Type" Heater to Replace Carbon Radiator Lamps.



Element Removed from Reflector.
(Messrs. Drake & Gorham.)

contact of the glower with the air give a powerful heating effect. It is advisable to fit a wire guard across the front



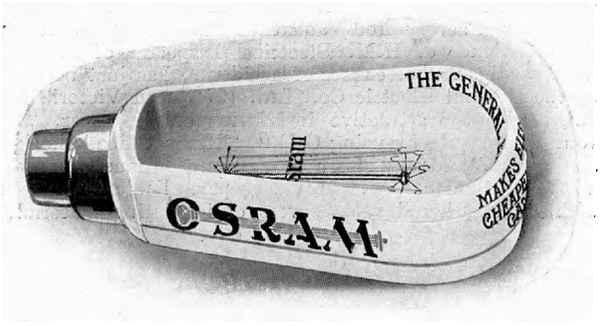
Quartzlite Lantern Form of Heater.
(Messrs. Drake & Gorham.)

of the heater to prevent dresses, &c., coming into contact with the hot glowers.

Messrs. Siemens Brothers Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E., beg to remind their friends in the trade that owing to the already considerable numbers of orders and request for designs of complete decorative schemes which they have already received, it will be advisable to apply early for any such designs that may be required. Orders and inquiries will be dealt with in the strict rotation in which they are received, and should consequently be placed as early as is convenient. It will be noticed that Messrs. Siemens are prepared to quote for complete Coronation illumination schemes, but, as is their invariable practice, they are arranging to sublet all the wiring and erection among contractors, who will doubtless appreciate such an attitude, which cannot fail to be of assistance to them. Every contractor should apply for copy of the Siemens Coronation Decoration List, which, we understand, will be supplied to any member of the trade on receipt of application accompanied by trade cards.

SMOKERS AND OSRAM LAMPS

The General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), have designed a remarkably effective china ash-tray in the shape of an Osram lamp, a specimen of which is now brightening our Editor's writing table. The illustration

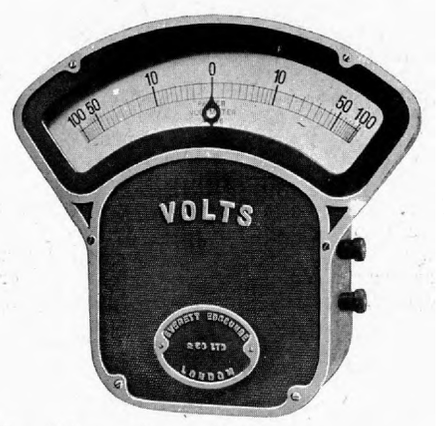


Osram Ashtray.

here gives some idea of its appearance, but the gilt cap of the lamp should be seen to be appreciated. The Company offer to present the ash-tray free to contractors and other friends who may have seen this notice, and applications for these charming and useful souvenirs are invited.

A NEW PARALLELING VOLTMETER FOR ALTERNATING CURRENT

The central zero moving coil voltmeter has long been used for the paralleling of continuous-current generators in place of two separate voltmeters for the 'bus-bars and the incoming machine respectively, but in the case of alternating-current machines a corresponding instrument has not been available, although considerable attention has been devoted to the perfecting of the rotary synchroniser. The synchroniser has now practically superseded the synchronising lamps and voltmeters of bygone days, but does not by itself meet all requirements. The voltage of the incoming machine has still to be considered. The use of two distinct voltmeters or a voltmeter having two pointers working over a common scale is open to considerable objection. In the first place, the scale is usually somewhat cramped, so that it



The "Paller" for Alternating-current.
Paralleling Voltmeter.

has to be viewed from close by; and again, as two separate movements are involved, any error in one or the other of them will give an entirely erroneous impression as to the equality of pressure.

The construction of a central zero voltmeter to correspond with the moving coil continuous-current pattern presents some difficulties, but these have been surmounted in the instrument illustrated here, which has been introduced under the name of the "Paller" by Messrs. Everett, Edgcumbe, and Co., Ltd. (Collindale Works, Hendon). The apparatus is of extreme simplicity, being provided with four terminals, two for connection to the 'bus-bars and the other two to the incoming machine, and the windings are so arranged that equality of pressure is shown by the pointer standing at zero in the centre of the scale. Should the voltage of the incoming machine be higher than that of the 'bus-bars, the pointer deflects on one side of the scale, and if lower, to the

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other. One side of the central zero is marked "too high" and the other "too low," to correspond with the voltage of the incoming machine. The voltmeter illustrated opposite is wound for a voltage of 100, and is suitable for connection to the secondaries of step-down pressure transformers, in which case the scale is often graduated to correspond with the primary or high-tension voltage. A feature of importance is the extreme openness of the scale on either side of the zero. In the case of a moving coil instrument for continuous current, this opening out of the scale is only possible by means of an auxiliary spring or some such comparatively complicated method, whereas in the present instrument it is a fundamental feature of the design.

In order to simplify matters still further for the switchboard attendant, an arrangement can be provided whereby an audible or visual signal is given when the voltage of the incoming machine is the same as that of the 'bus-bars, so that it is only necessary for the attendant to watch the synchroniser, the whole operation being rendered perfectly automatic.

These voltmeters can be fitted in a variety of cases, that shown in the figure having a 9-in. scale, which can be illuminated if desired. This forms a very convenient size, but many purposes a 12-in. scale may be preferred. In the case of continuous-current stations, it is often a great convenience to be able to move the voltmeter from one part of the board to another, and for this purpose a plugging-in voltmeter is often used. For alternating-current stations this is not as a rule required, owing to the fact that all the paralleling gear is usually collected at one spot, but if desired the present instruments can be fitted in cases provided with handles and a plugging attachment.

A 10,000-VOLT STORAGE BATTERY

AT a meeting of the Röntgen Society on Thursday last, Mr. A. A. Campbell Swinton made some interesting experiments with a 10,000-volt storage battery, which has been constructed in order that certain experiments with canal rays made by Mr. Swinton in 1907 might be repeated with continuous current, as was suggested at the time by Sir William Crookes. After referring to the 10,000-volt silver-chloride battery of Mr. W. de la Rue, constructed some thirty years ago, and the 40,000-volt battery of Prof. Trowbridge, Mr. Swinton described his own battery, which consists of 4,800 Planté cells, which are charged in sections of 80 cells each in parallel off the 200-volt supply. Connected in series, the battery gives 10,400 volts on open circuit. The cells are contained in five cabinets, each holding 960 cells arranged in twenty-four blocks of forty cells each. Each cell consists of a 4-in. glass test tube of $\frac{3}{4}$-in. bore, and each set of forty is cast solid with paraffin wax into a wooden tray. The plates are strips of sheet lead corrugated longitudinally, and are not pasted. Celluloid separators are employed. There are 400 lbs. of lead in the whole battery, which weighs nearly 1,000 lbs. complete. The battery is charged at the rate of 10 milliamperes only to avoid bubbling of the acid. Creeping has been prevented by this means, and the battery has a good insulation and keeps its charge well. It is capable of discharging at a rate of 150 milliamperes (*i.e.*, $1\frac{1}{2}$ kw.) for several minutes, and is highly dangerous to touch. The internal resistance varies with the current between 3,000 and 4,000 ohms, and the short-circuit current is estimated at two or three amperes. An adjustable water-resistance and a double-pole switch worked by cords are employed for safety. Mr. Swinton showed many interesting experiments, including the formation of striae in a 4-ft. vacuum tube, the rotation of mill-wheels by canal rays, and the Armstrong electro-capillary effect. The current could jump a 2·5 mm. spark gap, but even when there were no Leyden jars in parallel with the gap the discharge gave a whistling sound, showing that there were high-frequency oscillations due to the capacity of the wires, &c.

In the ensuing discussion Mr. W. W. Duddell referred to the 10,000-volt battery at the Reichsanstalt, Berlin, which delivered one ampere, for testing purposes, and stated that a 150,000-volt influence machine was being experimented with in London. He doubted whether it was possible to get an absolutely continuous discharge at such high pressures on account of the capacity and self-induction of the circuit.

Wireless Telegraph Notes.—It is stated that the Brazilian Government has commissioned the German Telefunken Co. to erect six wireless telegraph stations in Brazil. The same company have also received orders from the Argentine, Peru, Chili, and Uruguay Governments. all of whom have declared wireless telegraphy a State monopoly.

TESTS OF A 6,000-KW. TURBO-ALTERNATOR

A REPORT has just been issued by Messrs. Merz and McLellan, Consulting Engineers to the Newcastle-upon-Tyne Electric Supply Co., which contains results of tests of a 6,000-kw. turbo-alternator supplied last year by Messrs. Brown, Boveri & Co., Ltd., to the company's new power station at Dunston, and includes some remarkably low figures of steam consumption.

The set in question comprises a 9,000-b.h.p. turbine of the two-cylinder Parsons reaction pattern, with a uniflow h.p. cylinder, and the l.p. cylinder partly double flow, manufactured by Messrs. Richardsons, Westgarth & Co., of Hartlepool, to the designs of Messrs. Brown, Boveri & Co., of Baden (Switzerland), coupled to a 6,250-kw. Brown, Boveri alternator running at 1,200 r.p.m. The turbine was designed for a steam pressure of 190 lbs. per sq. in., and 190° F. superheat. The alternator is of the revolving-field type, rated at 7,000 k.v.a. at 0·9 power factor, 5,750 volts, three-phase, and is provided with a direct-coupled self-excited exciter. The surface condensing plant has 13,000 sq. ft. surface, and is of the "Contraflo" type, manufactured by Messrs. Richardsons, Westgarth & Co. The tubes are 18 B.W.G. and $\frac{3}{4}$ in. external diameter. The allowable circulating water per hour is 630,000 gallons at a specified inlet temperature of 50° F. The Edwards pattern three-throw motor-driven air pump has a capacity of 3·68 cu. ft. per barrel, and 1,660 cu. ft. per min. is the total volume swept through by the plungers. A vacuum augmenter is fitted with 400 sq. ft. surface, and the circulating pump is of Messrs. Greenwood & Batley's make.

Official tests of steam consumption were taken on December 16th last, with the following results:—

Output	4,256 kw.	5,600 kw.	6,257 kw.
Speed	1,210 r.p.m.	1,210 r.p.m.	1,210 r.p.m.
Steam pressure (lbs. per sq. in.)	192	192	192
Superheat	162° F.	166° F.	176° F.
Condenser pressure abs. (ins. of mercury)	0·81	0·88	0·90
Temperature in condenser	73° F.	75° F.	76° F.
Total water used per hour	52,902 lbs.	67,950 lbs.	75,000 lbs.
Water used per kw. hr. ...	12·44 ,,	12·14 ,,	11·97 ,,
Ditto. corrected for condenser leakage	12·42 ,,	12·12 ,,	11·95 ,,
Steam consumption corrected for 192° F. superheat and 29·1 ins. vacuum not allowing for power taken by auxiliaries ...	12·15 ,,	11·85 ,,	11·80 ,,

Parliamentary.—Although the Metropolitan Electric Supply Co.'s Bill which gives powers to acquire the Acton electricity undertaking is unopposed, it has been decided to refer it to a Committee to be treated as an opposed Bill. This is due to a suggestion by the Board of Trade, in consequence of the close division on the second reading of the Bill last week.

Automatic Signalling on the Metropolitan Railway.—The Metropolitan Railway has now adopted automatic signalling on their Baker Street—Neasden line, as well as on their portion of the Inner Circle. The system is described in the *Railway Gazette* and is all electric, having been specially designed for the service by the McKenzie, Holland & Westinghouse Power Signal Co., under the supervision of Mr. W. Willox, engineer to the Railway. The track circuit arrangements are similar to those on the District Railway, and can allow of 50 seconds headway between through trains. At St. John's Wood, Finchley Road, and West Hampstead, signal cabins have been retained for working crossings and sidings, but for normal working these boxes are closed and full automatic working is used. At Willesden Green a new cabin has been built with an illuminated track diagram. The 23 block sections over the five-mile stretch average 1,200 ft. in length, and automatic train stops are employed throughout. Lamp signals, dwarf signals, and semaphore signals are employed. In the two latter forms the line-clear position of the arm inclines upward instead of downward, so that it tends to fall naturally into the horizontal stop position and balance weights can be dispensed with. The gear, comprising electric motor, cut out, transmission gear, clutch and pneumatic buffer is fully enclosed and very compact. The arm is held in the clear position by an electromagnet, and thus drops to danger if the actuating current fails. Power is supplied by special motor generator sets in the sub-stations. All the signals are electrically lighted by two lamps in parallel, but oil lamps can readily be substituted. Automatic train describers have been installed at some of the stations, working on the same principle as those on the District Railway.

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HIGH-TENSION TRANSMISSION LINES

THE two Papers on this subject by Mr. W. G. Taylor and Messrs. R. Borlase Matthews and C. T. Wilkinson, read before the Institution of Electrical Engineers on January 26th, were further discussed on February 23rd. Abstracts of the papers and reports of the previous discussions in London, Newcastle, and Manchester were given in ELECTRICAL ENGINEERING, February 2nd, February 9th, and February 23rd. The following is a report of the discussion in London on February 23rd :—

Mr. C. P. SPARKS (County of London Electric Supply Co., Ltd.) compared the 4,000 to 5,000 kw., which was commonly distributed per feeder in this country, with the 20,000 to 25,000-kw. circuits of the Paper. He did not agree that the pressure would be limited to 20,000 volts in this country; they might even reach 40,000 on account of the difficulties of handling the heavy conductors which would be necessary at the lower pressure. Transferring the load from a faulty line to another line, as done in some of the cases described, meant depriving important consumers of their supply for some time. It would be necessary, in this country, to adopt similar safeguards to those now used on underground systems to ensure continuity of supply. By working just below the critical pressure a heavy corona discharge would take place on the pressure rising due to lightning or other disturbances; this was a most practical safety valve. He thought that practicable H.-T. direct-current systems were as far distant as they were five years ago. It was necessary to provide more efficient earthing of the steel towers than was suggested in the Papers. The charges for power in America generated by so-called cheap water power did not compare favourably with the charges in England for power generated from coal.

Mr. W. B. WOODHOUSE (Yorkshire Electric Power Co.) referred to the difficulty of obtaining way-leaves in this country, consent sometimes only being granted for a few years, thus endangering the continuity of supply. Again, local authorities could, under the Electric Lighting Acts, refuse overhead lines being put up, even if they were run on private property and not across public highways. In America and most Continental countries legal machinery existed for providing way-leaves for public supplies, and he urged the Institution of Electrical Engineers to take up the question.

Mr. E. J. FOX (Stewarts & Lloyds, Ltd.) pointed out that the general consensus of opinion was that ten years was a fair average life for wooden poles, and thirty years for steel poles. The price of wooden poles was increasing daily, and at present they were almost as dear as steel poles. Mr. Trotter had put the life at about the same as steel poles, but the Board of Trade Regulations stipulated for a factor of safety of ten in the case of wood, and six in the case of steel. (Mr. Trotter intervened with the remark that he put the life of a wooden pole at about five times that of a steel pole.) The Papers referred entirely to towers built up of channels, angles, T's, &c. Much attention was now being paid on the Continent to tubular towers on account of their lower weight and first cost. The Cornwall Electric Power Co. were using tubular towers.

Mr. A. JACOB (British Aluminium Co., Ltd.) referred to the fact that the 110,000-volt system of the Hydro Electric Power Commission of Ontario employed between 300 and 400 miles of aluminium wire. The average span was 520 ft., with 65½-ft. towers. Altogether some 2,000 tons of aluminium had been installed, including the distribution system at 13,500 volts. The factor of safety required in this country was twice that demanded in Canada, notwithstanding that the weather conditions there were much more severe. The formula used for calculating the stress due to wind pressure for both copper and aluminium cables did not take into account the elasticity of the metals, and consequently the stresses calculated were much greater than those met with in practice. The error might be as great as 400 per cent., and the result was an unnecessarily heavy and costly pole line construction. The Macintyre joint had solved the difficulty of jointing aluminium cables, and had even been adopted on copper lines. The troubles due to galvanic action had now been overcome by the use of aluminium for binders and clamps, or by providing ample protection from moisture when other metals were used. Alloys of copper with aluminium, although giving a higher tensile strength, had a higher resistance than pure aluminium, and also corroded very readily. Experience showed that aluminium lines did not corrode more readily than copper lines, even on the sea coast. In a certain case described by Mr. Taylor a saving of 35 per cent. would have been accomplished by the use of aluminium cables, allowing for the necessary differences in pole line construction. Mr. Jacob then exhibited a number of slides of aluminium lines erected by the British Insulated & Helsby Cables, Ltd., in this country, including some cases of lines in South Wales where solid aluminium conductors have been used for street lighting and distribution to small houses.

Mr. C. GREEN referred to some tests which showed that the Macintyre joint had only 60 per cent. of the strength of the wire. A bolted-up clamp joint had been used on aluminium lines by the British Insulated & Helsby Cables, Ltd., and it would be interesting to know the strength of this joint as compared with the wire. Aluminium conductors would, he thought, be more likely to swing out of phase with sudden gusts of wind on account of their lightness. He believed that the cost of wooden poles was less than that of steel poles with spans up to 100 yards.

Mr. E. H. RAYNER (National Physical Laboratory), after commenting upon the large amount of plant which had to be kept running in order to keep the line charged, even on conditions of light load, pointed out that with star-connected E.H.T. transformers it would only be necessary to insulate one terminal of each transformer. A strong argument for high pressures was the fact that by doubling the pressure it was possible to double the capacity of a line without increasing the capital cost of the line more than a few per cent. Lightning was also less dangerous at 100,000 volts than at 20,000 volts, and working just below the critical corona pressure was an excellent safeguard. He knew insulators which had failed owing to the glaze not extending over their whole surface.

Mr. H. BRAZIL (Charing Cross, West End & City Electricity Supply Co., Ltd.) thought that lightning arresters could be arranged with resistance in series, so that they could do their duty without disturbing the line. Aluminium cell arresters were not, he thought, reliable. Water jets for discharging the line of any accumulated charge were unsatisfactory for various reasons; a carbon power resistance was very reliable for this purpose. Finally, he thought that generally too many lightning arresters were installed, and that one or two in good condition on the main 'bus-bars would be more efficient.

Mr. B. M. JENKIN (Messrs. Kennedy & Jenkin) referred to the increased difficulties which would arise when duplicating E.H.T. lines, on account of the extra way-leaves required.

Mr. A. J. STUBBS (Assistant Engineer, G.P.O.) referred to the unsatisfactory experience of the Post Office about ten years ago with aluminium wires, and described a number of tests which showed that under continued stress aluminium wires had a much greater permanent elongation. British-made Post Office insulators did not, he said, depend upon the glazing for their insulating properties.

Mr. F. V. T. LEE, who has been responsible for some installations in California, called attention to the use of synchronous motors to maintain the power factor. On one 67,000-kw. system, with eleven power-houses, regulation was effected by means of tappings on the transformers at the sub-stations. Difficulties sometimes arose with regard to way-leaves in America and Canada, as in this country, when they came to municipal areas. He was of the opinion that 100,000 volts would remain the limit for some time. With regard to protection against lightning, he thought that the gap arrester with a small resistance in series was best. To ensure continuity of service it was essential to have duplicate pole lines with different routes if possible. He emphasised the importance of fireproof insulation for transformers, and advocated the use of three single-phase transformers instead of a single three-phase transformer with large capacities. Experience had led him to prefer for 600,000 volts a horizontal break switch with plenty of oil. Mr. Taylor's figures of depreciation seem to be rather low. In California they were not able to cut poles down as the line was being erected; all their poles had to come from Oregon, over 1,000 miles distant. A life of ten years was a fair average, although some had lasted forty years. The poles were not treated. There was a good future for concrete poles, as cement was becoming cheaper, and wood and steel dearer. The only basis for assuming a life of thirty years for steel towers was the fact that windmill towers of this character had lasted for that period. The general practice in California was to have ten towers to the mile, or twenty poles. Until recently forty poles to the mile was the usual construction, but owing to the cost of insulators due to troubles with them, it was found that a cheaper and better line was obtained by cutting out every other pole. There still remained the need for a properly designed horizontal strain insulator. In conclusion, the speaker advocated the installation of additional stand-by plant at the receiving end of the line rather than the duplication of the pole line. In his experience, a 3,000 kw. gas engine plant had been put into service within 35 seconds from the time of interruption of the overhead line.

Mr. R. BORLASE MATTHEWS replied briefly to the discussion. He said that two projects were now under consideration involving transmission over distances up to about 400 miles with a pressure of 165,000 volts. Experience showed that the greatest difficulties were encountered between 30,000 and 80,000 volts, and that above and below these points the troubles were very much less. With regard to the use of a ground wire, opinion in the United States and other parts of the world was practically unanimous in favour of a steel ground wire over the conductors. The practice in the Newcastle district of carrying the ground wire underneath the conductors had not been seriously considered elsewhere.

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CIRCUIT BREAKING

A PAPER entitled "Breaking high and low potential circuits," by Mr. A. G. Collis, was read on Thursday, February 23rd, before the South Wales Institute of Engineers, at Cardiff. The author pointed out the growing importance of extremely rapid opening of circuit breakers on short circuits, especially in view of the quality of turbo-generators standing up to their work under fault conditions. He referred briefly to previous investigations of Prof. B. Hopkinson and Mr. Miles Walker, and spoke of a switch

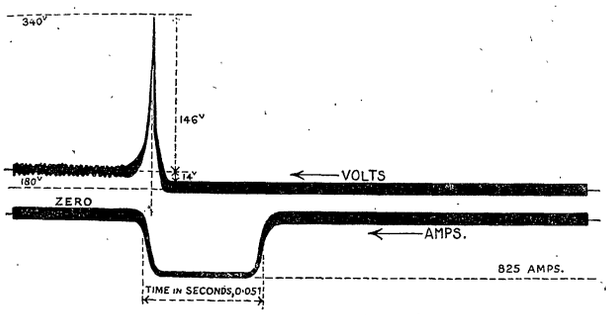


FIG. 1.—BREAKING ON PREDETERMINED LOAD. CIRCUIT BREAKER WITH STRONG MAGNETIC BLOW-OUT. 825 AMPERES. 180 VOLTS D.C.

that had recently been designed to open in 1/500 sec. on a short circuit in which the energy of the circuit was dissipated in resistances composed of thin metal strips immersed in oil and gradually thrown into the circuit by the motion of the switch blade. The objections to the use of oil switches for continuous currents on account of abnormal pressure rise and carbonisation of the oil were, he thought, overrated, and he quoted Mr. W. Browning's statement that a contact immersed in oil has at least twice the conductivity of a

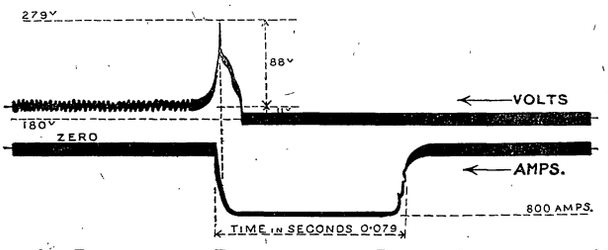


FIG. 2.—BREAKING ON PREDETERMINED LOAD. OIL-SWITCH. 800 AMPERES. 180 VOLTS D.C.

similar dry contact. He commented on the futility of attempting to construct really gas-tight switchgear, and suggested gauze or plate protection.

The principal part of the Paper was devoted to a description of a series of oscillograph records of the action of seven or eight typical forms of circuit breakers, including carbon air breaks, with and without magnetic blow-out, and breaks under oil and water. An ordinary fuse was also tested. In the first series of tests a predetermined continuous current

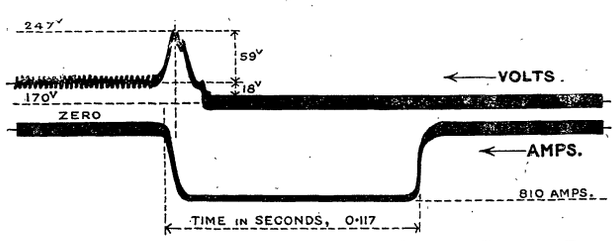


FIG. 3.—BREAKING ON PREDETERMINED LOAD. CARBON BREAK ON INDUCTIVE CIRCUIT. 810 AMPERES. 170 VOLTS D.C.

load was suddenly thrown on to the circuit-breaker by opening a diverting switch, and the oscillograph was arranged to record the current through the circuit-breaker and the voltage across its terminals. A typical oscillogram is shown in Fig. 1 (with the voltage scale inverted for clearness), which is for a breaker with a strong magnetic blow-out, actuated by a series coil. The next breaker tested was provided with a continuously maintained blow-out field. The time occupied both before the commencement of and during the break is about the same, but the rise of pressure seems higher for corresponding currents. In both cases the rise of pressure is a function of the current interrupted. A typical record for continuous current break under oil is given in Fig. 2. Both the times taken in completely interrupting the circuit and in disrupting the arc are considerably longer than with the air breaks with magnetic blow-out, the latter probably

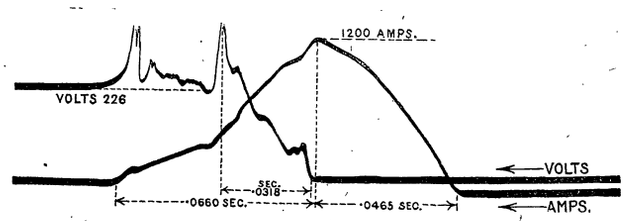


FIG. 4.—SHORT-CIRCUIT CONDITIONS. OIL-BREAK SWITCH ON D.C. GENERATOR.

due to the feeding of the arc by the vapour of the oil. The pressure rise is remarkably less, as might be expected. Further tests with a non-magnetic blow-out carbon air-break show a relatively low pressure rise and longer time of disruption of the arc (see Fig. 3). Other tests were also made with a view to show the effect of varying the number of turns in the blow-out coil. It was remarked that the short break with strong magnetic field appears to be giving way to a wider break with comparatively weak field. An ordinary

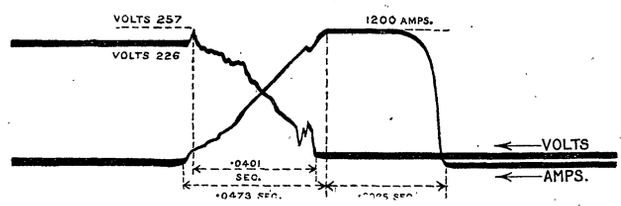


FIG. 5.—SHORT-CIRCUIT CONDITIONS. OIL-BREAK SWITCH ON BATTERY.

fuse was also tested, which took about 2½ times as long as a blow-out circuit breaker to interrupt the same current. Replacing the oil in the oil switch tested by water had the effect of reducing the rise of pressure. It must be understood that in all the above experiments the load was inductive, consisting of a motor driving a pump.

The next series of experiments represented dead short circuit conditions, and Figs. 4 and 5 give the results with oil-break circuit-breakers on a steam-driven generator, and a battery respectively. The voltage curves are not here inverted. It will be seen that the dead short on the generator was interrupted in about 1/10 second with a pressure rise of only 200 volts, the current reaching a value of 1,200

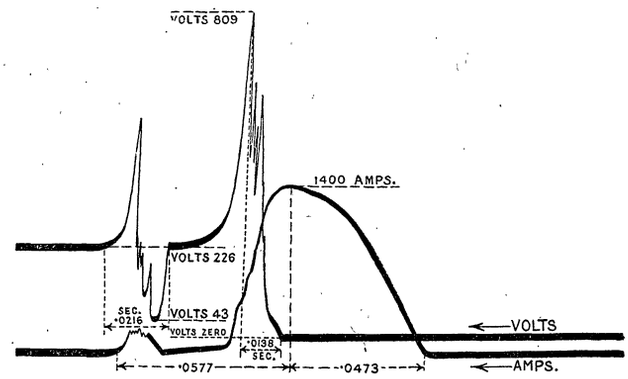


FIG. 6.—SHORT-CIRCUIT CONDITIONS (D.C. GENERATOR). MEDIUM FIELD MAGNETIC BLOW-OUT BREAKER.

amperes. The variations in the current due to the changes in the resistance of the arc are reflected in the voltage curve, and there is only a very small upward kick of pressure at the final rupture of the arc. In Fig. 5 the absence of inductance is shown in two ways; the steep rise of the current curve when the circuit is closed and the small rise of pressure at final break. The limit of supply of the battery was

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about 1,200 amperes, and was reached before the breaker opened. The most remarkable of the records with magnetic blow-out breaker is reproduced in Fig. 6. Here a violent fluctuation of the arc is responsible for a rise of pressure of 583 volts; the arc appears to have been disrupted, and then to have started again, the final kick amounting to 316 volts. This record refers to the generator, and not the battery. The same circuit-breaker cleared a battery short circuit in 0·0156 sec., which is the quickest action in any of the tests. The author considers that these tests point to the facts that continuous current oil-breaks are satisfactory, and that a carbon break tends to reduce the rise of pressure at rupture of the circuit.

Finally, alternating currents were experimented with. A typical curve is shown in Fig. 7. Here, the current wave was interrupted as it was approaching zero value. There was an immediate inductive pressure rise, which appears to have been checked very suddenly, probably on account of the fact that the impressed voltage wave is endeavouring

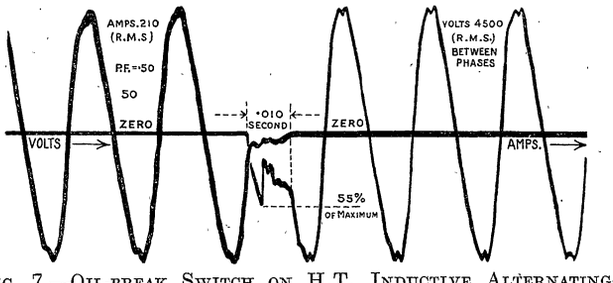


FIG. 7.—OIL-BREAK SWITCH ON H.T. INDUCTIVE ALTERNATING-CURRENT CIRCUIT.

to establish itself in an exactly opposite direction to the direction of the induced volts. On the other hand, it would appear that it only required a period of time represented by one-half of the complete period 0·010 sec. for the voltage wave to establish itself in a normal manner, and it will be noted that the first complete half-wave of the voltage curve reached its normal maximum value.

In all cases the records show that the circuit may open at any point on the current curve; but after the current has died down to zero value it never again rises on the other side of the zero line. It would appear, in fact, that in all cases the oil rushes in between the contacts, and prevents an arc being drawn out, which otherwise might permit the current to rise again after it has passed through zero value. Similar results were obtained with low-tension tests.

DISCUSSION.

After a few remarks by the Chairman, Prof. A. C. Elliott, the discussion was opened by Mr. E. B. WEDMORE (British Thomson-Houston Co.). He did not see much point in moderate field circuit breakers, and preferred the ordinary carbon breaker. With large power short circuits, breakers must open very rapidly to check the current rises. If the time required is doubled, the heating effect on the switch is increased eight times. The carbons even of quick breaking switches often get red hot, and there is difficulty in preventing them cracking and flying. The magnetic blow-out was useful where the breaker had to be enclosed, and gave a quick break on small powers without undue heating. Oil was useful for enclosing the sparking point of breakers, but stopped the dispersal of the metal vapour, and thus caused increased burning and wear. With continuous current there was danger of firing the oil. He preferred non-automatic switches for general mining work, with the automatic features in a safe portion of the mine. Mr. Wedmore also spoke of the advantages of the free-handle type of circuit breaker, and remarked that the alternating current tests were limited by the small amount of power available. On testing breakers of the size used with their full currents, the current had been found to pass repeatedly through the zero value before the arc was quenched. With reference to Mr. W. Browning's tests, vaseline on the breaker contacts reduced contact resistance, and at small distances oil was easier to puncture than air.

Mr. J. E. TEASDEL said that a 2,000 ampere circuit breaker would open quicker than a 25 ampere fuse in series with it. He recommended breakers in preference to fuses for all motors over 5 h.p., and wished to know whether zinc tips for circuit breakers had been tried.

Mr. W. A. CHAMEN also regretted the limited power available on the tests, and suggested that troubles might be introduced by the rushes of current at certain points in the wave due to the brands of transformer iron now used.

Mr. COLLIS, in his reply, referred to an 800 ampere 400 volt switch in successful use in a planing machine circuit, which was opened and closed several times a minute. He also spoke of the impossibility of making even oil switches really gas-tight, and with reference to Mr. Teasdel's remarks mentioned some tests on a large battery at Manchester, where the fuses had always opened before the circuit breakers.

A written communication from Mr. A. M. TAYLOR was then read, in which reference was made to a circuit breaker of his design, which contained both a magnetic blow-out and oil quenching, and was expected to be able to open an alternator circuit in 0·002 second. This switch had been designed to give the energy of the circuit first to the oil, then to the water, and hardly any to the arc.

Mr. COWAN, in another communication, wrote that in his experience oil switches had worked satisfactorily on continuous current motor circuits. There was more carbonisation than with alternating currents, but if the design was such that the carbon particles did not lodge on insulating surfaces, but fell to the bottom of the tank, that did not interfere.

Mr. J. G. STATTER wrote advocating oil immersed contacts for low as well as high pressures, and pointed out the advantages of the sucker over the dash-pot pattern of time lag.

Mr. W. B. WOODHOUSE had worked with oil switches for continuous currents, but found that the carbonisation rendered frequent changing of the oil necessary. They had been employed on coal cutters, changing the oil entirely every month.

A long communication from Mr. J. S. PECK was also read, who thought that the subject was too wide for general conclusions to be drawn from these tests. He pointed out that the volt coil of the oscillograph in the tests in the Paper was connected across the breaker, and thus did not take account of the impedance being divided between the generator and the motor. He thought that it was wrong to state that in alternating current breaking the current never passed its zero value, and quoted published oscillograms supporting his view. After a few remarks from Mr. Collis in reply, the discussion was adjourned.

SYMBOLS

AT the unofficial Conference of the International Electrotechnical Commission, held at Brussels in August, 1910, the delegates expressed the desire that the following propositions in reference to symbols should be studied by the various Electrotechnical Committees, with a view to formal adoption at the next plenary meeting of the Commission, to be held at Turin in September, 1911. Anyone interested in the subject should send in his observations to Mr. P. F. Rowell, Secretary of the British Electrotechnical Committee, Institution of Electrical Engineers, Victoria Embankment, W.C.

That small letters be reserved for the representation of the instantaneous values of electrical quantities which vary with the time. That capital letters be reserved for the representation of effective or constant values of electrical quantities. That capital letters followed by the subscript "m" be reserved for the representation of the maximum values of periodic electrical quantities. That capital script letters be reserved for the representation of magnetic quantities, constant or variable. That capital script letters accompanied by the subscript "m" be reserved for the representation of the maximum values of magnetic quantities. That the following letters be reserved for the representation of the following quantities: Electromotive force, E, e; Electric quantity, Q, q; Inductance, $\mathscr{L}$; Magnetic force, $\mathscr{H}$; Magnetic flux density, $\mathscr{B}$; Length, L, l; Mass, M, m; Time, T, t.

National Electrical Manufacturers' Association.—The first meeting of the new Council of this Association, which was elected last Tuesday under the new Articles of Association, will be held at Balfour House, Finsbury Pavement, E.C., on Tuesday next at 2.30 p.m.

South-Western Polytechnic.—The annual distribution of prizes and certificates will take place at the Institute, Manresa Road, Chelsea, on Friday, March 10th. Sir Alfred Keogh, K.C.B., will present the awards, and the chair will be taken by Mr. W. Hayes Fisher, M.P. The laboratories and workshops will be open to inspection.

Royal Institution.—Among the lecture arrangements after Easter are included a course of two lectures by Mr. T. Thorne Baker on "Changes Effected by Light" and "Practical Progress in Wireless Telegraphy" respectively. Among those who will probably deliver Friday evening discourses are Mr. G. Marconi and Prof. Svante Arrhenius.

American Electric Lamp Combine.—Information from America states that the Cleveland (Ohio) authorities have taken action against the General Electric Co. of Schenectady in connection with the agreement with the National Electric Lamp Co., which it is alleged is an unlawful combination and conspiracy in restraint of trade. It is declared that agreements exist with the Westinghouse Co. and others to sell lamps at fixed prices, and that special companies have been organised to sell inferior lamps in order to damage the trade of genuine independent companies. It is thought possible that the dissolution of the combination will be effected without long litigation.

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PHASE DISPLACEMENTS IN SYNCHRONOUS MACHINES

MR. W. W. FIRTH read a Paper on February 20th before the Newcastle local section of the Institution of Electrical Engineers entitled "Measurement of Relative Angular Displacements in Synchronous Machines." He pointed out that when the working conditions of a generator and synchronous motor system are changed by alteration of load or excitation of either machine, a relative mechanical displacement of the rotors takes place, and if the change is sufficiently rapid there is an oscillation or phase swing about the new position of equilibrium which is quickly damped out by eddy currents and friction. The magnitude of the steady displacement is governed by the condition that the vector sum of the circuit voltages must be zero, or, in other words, that the resultant of the generated voltages of generator and motor is equal to the impedance-drop in the circuit. These voltages depend upon the exciting currents of the machines together with their armature reactions, whilst the impedance-drop is proportional to the line current.

He proceeded to consider the matter mathematically, and developed a vector diagram illustrating the effect, which showed that this change of phase position is partly due to the change of impedance-drop, but chiefly to the change of the generated voltages by armature reaction. Even when the power factor in the generator is unity, armature reaction has a weakening effect on the main field; in fact, the angle of lead must be considerable before the action becomes strengthening. In the motor the armature field only strengthens the main field when the lag is fairly large. Stated generally, a lagging current in the line always has a demagnetising action in the generator, and a leading current a demagnetising one in the motor; further, to produce a magnetising action in the generator or motor, the line lead or lag respectively must exceed a certain value, which depends upon the magnitude of the line current.

The truth of these conclusions was confirmed experimentally on machines fitted with exploring coils to observe the change of flux, and a simple optical arrangement arranged so that the angular displacement of a mirror carried on one machine deflected a beam of light allowed to fall on it once per revolution through a slot carried by the other machine. Curves of observed displacements for various circumstances are given in the paper, from which it is seen that the displacement decreases with increase of speed for any given load; that it is much less in three- than single-phase machines and less again for converters than for synchronous motors. Photographic records of the movement of the spot of light show the phase displacements and swing due to various circumstances. These diagrams also show the natural period of the swing, and the marked difference in its value thus revealed from that obtained from the formula of S. P. Thompson is interpreted as indicating that the voltage drop in alternators is almost entirely due to demagnetising armature reaction, the true or leakage inductance drop being practically negligible.

DISCUSSION.

Dr. W. M. THORNTON (Armstrong College, Newcastle) defined "phase swing" as a mechanical swing controlled by the elastic nature of the magnetic lines of force, voltage and current remaining strictly in phase in both machines, the latter varying during the swing in time with the movement. The two problems to be investigated were: shift of load and shift of field strength.

Mr. LEAKE suggested plotting phase displacement against total load. The Paper clearly showed that the actual magnetic centre line shifted, contrary to what had hitherto been commonly assumed, and the maximum voltage in a generator was thus reached somewhat later than was usually thought to be the case. He suggested that the demagnetising ampere turns in an alternator were not equal to $\sin\phi$ but to $\sin(\phi+\alpha)$ where α is the angle through which the magnetic centre line moves. The ratio of actual back ampere turns to calculated back ampere turns was thus equal to $\frac{\sin\phi+\alpha.}{\sin\phi}$ He questioned the correctness of measuring the voltage with ϕ nearly equal to 90° when predetermining alternator characteristics by the Fischer Hinnen and Potter methods, as the values thus arrived at are probably in error due to phase displacement.

Mr. W. T. MACCALL (Sunderland Technical College) made some suggestions as to how the results might have been presented with greater clearness. He had worked out some cases roughly showing break of step with less relative displacement when under light loads. The weakening of the field in the case of the light load accounted for this apparent anomaly. He pointed out that, contrary to the general assumption, an armature current of unity p.f. did actually weaken the main field, and Mr. Firth had experimentally verified that this was so.

Messrs. C. FARADAY PROCTOR and P. V. HUNTER also spoke, and Mr. FIRTH briefly replied to the various speakers.

RECENT ELECTRICAL DEVELOPMENTS AT DRURY LANE

ABOUT a week ago a new and pleasing electrical effect was introduced into the Drury Lane pantomime, "Jack and the Beanstalk." After the Widdicombe Market scene two large pieces of iron framework are pushed on from opposite sides of the stage. These consist of a number of small iron ladders held in position by a frame and leaning slightly back at the top. They are painted green, and are carried on low-wheeled carriages. On the carriages, hidden from view of the audience, are eighteen Chloride accumulators, each having a capacity of 200 amp. hours, in lead-lined teak boxes. Running from these cells are thirty-six separate 4-volt circuits, all provided with double-pole fuses in porcelain chambers and double-pole switches. Each of these circuits terminates in a plug socket on the front of the framework.

The two halves of the frame meet together in the middle of the stage, thus forming one large frame measuring 36 feet long by 18 feet high. Directly it is in position the troop of Boy Scouts proceed to storm it, each carrying a rectangular piece of cloth, long enough completely to hide him, one side being coloured khaki and the other red, white, or blue. On the latter side are also 4-volt lamps, agreeing in colour with the cloth. At a blast from a bugle every boy reverses his cloth, producing an enormous Union Jack. They then insert plugs into the sockets provided, and at another blast of the bugle the flag is outlined with some 3,300 electric lamps of the proper colours.

A very effective scene is that of the storm, in which the wind is so strong that people are blown clean off the stage—when assisted by wires from the flies. This mighty hurricane is produced by a couple of 25-h.p. motors and blowers, supplied by the Electric Ordnance and Accessories Co.

The "big" scene this year is the harp scene. Nine enormous harps are lowered so as to hang several feet from the stage, and each is provided with 160 coloured lamps, each of 2½ c.p. and taking 50 volts, arranged that there are only two lamps per circuit, and all the circuits are fed through rotatory switches in the flies. When the real harps begin to play, the switches are worked, and the result is that the lamps on the harp strings are alternately extinguished and illuminated in such a way as make it appear that light is travelling down the strings.

Some 9,000 metal-filament "Z" lamps are used in the theatre, in addition to the "effect" lamps previously mentioned; 32-c.p. are employed on the stage, 25-c.p. for corridors and ceilings, and 16-c.p. for ordinary rooms. All are run at 100 volts.

With regard to the outside of the house, it may be remarked that a new switchboard has recently been installed in the intake room at the front. This board controls twelve new "Excello" white-flame arc lamps, and is of the three-wire type. On it are twelve ways for controlling the arcs, which are run two in series. The remaining six ways are provided for the special Coronation illuminations which it is proposed to put up. Messrs. Baxter & Caunter were responsible for the construction of the board.

In concluding these notes, we have to acknowledge the courtesy of the theatre management in enabling our representative to obtain information, and especially are we indebted to the stage manager, Mr. Ernest D'Auban, and to the electrician, Mr. Mather.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ILLUMINATION DEVICES, &c.—An advance sheet from the Sun Electrical Co., Ltd., 118-120 Charing Cross Road, W.C., illustrates a fine example of coronation decorative illumination, making use of a special miniature strip with watertight porcelain holders with small bulb 10 to 14 volt 2-c.p. lamps run in series at 2½ or 5-inch centres.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

KALKOS FITTINGS.—Some further leaflets from the Sun Electrical Co. deal with the switch to which we referred on January 12th in connection with remarkable results of durability tests. Reduced prices are quoted for certain Kalkos fittings.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published March 2nd, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

3,098/10. **Solenoid-controlled Switchgear.** J. G. CHILDS and T. S. HILL (London). In A.C. solenoid operated gear, the cores of the solenoids or electromagnets are provided with counterbalance weights in order that the magnetic pull may be almost wholly available for exerting pressure at the contacts. Further, the contact surfaces are placed at an angle to the solenoid axis in order to increase the pressure for a given pull. Four figures.

3,336/10. **Carbon Brushes and Electrodes.** BRITISH THOMSON-HOUSTON CO., LTD. (*General Electric Co., U.S.A.*). Brushes or electrodes of increased density and mechanical strength and of high conductivity are produced by moulding from a mixture of carbon and a carbonaceous binder and baked to a temperature of 480° C. They are then impregnated with pitch or other suitable material, and fired to a temperature of about 1,400° C. The following result is given as an example: apparent density, 1·66; absolute density, 2·05; porosity, 19 per cent.; resistance, 0·00108 ohm per inch cube; tensile strength, 2,130 lb. per sq. in. Two figures.

4,885/10. **Arc Lamp.** JOHNSON & PHILLIPS, LTD., and J. BROCKIE. This specification describes the mechanism of a magazine flame arc lamp of the pattern in which the magazines have each two compartments from which the carbons are fed alternately. When the burning carbons cease to be fed forwards, another pair of carbons is brought forward by the feeding mechanism into such a position that the arc transfers itself to this pair without any lateral movement of the magazines or extinction of the arc. Four figures.

6,535/10. **Printing Press Controller.** T. BARNARD and C. EDWARDS (Toronto). Various detail improvements in solenoid-operated controllers with the object of rendering them safe and reliable, and of rendering possible very fine variations in speed, are described. Eight figures.

11,184/10. **Motor Starters.** ADAMS MANUFACTURING CO., LTD. (*Cutler Hammer Manufacturing Co., Ltd., U.S.A.*). In starters in which the spindle extends through the core of a blow-out magnet, one set of pole-pieces of the magnet are arranged on the rear side of an insulating slab opposite the contacts on the front side. The other set of pole-pieces is formed by radial contact arms mounted on the spindle. Nine figures.

27,710/10. **Supports for Metal Filaments.** LICHTWERKE GES. (Berlin). Elastic supports for preventing the sagging of metal filaments are made of an alloy of molybdenum with a small percentage of a highly refractory and brittle metal, such as tungsten, chromium, titanium, or vanadium. A wire containing 2 per cent. of tungsten is said to give excellent results. It is stated to be as elastic as watch-spring steel, and not to lose its elasticity with continued heating and cooling.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: RAILING and ANGOLD, 5,416/10; BISSON and BERGÈS, 12,149/10.

Dynamos, Motors, and Transformers: SIEMENS BROS. DYNAMO WORKS (*Siemens Schuckertwerke Ges.*) [Speed regulation of polyphase motors] 5,119/10; BRUSH ELECTRICAL ENGINEERING CO. and JONES [Cooling of commutators and slip-rings] 12,889/10.

Electric Ignition: GRAVDAHL [Reversing engines with electric ignition] 19,625/10; R. BOSCH [Connecting cables of ignition apparatus] 24,688/10.

Electrometallurgy and Electrochemistry: SIEMENS BROS. & CO. (*Siemens & Halske A.-G.*) [Purifying water by ozonised air] 17,787/10.

Heating and Cooking: BRITISH THOMSON-HOUSTON CO., LTD. (*General Electric Co., U.S.A.*) [Electric heaters] 26,120/10.

Instruments and Meters: SIEMENS & HALSKE A.-G. [Frequency meters and recorders] 16,342/10.

Storage Batteries: SMITH [Connector for use when charging accumulators] 7,593/10.

Switchgear, Fuses, and Fittings: MILCH [A.-C. induction current regulator] 869/10; JOEL [Portable battery lamp] 3,185/10; GIBBS and SANDYCROFT FOUNDRY CO. [Controllers] 4,190/10; CUNNINGTON [Twin lamp-holder] 4,299/10; DEAN [Iron-clad switch fuses] 5,054/10; CHARLTON [Switches] 6,704/10; SIDLER [Switches] 21,174/10; FORSBERG [Electromagnets] 22,394/10; KALAMBA [Plug connectors] 27,375/10.

Telephony and Telegraphy: WALL [Telephone calling apparatus] 3,582/10; EVERSHED & VIGNOLES, LTD., KILROY and MITCHELL [Signal devices] 4,427/10; MARCONI'S WIRELESS TELEGRAPH CO. and FRANKLIN [Receiving stations] 4,910/10; MARCONI'S WIRELESS TELEGRAPH CO., BANGAY and PRINCE [Portable wireless apparatus] 11,359/10, and [Portable motors and dynamos] 11,360/10; VON KRAMER [Inductive wireless telephony] 16,419/10; NEMETH [Telephonic distribution of music, &c.] 21,700/10; FORSBERG [Telephone call indicators] 22,394/10.

Traction: LUARD and THOMPSON [Flexible tubular connections for railway coaches] 3,941/10; CUNLIFFE and DEWHURST [Electric signalling] 4,230/10; MCKENZIE & HOLLAND, LTD., HUDD and HAYWOOD [Electric signalling] 4,997/10; FIXLER and BURGESS [Trolley stands] 12,862/10; SYKES, COOKE and JOHNSON [Insulated rail-joints] 16,933/10; JOHNSON [Rail-joints] 23,413/10; CONSOLIDATED BRAKE & ENGINEERING CO. and HARDING [Automatic brakes] 23,436/10.

Miscellaneous: BUTIKOFER (*Maitre*) [Soldering aluminium] 3,439/10; NEVATTE [Burglar alarm] 4,035/10; HAILWOOD [Miners' safety lamps] 6,928/10; LAUREYS [X-ray tubes] 14,004/10; KOVATCH [Coal-cutters] 18,135/10; FISCHER [Electrically-actuated typewriter] 20,526/10; KEITH [Centrifugal fans] 23,096/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: A.-G BROWN, BOVERI ET CIE [Frequency transformers] 600/11.

Electric Ignition: HARLÉ ET CIE. [Submarine mines] 2,713/11.

Electrochemistry, &c.: FRIEDMANN [Electroplating] 12,931/10; HESSELN [Two-fluid primary cells] 26,959/10; A.-G. FÜR OZONVERWERTUNG SYSTEM ELWORTHY-KÖLLE [Ozone apparatus] 3,119/11; OTTO [Sterilising water by ozone] 3,250/11.

Instruments, &c.: ALLGEMEINE ELEKTRICITÄTS-GES. [Meter for recording consumption above a certain amount] 1,930/11.

Switchgear: R. BOSCH [Contact pins] 72/11.

Telegraphy, &c.: SIEMENS & HALSKE A.-G. [Signalling] 2,014/11; BELLINI and TOSI [Wireless aerials] 2,632/11; MCBERTY [Automatic telephone selectors] 3,452/11.

Traction: ALBANESE [Conduit and track for slot traction system] 3,022/11.

Opposition to Grant of Patents

17,960/09. **Metal Filament Lamps.** FELTEN & GUILLEAUME LAHMEYER-WERKE A.-G. As a result of opposition, the right to a grant on this application has been surrendered. The specification (abstracted in ELECTRICAL ENGINEERING, May 26th, 1910, p. 346) describes the prevention of disintegration of the filaments by the introduction of phosphorus-nitride into the bulb.

22,997/09. **Heating Apparatus.** H. A. KENT. This patent has been granted in spite of opposition, but the Comptroller's decision requires an amendment of the specification. The patent covers heating elements consisting of tungsten granules enclosed in silica glass tubes, and was abstracted in ELECTRICAL ENGINEERING, October 6th, 1910, p. 636.

27,458/09. **Automatic Telephone Exchanges.** SIEMENS BROS. & CO., LTD. (*Siemens & Halske A.-G.*) The opposition to the grant of this patent has been withdrawn. An abstract of the specification was published in ELECTRICAL ENGINEERING, October 27th, 1910, p. 688.

Application for Revocation Dismissed

18,628/08. **Electric Ignition.** A. M. LOW. The application for the revocation of this patent, noticed in ELECTRICAL ENGINEERING of September 22nd, 1910, p. 608, has been dismissed. The patent covers a sparking plug in which one electrode is cup-shaped, and the other a point at the axial centre of the cup.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: CALLENDER'S CABLE & CONSTRUCTION CO. and A. V. DOWNTON [Cable stranding machinery] 23,757/05.

Dynamos, &c.: R. ROUGÉ and G. FAGET [Rotary converter] 5,562/00; G. G. MILNE [Train-lighting dynamo] 25,053/03; H. H. LAKE (*C. A. Gould, U.S.A.*) [Train-lighting system] 25,112/04.

Electric Ignition: EVERSHED & VIGNOLES and S. EVERSHED [Magneto blasting dynamo and indicator] 20,466/00.

Instruments, &c.: G. K. B. ELPHINSTONE and A. C. HEAP [A.C. moving-coil ammeters and voltmeters] 26,399/97.

Switchgear, &c.: O. O. POLLOCK [Prismatic lamp-shades and reflectors] 23,811/05.

Traction: P. WHEELER [Operating car doors] 24,535/04.

Miscellaneous: T. J. HOWELL [Induction coils] 24,701/03; W. CHADBURN [Solenoid-operated ships' telegraph] 23,607/05; T. A. B. CARVER [Electrically operated "let-off" motion for looms] 23,746/05.

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THE WELSBACH COMPANIES

TO the electrical industry the scheme of reorganisation of the Welsbach Incandescent Gas Light Co., Ltd., sanctioned at an extraordinary general meeting of the company last Thursday, is of considerable interest in view of the existence of an Electric Lighting Department inaugurated by this company about eighteen months ago. The German Welsbach Co. (the Deutsche Gasglühlicht Aktiengesellschaft), who will hold the controlling interest in the new company, is, as is well known, considerably interested in the Osram Lamp Works of Hammersmith in conjunction with the General Electric Co., Ltd., of London, and some of the fundamental patents under which the Osram lamp is made were acquired by the Osram Lamp Works from the German company.

The police court proceedings by the latter to prevent the English Welsbach Co. using the word "Aur" on their metal filament lamps will still be fresh in our readers' memories. It was currently reported at the time that the German Welsbach Co. were by no means pleased with the action of the English company in selling metal filament lamps, and it will now be interesting to see what steps will be taken with regard to the large electric lamp business which the Welsbach Co. have built up, for it does not seem probable that the German company will countenance the sale of lamps of another make in competition with the Osram unless under licence to the owners of the Osram patents.

The provisional agreement between the Welsbach Incandescent Gas Light Co. and the Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft), of Berlin, provides for the formation of a new company in England which will acquire the present English Welsbach Co., as mentioned in our last issue. The purchase price is to be £440,000, of which £240,000 will be in 4½ per cent. debentures, £100,000 in new shares, and £100,000 in cash. The object of the scheme is to bring the English, German, and Austrian Welsbach Companies under one united control, which will have the effect of obviating competition between them in the various markets of the world. The original capital of the English Welsbach Co. was £3,500,000, but this was reduced in 1903 to £1,343,975.

A CORONATION CIRCULAR

THE accompanying illustration is reproduced from the very artistic, brightly coloured front page of a leaflet relating to supply for Coronation illumination purposes, which has been prepared by the Electric Supply Publicity Committee for the use of the various supply authorities in London and the provinces. Like many of the circulars which the Committee have issued from time to time, it is a very artistic production.



Holborn Street Lighting.—The report of the sub-committee of the Works Committee of the Holborn Borough Council which, as mentioned in ELECTRICAL ENGINEERING, March 2nd, p. 110, was referred back by the Council to be considered by the Works Committee, has now been approved by the latter, and came before the Council at last night's meeting. We shall deal with the Council's decision in our next issue. The Works Committee, in presenting this report, recommend that the Gas Light & Coke Co. and the Metropolitan Electric Supply Co. be invited to tender according to the scheme contained in the report, and a new specification which has been submitted to the Council. They further propose that the term of the contract should be five years instead of ten, with an option to the Council to extend it for a further period of five years. It is suggested that the contractors should quote separate scale prices for any variations in light which may afterwards be required.

ENGINEERING EDUCATION

IN an address on February 25th, at the Municipal Technical School, Birmingham, Mr. M. Railing (Manager, General Electric Co.'s Works, Witton) raised the question of the alleged backwardness of this country in engineering matters in recent years, and dealt with what he considered to be the most important influences affecting the prosperity of the industry, namely, national policy and educational methods. He pointed out that engineering figured more largely than ever in modern life, and that it was the duty of the Government to recognise that the welfare of the people depended largely on how far their laws were consonant with engineering requirements. The ideal principle of free trade and a rivalry of perfection, even if adopted by all countries, would tend, he thought, to lead to a want of suitable employment and a lack of profitable return of capital. It could not be doubted that tariff walls would provide security for employment by freeing the home manufacturers from the anxiety of foreign competition, and making it possible to regulate prices both for labour and products. Mr. Railing further pointed out that municipal and Government contracts were often placed with foreign firms, who were not restricted by the extreme labour legislation of this country, which the municipalities and Governments would be the first to enforce had they entrusted the contracts to an English firm.

This severe foreign competition should, however, be met by thorough and efficient education. There were now in this country excellent technical schools and colleges, and it was no longer necessary to look abroad for highly trained technical men. He would advocate that employers should insist upon a guarantee, such as the passing of a certain examination, that applicants for posts had attained a certain standard of knowledge. This would afford the employer a security which at present he did not possess. That a man had passed an examination did not necessarily mean that he would be a capable and useful engineer, but, in his experience, such a guarantee was a useful guide. Mr. Railing then impressed upon his audience the importance of self-education and study on broad lines. It was necessary for the engineer to be well versed in all the factors of commercial, social, and political life, and to be capable of applying his mind in accordance with business methods. He should be acquainted with the rudiments of commercial knowledge, accountancy, business organisation, commercial law, bank practice, patent laws, &c., and able to judge commercial and social problems, and act rightly on the spur of the moment. He should be a man capable of initiative, with a knowledge of the languages and laws of other countries.

Finally, Mr. Railing outlined the responsibilities of the works manager. He must know what is the most up-to-date machinery, how to obtain the most efficient labour, the best markets in which to buy the raw materials and when to buy, and records of costs must be kept, besides the ordinary book-keeping to show the financial results of the works. Students apprenticed at works should, he said, insist on spending some time in the commercial departments of the concern, as well as going through the shops.

Amalgamation of London Electric Supply Companies.—According to the *Financial Times*, a movement is on foot for the amalgamation of certain important Electric Supply Companies in the west end of London, in connection with which it is stated that the rearrangement of the Notting Hill Electric Lighting Co.'s capital, which was sanctioned at a meeting on Tuesday, is not without interest.

Telegraph Traffic and Movements of Cable Ships.—The *via* Hanekin route was again working on the 27th ult.—The El Arich route broke down on the 1st inst., between Konia and Adana, but was repaired on the 4th inst., although there is still some delay on messages to Syria.—The CS. *Iris* is now repairing the New Caledonia cable of the French Cable Co.—The following cables, interrupted in February, still continue so:—Constantinople—Odessa, Madagascar—Réunion, Réunion—Mauritius, and Zante—Corfu.—The cable between Malta and Tripoli has been down since April 20th, 1910, and this long delay in restoring it to working order would make it appear that this section is to remain dead.—It is also difficult to understand why the owners are so long delaying operations on the following cables:—Lattaquie—Cyprus (May 24th, 1910), Tourane—Amoy (November 24th, 1910), and Teneriffe—St. Louis (October 26th, 1910), while the worst of all is the cable between Assab and Perim, down since July 8th, 1909.—The CS. *Contre Amiral Caubet*, of the French Cable Co., has repaired the St. Pierre—Brest cable off Cape Race, while the CS. *Minia*, of the Anglo-American Telegraph Co., was chartered by the Commercial Cable Co. to repair one of their sections some 150–200 miles from Newfoundland. After completing this work she went to attend to the Halifax—Rye Beach section of the Direct United States Cable Co.—The CS. *Mackay Bennett* has again returned to London from Havre, where she will have to go again to finally complete the work on the Havre—Waterville section. She will then return to her station, Halifax, N.S.

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LOCAL NOTES

Australia: *Edison Battery Cars.*—The Beaumaris Tramways Co. (Melbourne) have under consideration the adoption of tramcars fitted with Edison storage batteries.

British Columbia: *Electric Railway.* — According to the *Standard of Empire*, negotiations are at present in progress with a group of United States capitalists for the construction of an electric railway from Dean Channel to Rear River, with the idea of developing the northern interior of British Columbia.

China: *Telephones.*—According to *Commercial Intelligence*, a member of the Chinese Board of Communications, which controls the telephone system in China, has been pointing out to American manufacturers of telephone apparatus the very large field there is for telephonic business in China. Perhaps the hint will also be useful to British manufacturers.

Elland: *Tramways.*—The Council, in conjunction with the Greetland Council, is considering a proposal for the National Electric Construction Co. to build a tramway from Halifax to Huddersfield, those two Corporations, together with the Brighouse Council, borrowing the necessary capital and the Tramway Company paying interest, and taking the lines on a lease for forty-two years.

Hull: *Resignation of Tramway Chairman.*—Alderman E. Robson, Chairman of the Tramways Committee, has resigned, he having differed from his colleagues with regard to the policy adopted by the Tramways Committee. The Alderman protests against the allocation of £12,000 to the relief of rates from the tramway profits, and regards the transfer of large sums to relief of rates as the wrong policy in view of the fact that the net profits have diminished during the past few years and more repairs have been found to be necessary.

Manchester: *Corporation and Westinghouse Co.*—At the last meeting of the Corporation an attempt was made to get the name of the British Westinghouse Co. struck off the list of contractors for supplying materials to the Corporation. The reason put forward was that the Company have been in conflict with some of its employees, the details of which, it is alleged, constitute a breach of the "fair contracts" Standing Order of the Corporation. After some discussion the proposal was lost by seventeen votes to seventy-seven.

Tramwaymen's Conditions.—The Board of Trade have been asked to appoint an arbitrator to decide the question of working hours and other matters over which the Council and the Tramwaymen's Union have been in dispute.

Pontefract: *Transfer of Electric Lighting Order.*—The Corporation have decided to promote a Bill in Parliament transferring their Electric Lighting Order to the Wakefield and West Riding Tramways Co. The Company is to pay £400 towards the cost of the Bill, and £150, the cost of the original order. The proposed lease is for forty-two years, with an option to the Corporation to purchase at the end of twenty-seven years.

Sheffield: *Street Lighting.*—The Watch Committee have given instructions for schemes to be prepared for lighting the Attercliffe Road either by electricity or gas.

Tramway Profits.—The Tramways Committee propose to transfer only £11,000 to the relief of rates from last year's profits, compared with £14,350 in the previous twelve months. This is not due to a decrease in tramway receipts, which, as a matter of fact, have gone up considerably, but may possibly be attributed to the prospects of extra expense upon maintenance in the near future.

Stoke-on-Trent: *Electricity Extensions.*—A special meeting of the Council is to be held to consider the proposed scheme for adopting a high-tension system of generation, at an estimated cost of £60,000. Some particulars of Mr. Yeaman's proposal were given in our last issue.

Uruguay: *Telephones.*—The Government, says *Commercial Intelligence*, have under consideration a scheme for the construction of an underground system of telephonic communication, the surveys and estimates for which are already completed.

West Bromwich: *Dispute with the Tramways Co.*—The dispute which has existed for some time between the Council and the Tramways Co. has been settled. The Tramways Co. have agreed to take a minimum of 900,000 units per annum on a sliding scale from 2d. to 1d., and there has been a revision of the allowance to be made by the Company for the repair of the track.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Burnley.—A new 1,500-kw. generating set is to be installed.

Dublin.—The proposal to borrow £128,000 for extensions of the electricity undertaking was discussed at the last meeting of the Council. It is anticipated that £40,000 will be required for additional machinery, and £54,000 for new mains, whilst the remaining £24,000 will only be borrowed should the anticipations of the Committee be borne out. The recommendation was adopted.

Felixstowe.—A loan of £2,935 is to be taken up for extensions of generating plant.

Great Harwood.—Mr. J. W. Speight has placed a proposal before the Council for introducing electricity.

Ipswich.—An inquiry was held last week into a loan of £17,000, of which £6,000 has already been expended. The new expenditure of £10,992 includes a large sum for mains extensions and for wiring, motors, and arc lamps on hire.

Kendal.—Tenders are invited by March 14th for an underground feeder. Particulars from the Borough Electrical Engineer.

Leek.—A loan of £4,000 is to be taken up for extensions at the generating station.

Liverpool.—The Corporation propose to borrow £25,000 for mains extensions.

London: *Bermondsey.*—The Finance Committee of the L.C.C. recommend sanction to a loan of £5,000 for mains and house services.

Norwich.—A battery and motor-driven booster with regulating apparatus and switchboard is required. Particulars from the Borough Electrical Engineer.

Rochdale.—Additional plant is to be installed to meet the increasing demand, especially for tramways.

Rotherham.—Tenders are invited by March 23rd for a 1,000-kw. turbo alternator, condensing plant, steam and exhaust pipes, switchboard, gallery, switchgear, &c.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

New elementary school at Wood Green.

Twelve houses in Semley Road, Croydon.

Buildings upon site of Nos. 70 to 78 Portland Place, St. Marylebone.

Tenders are invited for bell hanger's work in the buildings of the Commissioners of H.M. Works and Public Buildings. Particulars from H.M. Office of Works.

PROVINCES.

Barrow-in-Furness.—Fire Station.

Beckenham.—Electric theatre.

Brighton.—New school in Coombe Road.

Cork.—It has been decided to light the new school by electricity.

Derby.—Several new schools and additions to existing schools.

Durham.—Art School.

Eastbourne.—Proposed new hospital. Governors of Princess Memorial Hospital.

Glasgow.—Rebuilding of Ruskin College.

Hull.—Reconstruction of Madeley Street Baths.

Merthyr Tydfil.—Three new schools. Architect, J. Llewelyn Smith, Aberdare.

Northfleet.—New fire station at the Hill. Borough Surveyor.

Nottingham.—New Infants' School at Sutton. Notts Education Committee.

Nuneaton.—New Post Office.

Wellingborough.—New Infants' School.

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MISCELLANEOUS

Aberdeen.—Track reconstruction is to be undertaken in Union Street and Holburn Street, at an estimated cost of about £500.

Bolton.—The Electricity Committee invite tenders for a twelve months' supply of various stores, including meters, motors, motor-starting switches, transformers, &c. (See an advertisement on another page.)

India.—Tenders are invited for 20-ton, 10-ton, and 5-ton electric cranes for the Bengal and North-Western Railway Co. and the Rohilkund Railway Co. Particulars from the London offices, 237 Gresham House, Old Broad Street, London.

Liverpool.—Additional cars are to be obtained, and a loan of £10,000 taken up.

London: *L.C.C.*—It is proposed to renew special track work at a number of points on the tramway system during the coming year at an estimated cost of £19,730.

South Africa.—The Rand Water Board, Johannesburg, invite tenders by April 3rd for transformers, poles, insulators, copper wire, &c. Particulars may be obtained at 73 Basinghall Street, London.

TENDERS RECEIVED AND ACCEPTED

Bacup.—A tender of Messrs. W. T. Glover & Co., Ltd., for mains, ducts, &c., has been accepted.

Blackburn.—The following tenders for a year's supply of stores have been accepted: Siemens Bros., Ozokerit tape, insulating plant, &c.; W. T. Henley's Telegraph Works Co., waterproof tape; Turners & Manville, armature insulating varnish; R. W. Blackwell & Co., insulating tape; Ferranti, Ltd., motor-starting switches; Tucker & Co., tumbler switches, fuses, lamp-holders, &c.; General Electric Co., switches; British Insulated and Helsby Cables, house service fuse boxes.

Hull.—The tender of Sir W. G. Armstrong, Whitworth & Co. at £2,180 has been accepted for the machinery in connection with the electrical working of Sculcoats Bridge.

Loughborough.—The following tenders have been received for two 350-kw. turbo alternators: Siemens Bros. Dynamo Works, Ltd., £1,700, efficiency at full load 89 per cent.; British Westinghouse Co., Ltd., £1,652 (92·5 per cent.); Phœnix Dynamo Manufacturing Co., Ltd., £1,600 (93·5 per cent.); Lancashire Dynamo & Motor Co., Ltd., £1,588 10s. (91·5 per cent.). Electric Construction Co., Ltd., £1,497 (93 per cent.); Brush Electrical Engineering Co., Ltd., £1,368 (93 per cent.); and Laurence Scott & Co., Ltd., £1,300 (91·5 per cent.). In three cases the speed is given as 3,000 r.p.m.; in two cases, 2,700 r.p.m.; in one case, 2,800 r.p.m.; and in another, 2,600 r.p.m.

Manchester.—The British Westinghouse Co., Ltd., have secured an order from the Partington Steel and Iron Co., Ltd., for four mixed-pressure "impulse type" turbo blowers for blast-furnace work and an electric generating set. The machinery in question is required for the extensive new works which the Partington Co. are erecting in the neighbourhood of Manchester.

New South Wales.—The D.P. Battery Company's tender has been accepted by the Inverell Council for a storage battery with booster.

Queensland.—The D.P. Battery Co. have secured the contract for supply of battery with automatic reversible booster and switchboard to the Toowoomba Council.

Swindon.—The tender of the Tudor Accumulator Co., Ltd., has been accepted at £138 for putting additional plates to the battery.

A number of tramcar meters are to be purchased from Messrs. Chamberlain & Hookham at £35 15s., and there is also to be a maintenance contract for five years at an annual charge of 5 per cent. on the original cost.

Messrs. Ferranti, Ltd., have received orders for tramcar meters from the Corporations of Llandudno and Plymouth. These orders are further evidence of the growing tendency of tramways authorities to fit meters to their cars.

APPOINTMENTS AND PERSONAL NOTES

Mr. L. Marshall Jockel, of Glasgow, has been appointed Assistant Manager of the Mexborough & Swinton Tramways Co.

The salary of Mr. W. T. Green, Chief Clerk in the Leeds Electricity Department, has been increased by £25 per annum.

Mr. Charles Leven, M.I.E.E., Managing Director of the Lahmeyer Electrical Co, Ltd., informs us that he has now resigned his position as Managing Director of the said Company since its absorption by the A.E.G. Co.

Mr. Leonard Llewelyn, General Manager of the Cambrian Combine Collieries, has left for a tour in Germany to study electric plant on the Westphalian Coalfields. Mr. Llewelyn will also visit some French coalfields with the same object.

Mr. H. W. Ridley has been promoted to the post of Senior Assistant in the Electric Lighting and Meter-testing Section of the Chief Engineer's Department, L.C.C., at a salary of £325, rising to £400 per annum.

The post of Station Superviser for the electric generating station at Haulbowline Dockyard is vacant. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 to £57 5s. (last week, £57 5s. to £57 10s.).

Liquidations.—The Electrolytic Apparatus Syndicate, Ltd., is to be wound up voluntarily. A meeting of creditors will be held at Queen Anne's Chambers, Westminster, on March 6th, at 12.30 p.m. Mr. W. Rennison is liquidator. Particulars of claims by March 22nd.

The trustee in the bankruptcy of Frank Shepherd, electrical engineer, 4 Haslett Road, Kensington, London, has been released.

We are informed that the Lichtwerke Co. (117 Frankfurte Aller, Berlin) and the Baldurwerke Electricity Co. (6 Clausius Strasse, Berlin), both of which, we understand, are metal filament lamp firms, are in liquidation.

Canadian Agencies.—A Vancouver correspondent asks for names of manufacturers of electrical fittings, carbon and tungsten lamps, carbons, and porcelain goods.

A Birmingham firm manufacturing all kinds of electrically welded chains, rings, &c., desires to enter into correspondence with Canadian buyers. Particulars from the High Commissioner for Canada, 17 Victoria Street, London, S.W.

Wolf Locomobiles.—Messrs R. Wolf, 7 Laurence Pountney Hill, Cannon Street, London, were awarded a gold medal at the Allahabad International Exhibition for their portable and stationary patent superheated steam locomobiles.

Plant for Sale.—The Wolverhampton Electricity Committee have a number of generating sets for sale. (See an advertisement on another page.)

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Newcastle & District Electric Lighting Co.—Final dividend, making 3 per cent. for 1910, carrying forward £4,806.

Lancashire United Tramways Co.—There is a net profit of £1,188 for 1910, which has been carried to depreciation account.

W. T. Henley's Telegraph Works Co.—The net profit for 1910 was £77,556. The sum of £10,000 has been transferred to reserve, and £6,394 transferred to reserve in respect of trustee securities, after which a dividend of 15 per cent. on the ordinary shares is recommended. A balance of £27,311 is carried forward.

North Metropolitan Electrical Power Distribution Co.—The revenue for 1910 allows of a dividend at the rate of 4 per cent. per annum, with £1,500 to depreciation, carrying forward £331.

Metropolitan Electric Supply Co.—The net revenue for 1910 was £94,454, and a sum of £15,000 has been set aside for depreciation. After adding £3,500 from the undistributed balance of the Marylebone purchase money, a dividend at the rate of 5 per cent. per annum is recommended on the ordinary shares, carrying forward £771. Depreciation reserve fund now amounts to £250,355. The company have recently commenced a supply of electricity in Hanwell and Southall.

City of London Electric Lighting Co.—The net profit for 1910 was £100,790, and after meeting the 6 per cent. preference

OSRAM·LAMPS

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dividend, a final dividend of 8s. per share for the December half-year is recommended, carrying forward £27,656, after transferring £4,000 to dividend equalisation fund. The special expenditure on street lighting demonstrations has amounted to £2,272, which has been placed to a suspense account for the present. The total number of units sold during 1910 show a decrease of 271,105 compared with 1909.

County of London Electric Supply Co.—The revenue for 1910 was £114,093, and after meeting debenture stock, interest, and dividends on the preference and ordinary shares, and also transferring £20,000 to reserve for depreciation, &c., there is a balance of £28,895. A dividend at the rate of 6 per cent. per annum for the December half-year is recommended, leaving a balance of £1,358. The number of units sold increased by 2,249,578 compared with 1909. The company's borrowing powers are to be increased by £200,000.

Westminster Electric Supply Corporation.—At the annual meeting last week the Chairman mentioned that the new Horseferry Road Station is now at work, and that the change over of the supply from Millbank Street had been accomplished without a hitch of any kind. He also referred to the agreement with the London Electric Supply Co., which is at present the subject of an action in the Chancery Division. In the Westminster area, he said, over 90 per cent. of the consumers were supplied by the Westminster Co., and less than 10 per cent. by the London Co., involving two sets of mains and two sets of officials to do the work which one set could do quite well. He thought the agreement would have the effect of preventing both the electric supply companies from playing into the hands of the Gas Co. We refer to the lawsuit on another page.

Newcastle & District Electric Lighting Co.—At the annual meeting last week it was stated that a large colliery pumping plant will be added to the company's mains in the course of a few weeks.

Dispute between London Electric Supply Companies.—Under the Electric Lighting Act of 1908, electric supply undertakers, for the first time in the history of the electrical industry, were allowed to "associate" for the purposes of giving a mutual supply of electricity in case of emergency, or even to transfer the management of their undertaking. Acting under these powers, the Westminster Electric Supply Corporation and the London Electric Supply Corporation entered into an agreement whereby the former should manage the undertaking of the London company in the small portion of Westminster over which it had competing powers. The agreement defines the nature of the works to be so transferred, and provides for the London company renewing and repairing the same, and carrying out any necessary additional works. The Westminster company is to pay the London company £2,000 a year to meet the standing charges of the London company for the maintenance, renewal, and up-keep of the works which are, under the agreement, placed in the hands of the Westminster company; and also a sum of 0·85d. for each unit supplied. The Westminster company is also to pay to the London company the net cost of labour and materials required for additional works and for maintaining and repairing additional mains, &c., to be provided by the London company, with the addition of 10 per cent. upon such net cost for supervision and use of tools. The agreement continues until the undertakings are purchased by the London County Council in 1931. Before Mr. Justice Joyce, in the Chancery Division last week, the London Electric Supply Corporation sought an injunction restraining the Westminster Electric Supply Corporation from committing a breach of this agreement. In the Westminster area of the London company, the management of which the Westminster company have taken over, the London company only supply alternating current, whilst the Westminster company in the same area supply continuous current. All prospective customers of the London company in this area are passed on to the Westminster company to be dealt with, and the charge is made that it has been the endeavour of the Westminster company to induce such consumers to take current from their mains, one of the arguments put forward being that alternating curent will soon cease to exist as a method of electric supply. The case was argued on Thursday and Friday, and was continued yesterday. Mr. Younger, K.C., who appears on behalf of the Westminster Electric Supply Corporation, claims that his clients are only using ordinary commercial methods in advising the use of continuous current, and that if any consumer demands alternating current, they are bound to supply it. Mr. Gore-Browne, K.C., appears for the London Electric Supply Corporation. The case was still proceeding when we went to press.



NEW COMPANIES

ASSOCIATION OF MINING ELECTRICAL ENGINEERS, Bank Chambers, London Road, Derby. Registered with 1,500 members, each liable for £1 in the event of winding up, to promote the general advancement of science in its application to the mining industry.

INTERNATIONAL SYNDICATE FOR ELECTRICAL WATER POWER CONCESSIONS: Registered by Linklater & Co., 2 Bond Court, London, E.C. Capital, £10,000.

J. H. BALLANTYNE & CO.: 80 Hyland Road, Glasgow. Capital, £1,000. Electrical Engineers and Contractors.

SIMPLEX ACME PATENT FIRE ALARM CO.: 39 Chapel Chambers North, Chapel Street, Liverpool. Capital, £1,000. To acquire from Mr. J. R. Little a patent relating to fire alarms.

INTERNATIONAL ELECTRIC CO.—Registered by Cruesemann & Rouse, 85 Gracechurch Street, London. Capital £30,000. Dealers in electric cables, wires, accumulators, lamps, telephonic and telegraphic instruments, etc. (We understand that this company is not connected with the International Electric Company of Salusbury Road, Kilburn.)

RIDINGS ARC LAMP CO., 16 Tib Street, Manchester. Capital, £3,000. Lamp manufacturers and electrical engineers.

MIDGET ELECTRIC LAMP MANUFACTURING CO.—Registered by E. Chace, Carr & Co., 11 Great Tower Street, London. Capital, £2,500. Manufacturers of lamp filaments, &c.

WATLINGTON & CO., Moorgate Station Chambers, London Capital, £5,000. To take over existing business of manufacturers and dealers in electrical goods.

ARMSTRONG, STEVENS & SON, 15 Whittle Street, Birmingham. Capital £50,000. Manufacturers of incandescent lamp sockets, telephone and telegraph wire, &c.

LORD-HOWE ELECTRICAL ENGINEERING CO.—Registered by Jordan & Sons, Ltd., 116 Chancery Lane, London, E.C. Capital £1,000. Electrical, mechanical, and ventilating engineers.

BUENOS AIRES, CITY & SUBURBAN TRAMWAYS.—Registered by Ashhurst, Morris, Crisp & Co., 17 Throgmorton Avenue, London. Capital, £500,000 (in 77,000 £5 preference shares and 115,000 £1 ordinary shares). To adopt an agreement with the Buenos Aires Port & City Tramways, Ltd.

ELECTRICAL CONDUITS.—Registered by C. Doubble, 14 Serjeant's Inn, London. Capital £5,000. Manufacturers of electrical conduits and fittings. The subscribers are B. W. and A. K. Incledon.

INTERNATIONAL RUSSIAN CORPORATION, Winchester House, Old Broad Street, London. Capital £200,000. To acquire rights to construct electric lighting systems, tramways, power installations, &c., in the Russian Empire. J. G. White is one of the directors.

F. PRICE & CO., 6/7 St. John's Square, Cardiff. Capital £2,000. Electrical engineers and contractors.

The Damp Safety Cut Out.—In an informal Paper read last month at a meeting of the Newcastle Local Section of the Institution of Electrical Engineers, Mr. G. Ralph described the working of the Holmes-Alderson automatic device for cutting off the current from electrical apparatus in mines, when the percentage of fire-damp in the atmosphere tends to reach a dangerous amount. The apparatus was fully described and illustrated in ELECTRICAL ENGINEERING IN MINES, Dec. 1st, 1910, p. cxxvi. Mr. Ralph pointed out that the device could be used as an indicator of fire-damp only in combination with one or several warning bells distributed throughout the workings. A brief discussion followed after a demonstration of the working of the device. Prof. Thornton said that the apparatus would be useful in settling disputes as to the presence of gas, and would be much more definite than the safety lamp. It would, however, he thought, suffer from the action of the hydrocarbons on the platinum. Mr. A. Barker thought that the device was hardly robust enough for use at the coal-face. Mr. Ralph, in reply, mentioned that the device could not detect the presence of coal-dust. No trouble was expected from dirt on the contacts, which consisted of two knife-edges at right angles. The surface of the platinum wire could easily be restored by raising it to a white heat, and this could readily be done.

The Marconi Wireless Telegraph Patent Case.—We are informed that the British Radio-Telegraph and Telephone Co., Ltd., do not intend to appeal against Mr. Justice Parker's judgment, delivered on February 21st, which held that the Marconi patent No. 7,777 of 1900 is valid and had been infringed. We gave the judgment on page 89 of our issue for February 23rd. We also understand that no further litigation may be anticipated in respect of the other two Marconi patents which the British Radio-Telegraph and Telephone Co. are alleged to have infringed.

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SUMMARY

A SPECIAL Literary Supplement is included in this issue, containing notices and reviews of books, and a carefully revised list of selected works on electrical engineering and allied subjects.

A PAPER dealing with practical points in laying H.T. cables was read by Mr. C. Vernier at the Institution of Electrical Engineers last week, and was discussed in Newcastle and London. The author reviewed the whole subject, and described a method of straight-through jointing with copper braid, and also an expansion joint, both of which he had used with considerable success. In the Paper and discussions the relative advantages of the drawn-in, "solid," and direct-in-ground systems were discussed, the question of the need for cable-charging gear and the harmful action of vibration on cables near railways were also dealt with. (Page 135.)

Mr. L. F. MOUNTFORT'S Paper on the Electrical Undertaking of the Birmingham, Tame, and Rea District Drainage Board, read before the Birmingham Local Section of the Institution of Electrical Engineers, has been further discussed at Manchester. (Page 137.)

IN the course of an informal discussion on boilers at Sheffield last week, two new types were described. One of these, made by Hawksley, Wild & Co., is a water-tube boiler with nearly vertical tubes, and embodying a new design of tube-plate; the other, made by Fraser & Chalmers, under the Bettington patents, is fired with coal dust. Detailed descriptions of these boilers and a report of the discussion appear on page 138.

THE proposal to form a Joint Committee to acquire the Lots Road generating station, with powers to supply electrical energy to all the tube railways in London, was passed by a House of Commons Committee last week. The opposition of the London Electric Lighting Companies has been met. (Page 139.)

AMONG the Specifications published by the Patent Office on Thursday last, was one by the British Thomson-Houston Co. for a heating element consisting of a close helix of insulated resistance wire, electroplated to form a rigid metal disc. A method of cooling commutators by enclosing them in a cylindrical box to produce a circulation of air round the surface is described by the Brush Electrical Engineering Co. Two important patents relating to exhaust steam accumulators have been granted to Messrs. James Howden & Co., in spite of opposition and an appeal to the Law Officer. A patent by J. Gunning for a clockwork time-switch expires to-morrow, after its full life of fourteen years. (Page 140.)

AMONG novelties described in this issue are a fire extinguisher which is claimed to be able to deal with short circuits and petrol fires, and some new holophane reflectors. An automatic time ball is also described. (Page 141.)

THE Metropolitan Electric Supply Co. and the Gas Light & Coke Co. are to be asked to submit fresh tenders according to a new schedule and specification for the public lighting of the Borough of Holborn. (Page 141.)

EXCELLO flame arc lamps have been recommended for street lighting in Calcutta.—The District Auditor has criticised the accounts of the Marylebone Sales Department.—Nottingham traders are complaining at the high charges for electrical energy compared with

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other towns of similar size.—A proposal has been made that the lines of the Dublin and South-Eastern Railway Co. should be converted to electric traction. (Page 142.)

Stoke-on-Trent Corporation have decided to proceed with a £60,000 scheme of extensions.—A loan of £1,970 is to be taken up at Barnstaple.—Electrical stores are required at Glasgow, Govan, and Wallasey.—A 600 kw. D.C. turbo-generator, &c., is required at Handsworth, two 2,000 kw. turbo-alternators at Hull, and four electric watering cars by the L.C.C.—An electric lighting scheme is under consideration at Woodbridge.—Mains are to be extended at Wednesbury.—There has been considerable comment upon the acceptance, by the Birmingham Tramways Committee, of a German tender for tramway rails. (Page 142.)

New issues of capital are being made by the Christchurch (N.Z.) Tramway Board and the Rhondda Tramways Co.—The British Insulated & Helsby Cables, Ltd., and Henley's Telegraph Works Co., have shown considerable expansion in their foreign trade during 1910.—Further generating stations for the utilisation of waste heat are being erected in the North-East Coast district. (Page 143.)

Sir John Benn's appeal against the verdict for the G.B. in the recent libel suit commenced yesterday. A report will appear in our next issue.

Telegraph Traffic.—The El Arich route was restored to normal working order on the 7th inst. On the succeeding day the line between Baghdad and Bassorah failed, but repair was effected on the 11th inst. On the 8th inst. the cable section between Djedda and Souakim was again working. As from the 10th inst., messages for Chihuahua are not accepted until further notice. No sooner was the French company's Australia—New Caledonia section restored on the 13th, when the Cayenne-Salinas cable broke down. This means the interruption of the *via* Hayti route to Brazil and South America, and more work for the *Pouyer-Quertier*. The upkeep of the French West India system must be enormous, and it seems curious that these repeated interruptions in this part of their system should occur.

ARRANGEMENTS FOR THE WEEK

FRIDAY, MARCH 17th.

Batti-Wallahs' Society.

7 p.m. Annual Dinner at Holborn Restaurant.

MONDAY, MARCH 20th.

Institution of Electrical Engineers: Newcastle Section.

7.30 p.m. At Armstrong College. Continuation of discussion on "The Laying and Maintenance of Transmission Cables," by C. Vernier.

Royal Society of Arts.

8 p.m. Cantor Lecture III. : "Applications of Electric Heating," by Prof. J. A. Fleming, F.R.S.

TUESDAY, MARCH 21st.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "Electricity Meters," by H. A. Ratcliff and A. E. Moore.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. Annual General Meeting at the Municipal School of Technology.

THURSDAY, MARCH 23rd.

Institution of Electrical Engineers.

8 p.m. "Electricity Meters," by H. A. Ratcliff and A. E. Moore.

FRIDAY, MARCH 24th.

Physical Society.

5 p.m. At the City and Guilds (Engineering) College, South Kensington. (1) "Experiments on the Measurement of Electrolytic Resistances using Alternating Currents," by H. F. Haworth. (2) "Oscillatory Currents in Coupled Circuits" and "Some Radio-telegraphic Apparatus in use at the City and Guilds (Engineering) College," by Prof. G. W. O. Howe.

Institution of Civil Engineers.

8 p.m. At 25 Great George Street, Westminster. "The Uses of Chemistry in Engineering," by Mr. James Swinburne.

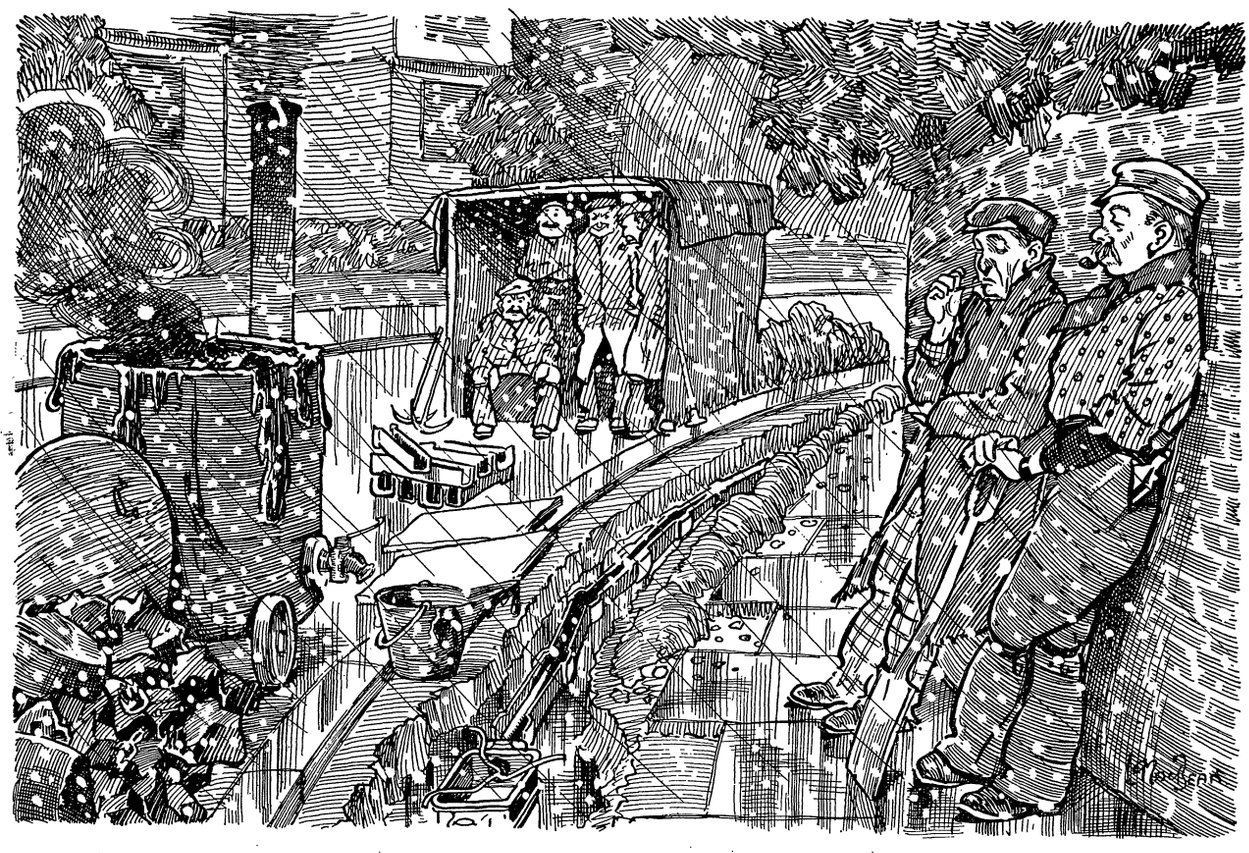
Electro Harmonic Society.

8 p.m. Smoking Concert at Holborn Restaurant.

SATURDAY, MARCH 25th.

Association of Mining Electrical Engineers.

3.30 p.m. *Notts and Derbyshire Branch.* At University College, Nottingham. (1) "The Use of a Milli-ampere Testing Set," by E. E. Beadsmore. (2) Discussion on the new Home Office Regulations.



In the course of a paper on the laying of cables read before the Institution of Electrical Engineers last week Mr. C. Vernier said :—"The solid system . . . has many objections . . . the chief of which is the difficulty of getting the work done satisfactorily under adverse conditions of weather, and similar inconveniences encountered when carrying on out-door work on a large scale."

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"ELECTRICAL ENGINEERING"

LITERARY SUPPLEMENT

NEW PUBLICATIONS

We shall be pleased to send any of the undermentioned works to addresses in the United Kingdom, at the net prices quoted. The price for sending to the Colonies and abroad is also quoted when there is an increase. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Electric Wiring, Fittings, Switches, and Lamps: Circuits," by W. P. Maycock. 4th edition. 628 pp. 7¼ in. by 5 in. 624 figures. (London: Whittaker and Co.) 6s. net; abroad, 6s. 8d.

"The Elements of Telephony." By A. Crotch. 90 pp. 7½ in. by 4¾ in. 51 figures. (London: E. & F. N. Spon.) 1s. 6d. net; by post, 1s. 7½d.

"Practical Electricity." By Prof. W. E. Ayrton and Prof. T. Mather. 3rd edition. 539 pp. 8¾ in. by 5¾ in. 289 figures. (London: Cassell & Co., Ltd.) 9s. net; abroad, 9s. 10d.

"Electric Wiring Diagrams." By W. P. Maycock. 146 pp. 5 in. by 7¾ in. 246 figures. (London: Whittaker & Co.) 2s. 6d. net; abroad, 2s. 9d.

REVIEWS OF BOOKS

Practical Electricity. By Prof. W. E. Ayrton and Prof. T. Mather. 3rd edition. 539 pp. 8¾ in. by 5¾ in. 289 figures. (London: Cassell & Co., Ltd.) 9s. net; abroad, 9s. 10d.

BEFORE Prof. Ayrton's death, the decision had been arrived at that an enlarged edition of his well-known *Practical Electricity* should be published under the joint names of himself and his colleague and now successor, Prof. Mather. Upon no one better than him could it have devolved to finish the task, and we take up the result of his labours with great interest. In many ways, the rapid advance of electrical science has necessitated some bringing up to date, but there is much of Prof. Ayrton's original work of as permanent a character as the principles themselves which he expounded. The book at the time of its original production in 1886 broke much new ground; not only was the subject young, but the author was the pioneer in striking out what was then a new method of teaching it. The idea underlying the system can be no better presented than in the words of the original preface again quoted in the re-written edition of 1896:—

> Readers . . . will be surprised at the arrangement of the subjects in this book . . . the order in which they have been arranged has been a matter of most careful consideration, and has been arrived at by what appears to me to be the *natural*, as distinguished from the *scholastic*, method of studying electricity. I have endeavoured to treat the subject analytically rather than synthetically, because that race of successful experimenters—children—adopt this method.

This was the keynote to the whole system, and there are few, if any, works that carry out this educational ideal so consistently.

The book is essentially a text-book and laboratory guide for a first-year student who desires to take up "Practical Electricity" as a business or profession, and to avoid misunderstanding and disappointment, we should point out that it does not attempt to be "practical" in the sense of dealing with the latest practice in industrial applications, which is, of course, a more advanced part of the subject. Industrial appliances are, however, brought in where convenient to illustrate principles, but even if the dynamo and motor are not included in the first year's course, yet they should not have been omitted entirely from a first text-book on "Practical Electricity."

The chief directions in which Prof. Mather has expanded the treatment, besides the general painstaking revision, are in greater detail in the connection between electrical and mechanical quantities, new chapters on the potentiometer, induction of currents, and on the magnetisation of iron. More space is devoted to integrating meters, and new wire tables are given.

Elementary Principles of Alternating-current Dynamo Design. By A. G. Ellis. 300 pp. 8¾ in. by 6 in. 145 figures. (London: Blackie & Son.) 12s. net; abroad, 12s. 8d.

As mentioned in the preface, the greater part of this work was prepared during the period in which Mr. Ellis, who is now designer to the Elektrizitäts Gesellschaft Alioth, Basle, was associated with Mr. H. M. Hobart; thus the book is practically a companion to Mr. Hobart's *Continuous-current Dynamo Design*. The treatment in the present volume is very similar, a practical system of design being developed from first principles and on constants obtained from modern practice. Emphasis is laid upon the general influence of the various principal factors, such as speed, output, frequency, and voltage, and proportion, economy, and cost are carefully studied throughout. The text is concise, and accompanied by useful tables, schedules, and curves. Complete data with drawings are given of typical alternators of moderate speeds, accompanied in some cases by sketches of mechanical details and test curves. The special features in the design of turbo-alternators are also dealt with. Students will find the work a clear and reliable text-book of practical design, while the data and constants should be of considerable value to those already engaged in the design of alternating-current machinery.

Solenoids, Electromagnets, and Electromagnetic Windings. By C. R. Underhill. 342 pp. 9 in. by 5¾ in. 223 illustrations. (London: Constable & Co.) 8s. Abroad, 8s. 9d.

THE spreading developments of remote and indirect control of switchgear, of which examples are found in automatic starters in relays of all kinds and in the contactors which form a feature of multiple-unit traction systems, has caused the design of electromagnets and solenoids for definite and predetermined action to be a matter of much more moment than formerly. The author of this book has had these requirements in mind, and it has been his object to provide a study of the subject leading up to and including data for the design of such apparatus. The treatment has a completeness such as we do not remember to have seen elsewhere, and the many practical points both as regards electrical design and mechanical construction of electromagnets and solenoids, for continuous as well as for alternating currents, are evidently the results of experience. In the niceties of electromagnetic control, the United States have certainly led the way in the past, and it is not surprising that this work hails from the other side of the Atlantic. The scheme does not include the description of apparatus worked electromagnetically. All that is presented is a connected study of the influence of the proportions of the dimensions, and the nature of the windings upon the magnetic action produced with formulæ deduced from both theoretical and test results, together with full data, wire tables, &c., for the design of windings for any requirements. It will perhaps cause inconvenience to some engineers in this country that the Brown & Sharpe gauge is used in the tables, but the comparative tables of other gauges go far to remove this objection.

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Applied Thermodynamics for Engineers. By W. D. Ennis. 438 pp. 10 in. by 6¼ in. 316 figures. (London: Constable and Co.) 24s. net; abroad, 25s. 3d.

THE author aptly defines his standpoint in his preface, where he says, "This book takes a middle ground between those text-books which replace all theory by empiricism, and that other class of treatises which are apt to ignore the engineering significance of their vocabulary of differential equations." He does not shirk mathematics, but commendably avoids complication in his treatment. A presentation of the fundamental principles of the thermal and mechanical behaviour of gases, admirable in its clearness and logical sequence, is given in the earlier chapters, while the body of the book proceeds to apply the principles to the development of methods of investigating and understanding the phenomena met with in engineering. Compressed air is treated at more length than is usual in such works, and the gas engine, steam engine, steam turbine, and refrigerating plant are dealt with in turn. A brief chapter discusses some aspects of boiler-house plant. The book is in no way a treatise on design, but no designer in these days of progress can afford to be ignorant of the scientific side of the subject, which is here presented in a way preserving a nice balance between the pedantic and the empirical.

The whole of this work reflects great care in its compilation, and such details of its arrangement as the paragraphs being divided and printed in varying sizes of type according to their importance, and the presence of a summary of its contents at the end of each chapter enhances its utility. The problems following each section also appear well chosen.

Elementary Telegraphy. By H. W. Pendry. 216 pp. 7½ in. by 4¾ in. 200 illustrations. (London: Whittaker and Co.) 2s. 6d. net.

THIS useful little text-book has been written to meet the requirements of the ordinary grade examination of the City & Guilds of London Institute. In the first chapter, the author summarises the elementary principles of electricity and magnetism, but the student of the following pages should have had some further instruction, as the subject is treated purely in its relation to telegraphy. After a section on primary and storage batteries, the various instruments used in telegraphy are clearly described with the aid of numerous diagrams and excellent half-tone illustrations of modern apparatus. Telegraph lines are then dealt with, the various patterns of insulators and poles and methods of erection being described. Dry-core cables for underground lines, and submarine cables are only briefly referred to. A few pages are devoted to testing, and, finally, the various methods of operating are carefully explained, including the different central battery systems and their recent applications. Test questions are appended to each chapter.

The Telegraphic Transmission of Photographs. By T. Thorne Baker. 146 pp. 7½ in. by 5¼ in. 64 illustrations. (London: Constable & Co., Ltd.) 2s. 6d. net; by post, 2s. 8d.

WRITTEN for the general reader rather than for those acquainted with telegraphic work, the descriptions of the various systems of phototelegraphy contained in this book are mainly in non-technical language. The author explains the principles of the Korn selenium and telautograph systems, as well as other methods,, and describes the difficulties met with in the development of a practical system for the *Daily Mirror*. In parts the text is highly technical, as when explaining the compensation of selenium cells. The author's own apparatus, the telectograph, is described, and some preliminary experiments in the wireless transmission of pictures are referred to.

Industrial Pyrometry. By C. R. Darling. 30 pp. 10 in. by 6¾ in. 23 figures. (London: Royal Society of Arts.) 1s. net; abroad, 1s. 2d.

THIS is a series of four Cantor lectures delivered before the Royal Society of Arts in November and December, 1910. The first lecture covers the history of high temperature measurement, and the use of pyrometers in the manufacture of pottery, glass, iron, and steel, coal-gas, &c. The principles and the most modern forms of the three types of instruments, viz., thermoelectric, resistance, and radiation pyrometers, are described in the remaining three lectures.

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Drying Machinery and Practice. By Thomas G. Marlow. 326 pp., 9 in. by 6 in., 174 illustrations. (London: Crosby, Lockwood & Son.) Price 12s. 6d. net; by post in U.K., 13s.; abroad, 13s. 6d.

THIS is a well-written book on a subject regarding which little has hitherto been published in a collected form. The principle and construction of drying machinery are fairly well covered in the eleven chapters, and good illustrations are included, but electrical engineers will be disappointed that more information is not given with regard to the patterns of vacuum dryers employed in cable manufacture, and for drying and impregnating coils for electrical machinery. The design, construction, and application of the vertical shaft electric motor for that type of drying machine known as the "hydro-extractor," also merits more extended treatment than is accorded to it.

The Electrical Ignition of Petrol Engines. By J. W. Warr. 76 pp., 7¼ in. by 4¼ in., 60 figures. (London: H. Alabaster, Gatehouse & Co.) 2s. net; by post, 2s. 1½d.

IT has been the object of the author to supply a handbook for the use of persons in charge of motor cars who are not familiar with things electrical, but as ignition is such a very specialised branch of electrical work, there is a good deal that will be found useful to electrical men unfamiliar with motor cars. Such first principles as are required are put with sufficient clearness, the leading coil and magneto systems are explained, and various practical hints are given. On the whole, the work is accurate and reliable, but we do not like the author's proposed method (page 11) of charging cells in parallel, as cells in varying conditions will not share the current equally. A mistake has also been made on page 64 in referring to the diagram of the Bosch dual ignition system on the previous page as using the magneto windings as a coil with a battery. This is not the case, as a separate coil is provided on the dashboard. The diagram does not represent quite the latest pattern of the apparatus, but this does not detract much from its value.

Electric Railways. By J. R. Cravath and H. C. Trow. 153 pp. 9½ ins. by 6½ ins. 120 figures and illustrations. (American School of Correspondence of Chicago.) (London: Crosby Lockwood & Son.) 4s. 6d. net; abroad, 5s.

THIS is one of a series of sixty volumes prepared by the American School of Correspondence of Chicago, and the greater part is the work of Mr. J. R. Cravath, the Western Editor of *The Street Railway Journal*. It is in the main descriptive, and forms a very readable and instructive introduction to the problems met with in electric traction. Unfortunately, however, the text deals almost entirely with American practice and conditions, and although the electrical equipment is very similar, the general conditions and the construction of the rolling stock and permanent way are quite different in this country. Again, most of the text refers to interurban railways, of which we have comparatively few. The information with regard to heavy main line traction is somewhat out of date, in spite of the fact that a short section on single-phase railways has been added since the main portion was prepared.

Power and its Transmission. By Thomas A. Smith. 76 pp. 6½ in. by 4 in. (London: E. & F. N. Spon.) 2s. net by post in U.K., or abroad, 2s. 2d.

EVIDENTLY written by one who has had some considerable experience with shop driving, this little volume contains a great deal of practical information regarding the proper dimensions, arrangement, and care of belts, shafting, and rope drive, the choice and testing of lubricating oil, &c. A chapter on the gas engine is too short to be of much value, and refers to tube ignition only. The notes on electric driving are of an exceedingly elementary character, merely explaining in a non-technical manner the purpose of switches and fuses, and giving a few general hints as to the management of a motor. The glossary of some fifty electrical terms will be useful to some readers.

The Care and Management of Ignition Accumulators. By Harold H. V. Cross. 66 pp. 7½ ins. by 5 ins. 12 figures. (London: E. & F. N. Spon, Ltd.) 1s. 6d. net; by post in U.K. or abroad, 1s. 7½d.

THE first part of this little work contains information which should be of use to motor-car owners, cycle agents, and motor-car repairers, and others who have to look after the charging of ignition accumulators without the help of a skilled electrician, but we do not think that the second part would appeal to quite so many. It describes a cheap and rather makeshift method of house lighting with what is little more than a toy gas engine and dynamo, an eight-volt battery, and switchgear of too primitive a nature to be reliable.

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Electric Circuit Problems in Mines and Factories. By Ellis H. Crapper. 159 pp. 6½ in. by 4¼ in. 57 figs. (London: "Colliery Guardian.") 3s. 6d. net.; by post in U.K. or abroad, 3s. 8d.

THIS handbook, which is small enough for the pocket, would have been of enormous value to the colliery electrician if only it had been a little better. As an instance of the sort of thing that spoils it, we may take one numerical example which we noticed on opening the book at hazard. The case taken is an installation of fifty 60-watt carbon-filament lamps and a 20-B.H.P. motor 1,000 yards from the dynamo. A voltage of 250 is assumed, and the current required is first calculated, then the section of the cable from the formula $C=2{\cdot}6A^{0{\cdot}42}$ with the aid of logarithms, and the nearest cable to this section is found from a wiring table (which obviously would have given the cable at once without the necessity of a calculation and the employment of a table of logarithms). The drop of pressure at full load is then worked out and found to be 49·6 volts, and 300-volts is therefore recommended as the voltage for the dynamo; the reader is told that "it will be advisable to use an over-compounded generator." Further, in a small book such as this, written by the Head of the Department of Electrical Engineering at the University of Sheffield, and issued by a technical publisher, we do not expect to find a list of six errata at the beginning—a list which, moreover, does not include all the mistakes.

Theoretische und experimentelle Untersuchungen an der synchronen Einphasen-Maschine. By Max Wengner. 88 pp. 9¾ ins. by 6½ ins. 44 figures. (Munich: R. Oldenbourg.) 2s. 6d. net; by post in U.K., 2s. 10d.; abroad, 3s.

IN view of its adoption in connection with railway electrification on the single-phase system, the single-phase generator deserves more consideration than it has had in the past. The present work contains a thorough mathematical investigation into the theory of the machine, and, in particular, into the effects of the so-called inverse field, namely, the backwards rotating component of the two rotating elements into which the pulsating armature field may be resolved. The author concludes that the circle-diagram as applied to single-phase generators gives reasonably accurate results, except where the armature strength is exceptionally large. An approximate method is given for estimating the currents in the damping-coils which are placed in the pole-shoes to prevent distortion of the wave form by the inverse field.

Elektromotorische Antriebe. By B. Jacobi. 341 pp. 8¼ in. by 5½ in. 172 figures. (Munich: R. Oldenbourg.) 8s. net; by post in U.K., 8s. 4d.; abroad, 8s. 7d.

This volume is a compendium of all the various types of electric motors, and the different methods of control and the apparatus required. It is essentially a book of reference for the consulting or works engineer, and should be of assistance in the choice of motor and control apparatus. The arrangement of the information facilitates reference. The merits and demerits of alternative types of motors and control gear are tabulated, and a long list of industrial machines and machine-tools is given, with the probable horse-power required. The choice of system and voltage, mechanical drive, and other details are briefly discussed, and some chapters are devoted to the design of works installations and the calculation of the rating of motors for certain specified cases.

Practical Telephony. By J. Bell and S. Wilson. 5th edition. 306 pp. 7¼ in. by 4¾ in. 232 figs. (London: S. Rentell & Co.) 3s. 6d. net.

THE matter in this book is good, but the arrangement is bad. In revising it for the present edition, the authors have shown excellent judgment in collecting technical descriptions of exchanges and other material and apparatus from technical journals, but they have displayed no skill in piecing them together. The result will be highly perplexing to the student, who will find a great part of the book unintelligible to him. Yet both of the authors are teachers, and the book is, according to the title-page, adapted to the requirements of the City and Guilds of London Institute and the Post Office Department Examinations. The book concludes with some of the City and Guilds examination papers on telephony, and these afford an effective test of the inadequacy of the book, for a large proportion of the questions could not possibly be answered by information to be found in its pages.

Aeroplane Patents. By R. M. Neilson. 90 pp. 8½ in. by 5½ in. 77 figures. (London: Constable & Co., Ltd.) 4s. 6d. net; abroad, 4s. 9d.

THE author has collected together here the subject matter of the most important British aeroplane patents. The work is in no way critical, and a great deal of the space is devoted to descriptions of devices of questionable utility. For those experimenting, however, it should be of use as telling them what must be avoided if originality is to be claimed.

The Slide Rule, by C. N. Pickworth. 12th edition. 118 pp. 7¼ in. by 5 in. 34 figures. (Manchester: Emmott & Co.) 2s. net; by post, 2s. 3d.

THE twelfth edition of this well-known handbook to the slide rule is made even more complete than former editions by the addition of descriptions of one or two new forms of slide rule, including one by the author, upon which a scale of cubes is marked. Some additional remarks on the use of special gauge points are also given.

Logarithms for Beginners. By C. N. Pickworth. Third edition. 47 pp. 7¼ in. by 5 in. (Manchester: Emmott & Co.) 1s. net; by post, 1s. 2d.

THIS well-known text-book on logarithms, now in its third edition, is noted for the concise and lucid manner in which the methods and reasons of the various operations are explained, and is particularly suitable for self-instruction. The careful arrangement of the text and the use of heavy type for important rules, &c., are especially helpful. With the exception of some slight revision and the correction of a few numerical errors, the book is in its original form.

Universal Electrical Directory, 1911. 1,552 pp. 9¾ in. by 6¼ in. (London: Alabaster, Gatehouse & Co.) A. British and Colonial Sections only, 10s. B. British and Colonial, with Continental and U.S.A. Sections, 14s. 6d.

A NEW arrangement which has been introduced into the 1911 edition of the familiar Red Book is the separation of the London from the provincial names in the British alphabetical section; a radius of fifteen miles from London is taken for this purpose. For the rest, the directory contains all the old and invaluable features which render the book indispensable to everybody in the electrical industry. The present constitutes the thirtieth edition.

The Faraday House Journal.—A copy of the February issue of the *Faraday House Journal* has just come to hand. Amongst other things, it contains four technical articles by old students of the Electrical Standardising, Testing, and Training Institution on subjects of current interest, including some notes on pyrometry by H. G. Weaver, a note on resistances for horn type pressure limiters by H. W. Swann, and articles on faults in direct-current machines and on three-phase transformers by F. C. Topham and J. Goodman respectively. A notable feature is the long list of appointments obtained by students on leaving Faraday House on the completion of their course, and it is interesting to note that every Faradian who left at the end of the past two terms has already found a post.

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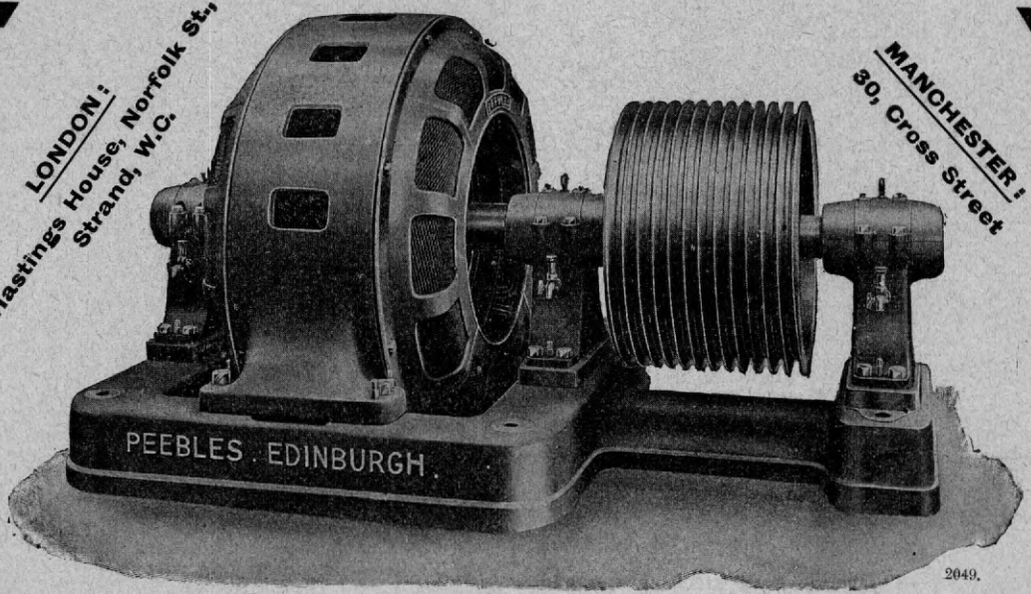
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CABLE LAYING AND JOINTING

A PAPER on "The Laying and Maintenance of Transmission Cables" was read by Mr. C. Vernier before the Newcastle Section of the Institution of Electrical Engineers last week, and also at the London meeting. The author estimated that the mains system represents from 30 to 50 per cent. of the total capital expenditure on an electric supply undertaking, and that the capital expenditure on mains of all kinds in the United Kingdom is probably not less than £25,000,000. He confined his remarks to three-phase underground transmission cables, for pressures between 6,000 and 20,000 volts.

Dealing with the draw-in system first, he expressed his preference for single pipes rather than multiple-way ducts to meet the event of a short circuit occurring in the ducts. As accidents have occurred from manhole covers being dropped on to cables, he recommended the arrangement illustrated in Fig. 2, in which the pipes are gradually

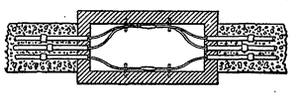


Fig. 1.—Common Arrangement of Cables in Manhole.

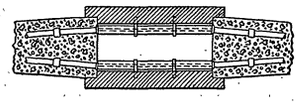


Fig. 2.—Recommended Arrangement of Cables in Manhole.

splayed out as they approach the manholes, to the more usual arrangement shown in Fig. 1. In a draw-in system, he continued, cables are liable in certain cases to damage by chemical action from bad water draining into the ducts from the surrounding soil, and as the pipes are frequently wet, electrolysis is greatly facilitated. From these points of view cast-iron pipes, where their cost is not prohibitive, are to be preferred, as they can be made much more easily watertight by means of leaded joints. The cables should be bonded to the pipes in a substantial manner at each manhole, and any electrolytic corrosion likely to occur will take place on the pipes. In earthenware pipes or ducts, it is preferable to use wire-armoured cables, the armouring taking the place of the copper tape B.O.T. earth sheath under the lead. Failing this, it is an advantage to use cable taped and braided over the lead sheath, as a protection against corrosion. The armourings and lead sheaths should be carefully bonded together, and earthed to an earth-plate at each manhole. On the question of repairs, he pointed out that, in the draw-in system, it is necessary in every case to draw in a whole length of cable between manholes in order to effect a repair, whereas on a solid system cases seldom occur where it is necessary to insert more than a few yards of cable.

Coming next to the solid system, he said that there is very little difference in the cost of wood and earthenware troughing, and in many cases earthenware troughs, which are more lasting than wood, and may be expected to outlast any cables, can be obtained more cheaply. Wood troughing, if used, should be boiled in Stockholm tar, not merely soaked or painted with the cold tar. When creosoting is ordered, the only satisfactory treatment is to impregnate the timber with creosote under pressure, as is done in the case of telegraph poles. Creosote obtained as a by-product of coal-tar distillation, if otherwise free from foreign matter, has no action upon lead or iron, but wood creosote obtained in the distillation of wood must be carefully avoided. Wood troughing is not brittle like earthenware, and can be obtained in much longer lengths, thus decreasing the number of trough joints, but the author thinks that these features are its only advantages, and that earthenware troughing is much to be preferred, except for situations where much vibration is to be expected, as in the case of cables laid along railways. Fig. 3 shows the wrong way to construct wood troughing, and Fig. 4 the right way. In the latter, it will be observed that the weight of the soil on the side-pieces is distributed on the bottom piece.

Earthenware troughing should be well glazed outside, but left unglazed inside, as the pitch or bitumen does not adhere to a glazed surface. The chief objection to earthenware troughing is the short lengths (about 2 ft.) in which it has to be manufactured, but in good ground this gives no trouble. Cast-iron troughing is expensive, but makes a thoroughly sound system, provided that, in addition to the troughs being bolted together, the lead sheath and armouring is well bonded to the troughs at intervals. In some cases iron supporting bridges are used, which grip the cable and are screwed to the iron troughs.

The filling compound for the troughs is usually refined pitch, or, less frequently, Trinidad bitumen. The latter is two and a half to three times as costly as pitch, but there can be no doubt of its superiority for cable laying. Pitch in its natural state is too brittle, and has to be mixed in suitable proportions with a thinning oil in order to render it more plastic. Unless great supervision is exercised in the mixing, the pitch will be too brittle, and from his experience the author inclines to the opinion that pitch which has been put into the troughs mixed with thinning oil in such proportions as to be quite plastic, does not retain this property indefinitely.

The weakest part of the solid system is the supporting bridges for the cables.

Wood should never be used in contact with the lead sheath of cables, as in its decay, which must inevitably occur sooner or later, organic acids are produced which attack lead. Oak is particularly bad in this respect. Cable bridges should therefore be made of earthenware, china, asphalte, or some other material not subject to absorption of moisture or to decay, and which is chemically inert. All bushes required at trough and pipe ends should be of glazed earthenware, and all organic materials, such as canvas, waste, &c., should be strictly kept clear of lead sheaths. Certain makes of cement also act chemically upon lead, and some engineers who have used conduits consisting of cement-lined steel tubes have experienced trouble from this cause. Asphalte bridges have the advantage that the hot filling composition softens their surface and thus adheres very closely to them. This property is sometimes a disadvantage with heavy cables, as the bridges are liable to soften sufficiently to be crushed out of shape by the weight of the cables. For heavy transmission cables the author prefers glazed earthenware bridges, and, in order to ensure the adherence of the filling composition, it is his usual practice to prepare the bridges by dipping them when dry in a fluid mixture of pitch and thinning oil, with which they become coated. Figs. 5 and 6 show designs of cable bridges, from

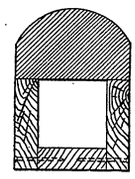


Fig. 3.—Wrong Way of Making Trough.

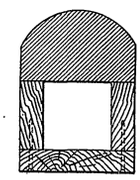
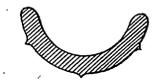


Fig. 4.—Right Way of Making Trough.



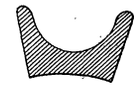


Fig. 5. Fig. 6.

Bridges for Solid System.

which it will be noticed that the surfaces in contact with the troughs are reduced to mere points, so as to allow the filling composition entirely to surround them. Cables with a braided covering, the author said, are much to be preferred, as the filling composition adheres very closely to such braidings, or, better still, armoured and jute served cables laid solid in bitumen.

A good hard-pressed dome-shaped tile about 3 in. thick cannot be excelled as a protective covering for transmission cables, whether laid in wood, earthenware, or cast-iron troughing. Cast-iron covers, about ¼ in. thick, such as are often used, do not offer sufficient protection to a blow from a sharp pick. It is a good plan to have the tiles stamped either with the name of the owners or with the word "electricity," which act as a warning to excavators of what the troughing contains.

The solid system is not, in the author's opinion (who has had some twelve years' experience of it), a thoroughly practical system to use for transmission work or any similar work on a large scale; the practical difficulties in obtaining good workmanship in the conditions under which the work has to be carried out are very great, particularly in our uncertain climate. A shower of rain will frequently saturate everything, while in dry, windy weather dirt gets blown into the troughs. In waterlogged ground it is practically impossible to obtain good work, and owing to the shrinkage of the filling compositions the greatest care has to be exercised in order to get the troughs full and also free from blow-holes.

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For transmission cables laid direct in the ground, the author prefers wire armoured cable protected either by tiles or creosoted planks about 2 in. thick, laid directly over the cables with about 3 in. of soil in between. Planks are less liable to be displaced. The author attributes the popularity of the solid system in this country almost entirely to some very rapid failures of armoured cable systems which have been experienced in the past. Armoured cables laid in dry sandy soils give very good results, while similar cables laid in made-up ground where decomposition of organic matter is liable to occur, or in ashes or in ground charged with sewerage matter, sometimes fail within a year or two, and in some cases even more rapidly. Clay has been said to affect armoured cables injuriously, but this has not been the author's experience. [Clay has, however, been known to act injuriously on the lead covering of cables.—ED. *E.E.*]

The solid system has many objections for transmission work on a large scale, the chief of which is the difficulty of getting the work done satisfactorily under adverse conditions of weather and similar inconveniences encountered when carrying on outdoor work on a large scale. Attention has therefore in some cases been directed to rendering the protective coverings on armoured cables as good a protection as a good solid system, but with the very important advantage that the work can be carried out in the cable-makers' shops under careful supervision and without any consideration of weather. All armoured cables laid by the power companies operating on the north-east coast now have a layer of a flexible bitumen compound 1/10 in. thick, directly on the lead and served with two specially closely woven bitumen-impregnated tapes. The cable is then served over these tapes with compounded jute yarn to form a bed for the armour, after which the armouring, either of steel tapes or wires previously passed through a bath of waterproof composition, is put on. This armouring is then served with jute yarn, passed through a bath of hot compound, and finally lime washed. The total cost of the specially protected armoured cables when laid is very little more than the cost of plain lead-covered cables laid on the solid system, and with this slight extra expense a much more suitable system is obtained.

The Paper next dealt with jointing, and expressed the author's disapproval, both of the copper sleeve joint and telescope joint for conductors, as apt to pull out after overloading and subsequent cooling, or in the event of subsidence of the ground. The method which he prefers and has patented (Patent No. 15,413, 1909), is to lay strips of flexible copper braid longitudinally along the conductors, to bind them on tightly with copper wire, and to solder the whole together. The flexible braid is compressed tightly into all the interstices of the conductor strand, and a joint of this type left unsoldered required one-third of a ton merely to pull one of the conductors out of the braids. A similar joint left unsoldered was run up gradually to 7,000 amperes per square inch, its temperature rise being at all times lower than that of the conductor. An alternative type of this joint for heavier conductors is to insert a layer of the copper braid over each layer of wire.

For insulating the cable, the author preferred the use of plain linen tape boiled in resin oil just before using, to the employment of tapes previously impregnated at the factory. The insertion of alternate layers of mica between the layers of tape actually gave a lower breakdown pressure than with tape only. With taped joints, after each of the three cores has been taped separately, he finds it preferable not to bind them together with a layer of tape from end to end, but to wrap on this tape in the form of bands at intervals along the cores, and similar bands on the cores themselves, as this leaves spaces between the insulated cores and the lead sleeve, which will be filled with oil subsequently poured in.

In a second type of joint the conductors are separated from one another by an insulating spreader or separator, which may be of ebonite, china, or some similar material. The cores are sometimes taped over with insulating tapes, but with certain precautions this is not necessary and is best avoided.

Joints of either type may be filled either with an insulating oil or a joint-box compound (of a solid or viscous nature). Oil is objected to by many engineers, who fear its being absorbed up the cores of the cables, but the author has not met a case in which a breakdown has occurred from this cause, and with cables impregnated under vacuum, as E.H.T. cables always are, the leakage should in any case be very small. In the second type of joint particularly oil or a viscous compound is preferable to a solid compound, as breakdowns have occurred due to shrinkage of the compound taking place in solidification after the joints have been filled.

It has been proposed by one large firm to exhaust such joints by a vacuum pump previous to running in the oil, and this will no doubt effectually provide perfect insulation for all pressures and also prevent any possibility of leakage up the cable cores. The author showed illustrations of this pump in the lantern. The pump produces a 29-in. vacuum in about half a minute, and before filling with oil this vacuum is maintained for about 30 to 40 minutes, and the oil is then let in.

A joint which the author considers more reliable than either of the two types already discussed is one in which the insulation is provided by loosely fitting tubes, preferably of micanite, which are sprung over the cores, the conductor joint being left bare inside them and the tubes overlapping some distance over the ordinary paper insulation at each end. The tubes, which are split on one side with a lap joint, are finally taped over their whole length, but not over the ends, with two layers of insulating tape to keep them together, and the three tubes are separated by star-shaped china pieces taped down to them, which keep them apart and centre them in the lead sleeve. This lead sleeve is then filled in with the insulating composition, either an oil or a viscous joint-box compound—preferably the latter—which can run into the tubes and all parts of the joint box. When cast-iron joint boxes with wiped glands are used to cover the joint instead of lead sleeves, the author recommends bonding across them, as he considers that sufficiently good contact is not made between the brass sleeve and the cast-iron box through the screw thread.

Another alternative suggested by the author, and used more recently, is a wrought-iron sleeve, as shown in Fig. 7, which is also bonded across.

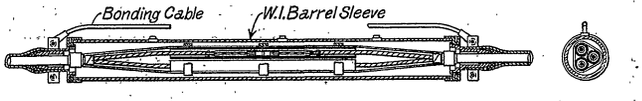


FIG. 7.

Mr. Vernier concluded his Paper with a review of the chief causes of breakdown. Breakdowns due to external damage had been rare in his experience, and had not averaged one case per annum over the past ten years. Other still less frequent cases of breakdowns due to external causes which the author had experienced, were leakage of steam and hot water from steam pipes in the neighbourhood of collieries and shipyards, destruction of the lead sheath by vermin, collapse of a dock retaining wall, and undermining of cables by leakage of water from water mains.

Where bad cases of electrolysis had occurred it had generally been due to excessive leakage from tramway undertakings or from three-wire D.C. networks. When this excessive leakage had been removed and the Board of Trade regulations complied with, electrolysis had been greatly minimised, if not altogether prevented. The author seemed to favour earthing the lead sheath to earth-plates at frequent intervals, but except at these points keeping it insulated from earth.

In mining districts serious trouble arises at times from the pulling out of joints or cable breakdowns due to subsidence of earth movements. These are much more frequent on solid laid cables than on either drawn in or armoured cables, although none of these systems can be said to be altogether free from this trouble. Sometimes the opposite effect, viz., that of compression of joints or of cable bursts, is met with.

When the ground subsides, the lead sheath is able to stretch, but the conductors do not, and the joints pull apart. Laying the cable with slack or snaked in the ground will not prevent this occurring, unless this snaking is done quite loosely in an empty trough. In order to overcome troubles of this sort, the author has designed (Patent 12,146, 1909) an expansion type of joint, which is illustrated in Fig. 8. The conductors are free to slide in a guide tube *a*, and their electrical continuity is maintained by strips of flexible copper braid *b*, which are bound down to them at each side and

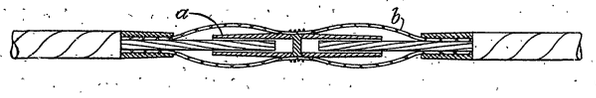


FIG. 8.

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to the guide tube in the centre in order to maintain the relative positions of the working parts. The insulation of the joint is the one with the micanite tubes already described. Joints of this type have been in use for about eighteen months on several 20,000-volt cables on the power companies' systems in the Newcastle district, and no breakdowns have occurred, although previous to this such breakdowns were very frequent. Joints opened up for inspection have shown movements of over 2 in. to have taken place, in some cases, in a few weeks. The latest joints installed provide for 6 in. movement in all, but joints can be made for much greater limits of movement if required.

These joints may also be employed to take up the expansion due to overload. Assuming a cable is laid in the ground and jointed up originally at a temperature of 60° F. (on cables jointed in winter these figures will be much exceeded), with a safe increase of temperature of 90° F., the conductors will expand 4ft. 6in. in a mile.

In cables laid alongside railway lines the breaking of the lead sheath due to vibration from passing traffic frequently occurs. This source of trouble seems to be confined entirely to cables laid on the solid system, and takes place at the joints of the troughing. The smaller the cable the more severe is the trouble, and even if a small cable and a large one be laid alongside one another in the same trench, the small one will always fail first. Serious cases have actually occurred on lead-covered cables laid within 2 ft. of tramways which were laid on a bed of concrete in the usual manner. The remedy for this trouble is to use only armoured cables laid direct in the ground and at greater depth than usual if within, say, a distance of 4 ft. from rails.

Resonance, fortunately, is not a very common cause of failure under normal conditions of working. Cables have usually a very heavy factor of safety (between 10 and 20, as a rule), and it has been found quite practicable to switch on and off long feeders direct on to the system without using any charging devices. Nothing else has ever been done on the large power companies' systems on the north-east coast, which were first put in operation in 1901, but cable-charging gear was still in use on some other large undertakings as recently as 1904–5 (*Journal* of the Institution of Electrical Engineers, Vol. xxxvi., pp. 85 and 120, 1905).

When pressure surges are the cause of breakdowns of cables or of their joints, it is usually the result of a heavy short circuit, which sets up oscillations in the system, and cables may break down due to a rise of pressure at some point often miles away from the short circuit causing the disturbance. The author added, "There can also be no doubt that the system persists in a condition which may give rise to further pressure rises for some time, as breakdowns often follow upon one another within a few days."

Finally, Mr. Vernier pointed out that it would be an advantage to use a non-metallic waterproof sheath for cables, if one could be obtained, which retained the great advantages of the present lead sheath without its disadvantages.

Our report of the discussion is held over until next week.

"Tantalum" Traction Lamps.—The general manager of a tramway company has written the following letter to Messrs. Siemens Brothers' Dynamo Works, Ltd., Tyssen Street, Dalston:—"Dear Sirs,—In reply to yours *re* the "Tantalum" lamps supplied to us for traction purposes, a sample batch were placed in Car No. — on February 21st, 1910. They have run up to the present 11,670 miles. There has only been one breakage, which took place during the first week the lamps were running. This was a broken globe, not a broken filament. The lamps appear to be still in very good condition, and in view of this test there is no question about them standing up to their work. Would you like us to return these lamps to you, or to leave them in the car and run them to destruction?"

The Metric System.—Our attention has been called by Mr. H. W. Sullivan to the work being done by the Department of Commerce and Labour of the Bureau of Standards, Washington, U.S.A., to popularise the metric system of weights and measures. A pamphlet explaining the system, and a useful book of tables of equivalents in metric and U.S.A. values were published in 1906, and are widely circulated. An effective coloured chart illustrating graphically the relative values is also published. A full-size yard rule is depicted alongside a metre rule, and a three decimeter rule by a foot rule, while the relative values of the weight and volume measures are illustrated by solid cylinders of equal diameter and different heights. This chart is suitable for hanging up in workshops, as it appeals to the artisan, and Mr. Sullivan suggests that the National Physical Laboratory should prepare a similar chart, as, of course, some of the American units are different to the English ones.

ELECTRIC POWER IN THE BIRMINGHAM DRAINAGE SYSTEM

THE Paper by Mr. L. F. Mountfort on "The Electrical Undertaking of the Birmingham, Tame, and Rea District Drainage Board," read recently at Birmingham (see ELECTRICAL ENGINEERING, February 23rd, p. 90), was further discussed by the Manchester Local Section of the Institution of Electrical Engineers on February 28th.

The discussion was opened by Mr. W. CRAMP (Municipal School of Technology), who took up the general question of the electrical driving of centrifugal pumps. The pressure and flow characteristics of a centrifugal pump were of the same general shape as the speed and current characteristics of a continuous-current motor. The exact shape is dependent in the case of the pump by the backward or forward curvature of the blades, and in the motor by the compounding. By suitable choice of these two features a combination can be obtained capable of providing from constant pressure electric supply mains any flow characteristic that we desire. It may be constant head with variable quantity, or constant quantity with variable head. With induction motors there was not the same possibility of adjustment, and hence the author's compromise with radial waves, which rather reduced the efficiency of the combination. He had used the divided end rings which the author objected to on single-phase motor.

Mr. S. J. WATSON (Borough Electrical Engineer, Bury) pointed out one or two inconsistencies in the load factors and statement of output in the Paper, and thought that the costs seemed rather high. He had himself once put down electrical plant at a combined destructor and sewage works. He suggested that a battery might have been employed to level out the peaks of the pumping load. The pump efficiencies were, in his opinion, very good. He did not like the idea of running a private station in parallel with a public supply.

Mr. A. G. COOPER (Borough Electrical Engineer, Colne) spoke of pump efficiencies as high as 75 per cent. At Colne they had separate surface water drains independent of the main sewers. They required about 40 h.p. at their sewage works for a town of 27,000 inhabitants, but there was no pumping to be done.

Mr. A. B. MALLINSON mentioned sewage plants which he had been connected with at Burslem and Huddersfield. At the former, low lift turbine pumps, driven by motors aggregating 160 h.p., and taking power from the town supply over an overhead line, are employed, and at the latter a number of revolving spreaders are driven by 2½-h.p. motors. He asked for some further particulars of the working of the motors and the lightning protection of the line.

Mr. W. B. SHAW asked how the diversity factor had been calculated, and for some further details regarding the drop in the line and the costs. He knew of motors which had refused to start until saw cuts were made in the end rings. With regard to the running in parallel of the station with the town mains, he asked whether any precautions were taken as to the excitation of the generators, as otherwise it might be possible to compel the mains to supply practically all the magnetising current, a state of affairs to which the Corporation Engineer would probably object.

Mr. MOUNTFORT, in his reply, said that the pumps were ordinary centrifugal pumps rather than high-grade turbine pumps, and first cost had been studied rather than very high efficiency. A battery would have been out of the question, as the peaks of the load often lasted for two or three days. With regard to running in parallel with the public supply, he thought that if anything went wrong, it would be the private plant that would suffer the most.

Peebles' Staff Ball.—The staff of Messrs. Bruce Peebles & Co. held a most successful ball recently in the North British Station Hotel, Edinburgh. Mrs. Lee Murray (wife of the general manager of the company), acted as hostess for the Committee, and received the guests. Supper was presided over by Mr. Lee Murray in his own and well-known genial style. The chairman, to use his own expression, "said a few kind words," and the speeches generally were of a high order, and reflected the satisfaction expressed by the shareholders at the annual meeting, which had been held during the day, at the progress made by the company, and with the very excellent work that had been carried out during the year just closed, by every member of the staff.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—Associate Members: J. Cowie, C. Davidson, J. Hardey, D. Hume, H. Kirkby, J. Marr, A. Moore, G. Peck, R. Porte, A. Roberts, A. Simpson, F. Symons, R. Whittington, C. Wickham. Associate: S. Stanley. Students: H. Addicott, G. Alvey, R. Andersen, W. Ball, J. Blythe, F. Boa, P. Bogà, W. Bull, E. Cheney, E. Clark, E. Elliman, G. Farrer, E. Fernandez, F. Fletcher, R. Hansford, R. Hargraves, T. Hornblower, M. Ichssan, F. Jackson, E. Johnson, G. Marris, H. Nadejde, A. Newbury, C. Newell, J. Page, D. Payne, R. Rao, W. Richardson, T. Riley, F. Rowcliffe, S. Smith, H. Stevenson, F. Tomlins, T. Turton, J. Warren, A. Woods.

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A DISCUSSION ON BOILERS: TWO NEW TYPES DESCRIBED

AT a meeting of the Yorkshire Section of the Institution of Electrical Engineers at Sheffield last week, an informal discussion took place on the selection of the best type of steam boiler. Considerable interest was aroused by the description of two new types of boiler being given for the first time.

The Brightside Boiler.

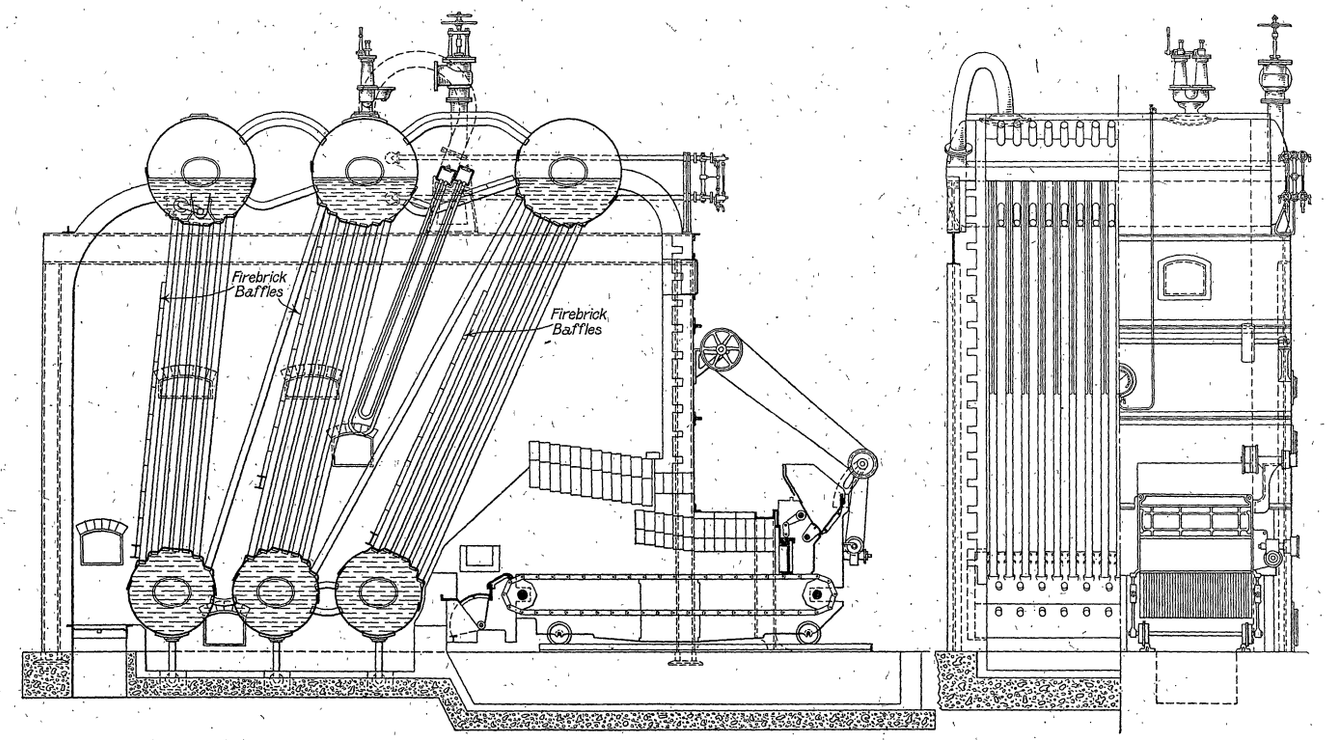
The first of these is a boiler which is being made by Messrs. Hawksley, Wild & Co., Ltd., at the Brightside Boiler Works, Sheffield. The Brightside water tube boiler is a boiler with tubes nearly vertical. The illustration below shows the general features of a boiler of medium size for evaporating about 10,000 to 22,000 lbs. of steam per hour, from and at 212° F., and for working at 200 lbs. per square inch pressure, but the firm also supplies boilers both of larger and smaller size; similarly, although the chain-grate stoker fitted to the boiler in the illustration is a Bennis, any other make can be fitted. The essential feature of the boiler is the method of pressing the tube plates, which allows straight tubes to be used in parallel rows, the pitch of which is $7\frac{1}{4}$ in. By the use of a special form of die for pressing these tube plates, the surface is at right angles to all the tubes entering. As the tubes are $3\frac{1}{4}$ in. diameter, and the pitch $7\frac{1}{4}$ in., a space of 4 in. is left between, and they can be taken out without drawing through the tube plate, so that no extra head room is necessary as with some types of vertical water-tube boilers. To remove a tube, it is cut off close to the tube plate by the usual method, and passed through the four-inch space to the space over the grate, where it is pushed through the door in the front of the boiler.

By the arrangement of the tubes in banks as shown, the first bank comprises $33\frac{1}{3}$ per cent. of the heating surface of the boiler, and 70 per cent. of the evaporation is performed there. The second bank supplies 36 per cent. of the heating surface and 22 per cent. of the evaporation, while in the third bank only 8 per cent. of the total evaporation takes place. Owing to comparatively low evaporation at the rear end, there is true progressive heating, and the water deposits its scale on the surfaces of these rear tubes. The boiler is illustrated fitted with a large superheater for 200° of superheat.

The Bettington Boiler.

The other new boiler described at the meeting is a water-tube boiler on an entirely new principle, for burning pulverised coal. It is made by Messrs. Fraser & Chalmers, Ltd., of 3 London Wall Buildings, E.C., and Erith, under the Bettington patents. The boiler has vertical tubes in circular headers. A mixture of pulverised coal dust and air is blown in through a vertical inlet, and a mushroom-shaped flame is produced within the closed ring of vertical tubes. A temperature of 3,000° F. or more is attained, and the returning gases always ensure incandescent brickwork around the tuyère so that heat is stored in them, and, after a temporary stop, it is sufficient to restart the fire merely by turning on the fuel supply.

The ash, as it passes through the zone of highest temperature, becomes converted to a liquid spray, and, being unable to adhere to the water-cooled surfaces, it drips down to the ashpit in the form of small globules, which are easily discharged to an ash conveyer or raked out. This liquid spray also incidentally seals up any crevices in the brick lining.



THE BRIGHTSIDE WATER-TUBE BOILER. (HAWKSLEY, WILD & CO., SHEFFIELD.)

The coal is fed into a hopper placed at the side of a combined pulveriser and blower, and the gases on leaving the boiler pass through an air heater, which pre-heats the air before it is drawn into the pulveriser fan and mixed with the coal dust. It is estimated that only about 3 per cent. of the total power developed in the boiler is required for the pulveriser and fan, and by the pre-heating of the air coal containing even up to 15 per cent. of moisture can be disintegrated and burnt.

Boilers of this type have been constructed in sizes from 6,000 to 40,000 lbs. per hour evaporative capacity, and a number of these have been in use in South Africa for some time. In one case, a low-grade coal was used, and a thermal efficiency of only 55 per cent. had been attained previously with a hand-fired water-tube boiler, even after screening and picking, while with the same coal, but without screening, an efficiency of over 80 per cent. was attained with the Bettington boiler. A boiler has been erected for demonstration purposes at Messrs. Fraser & Chalmers' works at Erith, and the erection of another is just being completed at a municipal electricity works. The boiler at Messrs. Fraser & Chalmers' works has been running regularly for over a year. It has 2,606 sq. ft. total heating surface with a single 14 in. tuyère fed with pulverised fuel and pre-heated

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air by the pulverising fan. Its calculated capacity was 10,000 lbs. of steam per hour, but we understand that it has been found to evaporate 12,000 lbs. without forcing, and has worked up to 22,000 lbs. without difficulty and with a correspondingly good efficiency.

Water-tube v. Lancashire.

The discussion at Sheffield, in the course of which these boilers were introduced, was opened by Mr. A. B. MOUNTAIN (Borough Electrical Engineer, Huddersfield), who briefly described and compared the boilers most commonly in use. He pointed out that the Lancashire and Yorkshire boilers both have the advantages of a large reserve of water and extreme simplicity of construction, but suffer from the impossibility of having a large grate area, and have a low evaporation per square yard of floor space. Another defect is the air leakage through the brickwork due to the constant expansion and contraction, and the liability to leakage from the down tube at the back of the boiler to the side flues, enabling the gases to pass straight from the back to the main flue. Comparing the Yorkshire with the Lancashire boiler, the furnace tubes of the former are gradually enlarged to the back of the boiler, and it is estimated that a 24 ft. Yorkshire boiler will do the same duty as a 30 ft. Lancashire.

Dealing next with the Babcock & Wilcox boiler, after describing it generally and appreciatively, Mr. Mountain suggested that, as the steam generated in all tubes has to pass up the front headers to the top drums under conditions of forcing, priming might result if superheaters were not used. The principle of the Stirling boiler was also explained and favourably commented on, and the question was asked whether the bent tubes implied any danger due to the difficulty of cleaning. The arrangement of the Woodeson or Clark-Chapman boiler, one of the latest developments in the vertical straight tube type, was also reviewed, and Mr. Mountain asked if any trouble had arisen from the flat surface into which the tubes are expanded, and if there were any difficulty in getting the dirt from among the tubes. He pointed out, however, that the ease with which the tubes can be cleaned and inspected is a strong point, but the fact that new tubes have to be put in through the manholes in the top drum, while very simple, necessitates a specially high building to allow the tubes, which are 14 ft. 6 in. long, to be withdrawn or replaced.

Mr. Mountain then gave brief descriptions of the two new boilers referred to at the commencement of this article.

On the question of maintenance and repairs, Mr. Mountain said that although there is not much difference in the maintenance costs for the various types of boilers, the arrangements for cleaning the water-tube boilers are much in advance of the Lancashire type, and he thought that the application of the vacuum cleaner to all boiler houses would no doubt become general and save much most unpleasant labour as well as improving the efficiency of the plant. He also mentioned that the first-class makers of fittings are now generally using steel for the bodies of all boiler mountings, and characterised cast iron fittings as not reliable.

The remainder of Mr. Mountain's remarks were devoted to a comparison of the cost of installation and efficiency of various boilers. Assuming that an evaporative capacity of 12,000 to 15,000 lbs. per hour was desired, he estimated the approximate cost as follows, including the cost of buildings, chimney, flues, economisers, stokers and fans for the water-tube boilers, but not including the cost of land:—8 Lancashire boilers, £16,750; 8 Yorkshire boilers, £15,500; 5 Babcock boilers, £15,000; 4 Woodeson boilers, £14,000; 4 Stirling boilers, £13,500. The efficiencies he assumed to be:—Lancashire, 65 per cent.; Yorkshire, 65 per cent.; Babcock, 70 per cent.; Stirling, 72½ per cent.; Woodeson, 72½ per cent.; and, taking the boiler to be evaporating at the rate of 100,000 lbs. of water per hour and working, say, 300 days of 18 hours, that the fuel to be worth 10s. per ton, he estimated that the annual saving due to the use of water-tube boilers over Lancashire or Yorkshire boilers would be from £750 to £1,125 per annum, in addition to the saving of capital and reduced cost of labour due to the fact that a smaller number of boilers would be in use.

Mr. HARTNELL mentioned the uniformity for all types of boilers of the curve connecting coal consumption per unit of heat surface with evaporation, and also spoke of the advantage of large grate areas, and boilers of large size.

Mr. CASMEY (Yorkshire Boiler Co.) explained at length the useful features he claimed for the Yorkshire boiler.

Mr. ATKINSON (Clarke, Chapman & Co., Ltd.), replying to Mr. Mountain's criticism, said that the connecting tubes between the drums of the Woodeson boiler were kept as straight as possible, and that the dirt was easily removed from between the tubes. He said that an allowance of 10 ft. head room above the upper tube plate was sufficient.

Mr. PIGGOTT (Babcock & Wilcox, Ltd.) said that the priming which Mr. Mountain feared in the Babcock boiler did not occur.

Mr. MCKAY (Stirling Boiler Co., Ltd.) explained that one of the objects in boiler design was to obtain the cheapest boiler per square foot of heating surface. Referring to the question of priming, he said that five years ago his company had accidentally discovered a method of curing priming, by one of their men having omitted to clean the circulating tubes between the two bottom drums. The improvement in this respect was at once manifest, and now only two tubes connect the two bottom drums to steady the water pressure between the rear and front tubes. The size of the drums of the Stirling Boiler Company had been increased from 3 ft. to 4 ft. in diameter. He had investigated straight tubes, but had come to the conclusion that the boiler with straight tubes having the same number of drums top and bottom did not have sufficient circulation. Moreover, each tube must take up its own expansion and contraction without creeping at the tube plates or producing leakage. This, he claimed, could only be accomplished by having bent tubes.

Mr. NOBEL (Hawksley, Wild & Co., Ltd.) explained the construction of the Brightside boiler (see page 138), and expressed the opinion that while the Yorkshire boiler might have advantages over the Lancashire boiler, yet it could not compare with any of the water-tube boilers shown.

Mr. V. BETTINGTON, who with his brother had invented the coal-dust boiler already described, explained its action, and answered several questions.

Mr. YERBURY (Electrical Engineer to Sheffield Corporation Tramways) pointed out that if Mr. Mountain had included the value of land in comparison with capital costs, the water-tube boiler would have shown to still better advantage.

A speaker favoured the marine tube boiler, both because of its high evaporative efficiency, and the small amount of floor space it took up, but a subsequent speaker pointed to the difficulty of obtaining superheat with a boiler of this class.

PARLIAMENTARY INTELLIGENCE

A House of Commons Committee last week dealt with the Bill of the Metropolitan District Railway Co., which proposes to form a Joint Committee to acquire the Lot's Road Power Station now owned by the Underground Electric Railways Company of London. As originally drafted, the Bill contained a clause empowering the Joint Committee to supply electrical energy to all the railway companies in London, and also general powers to supply electricity in bulk. There was considerable opposition to the latter proposal. Many of the London Electric Supply Companies petitioned against the Bill, but eventually they were all satisfied by a modification in the clause which struck out bulk supply, except the Metropolitan Electric Supply Company, who wished to prevent the Joint Committee from supplying the London & North Western Railway Company. The Bill has also been modified in a manner to prevent the Joint Committee from tendering for supplying the London, Brighton & South Coast Railway Co. The Metropolitan Electric Supply Co. withdrew its opposition to the Bill in the House of Commons, reserving the right to appear against it in the House of Lords, and eventually the preamble of the Bill was found proved, the Joint Committee being granted authority to supply electrical energy to the Metropolitan, London & South Western, Whitechapel & Bow, Great Northern & City, Central London, City & South London, London & North Western, North London, London, Tilbury & Southend, Wimbledon & Sutton, Great Western and Metropolitan Railways, and any other railway or tramway company with which the Metropolitan District and London Electric Railway Companies have through traffic or physical connections. It was further made clear in the Bill that the Joint Committee only has power to supply these railway and tramway companies, and is not able to take over any of their statutory powers. The Joint Committee will consist of three members each of the District and London Railway Companies, the lease being for 999 years.

The Bill of the London Electric Railway Co. was also under consideration by a House of Commons Committee last week. It proposes to construct a short loop line linking up the Trafalgar Square station of the Bakerloo Railway and the Charing Cross station of the District Railway Co., and also about half a mile of line joining up the Edgware Road station of the Bakerloo Company with the Paddington station of the Great Western Railway Co. To the former proposal there was no opposition, but to the latter there was opposition from the District Railway Co. The Great Western Railway Co. is financially interested in this extension. The preamble of the Bill was found proved.

The Halifax Corporation Bill was before the Standing Orders Committee in the House of Lords on Thursday, but was allowed to proceed on condition that four lengths of tramway, in respect of which the consents of the road authorities had not been secured, were struck out.

Electric Driving at a London Printing Office.—In the article on the *Illustrated London News* and *Sketch* printing office, which appeared in our issue of March 2nd, it should have been stated that Electromotors, Ltd., of Openshaw, Manchester, were the Main Contractors for the electric power equipment.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published March 9th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

4,299/10. **Lampholders for Trough Reflectors.** J. H. CUNNINGTON (London). A twin lampholder for taking two lamps end to end in a trough reflector consists of a cylindrical body with ordinary holders at each end, and a small clear space between for wiring. Five figures.

12,889/10. **Cooling of Commutators.** BRUSH ELECTRICAL ENGINEERING CO., LTD., and A. W. JONES. Commutators or slip-rings are enveloped in a stationary sleeve of insulating material cut away at convenient points to admit the brushes. Air circulates through the annular passage left between the sleeve and the commutator surface, special inlet and outlet openings being provided. Six figures.

16,342/10. **Frequency Meter.** SIEMENS & HALSKE A.-G. An instrument for indicating and recording frequency consists of a voltmeter arranged in parallel with an inductance, with a condenser in series with both. The closed iron circuit of the inductance is saturated so that the resonance point of the measuring circuit is displaced with any alteration of current, and the circuit is tuned so that the whole range of the instrument lies outside the resonance point. The use of a high saturated transformer with large leakage, and also of a second voltmeter in opposition, to eliminate the effect of variations in the pressure, are also covered by this patent. Five figures.

16,419/10. **Train Telephony.** H. VON KRAMER (Erdington). This patent covers certain details in the system of train telephony by magnetic induction between coils on the carriages and conductors along the line, which is now being tried on some railways. Two coils are employed, one for transmission, and one for reception. The active part of each coil is arranged beneath the carriage parallel to the line, while the rest of the coil extending over the roof is enclosed in a tube of brass or other non-magnetic metal. Eight figures.

26,120/10. **Heating Apparatus.** BRITISH THOMSON-HOUSTON CO. *(General Electric Co., U.S.A.).* A flat heating unit for hot-plates and other electric heating apparatus is constructed by covering a length of the insulated resistance conductor with a metal tape or a thin metal sheath deposited on the insulation. The conductor is then wound into a close helix and electroplated until the whole becomes as rigid as a solid disc of metal. This results in a heating unit in which the conductor is in close contact with the metal to be heated, and is well protected. Four figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: RADFORD, MUNTON, and JONES [Coil-winding machine] 4,129/10.

Dynamos, Motors, and Transformers: SIEMENS BROS. DYNAMO WORKS *(Siemens-Schuckertwerke Ges.)* [Rotary field transformers] 21,583/10.

Electric Ignition: COMPAGNIE POUR LA FABRICATION DES COMPTEURS A GAZ [Automatic ignition of gas burners] 11,722/10; SOC. D'ELECTRICITE NILMELIOR [Make and break device] 20,863/10.

Electrometallurgy and Electrochemistry: URBAIN, FEIGE and SEAL [Sterilising liquids by electric arc] 4,795/10; CONSORTIUM FÜR ELEKTROCHEMISCHE INDUSTRIE GES. [Manufacture of persulphuric acid] 23,548/10.

Incandescent Lamps: ELDRED [Leading-in wires] 4,467/10; CERVENKA [Manufacture of filaments] 8,341/10; BRITISH THOMSON-HOUSTON CO. *(General Electric Co., U.S.A.)* [Leading-in wires] 13,295/10; SIEMENS & HALSKE A.-G. [Manufacture of metal filament lamps] 19,077/10.

Instruments and Meters: STROMBERG and WILLIS [Meters] 4,273/10; CAMBRIDGE SCIENTIFIC INSTRUMENT CO. and DARWIN [Thermoelectric circuits] 24,668/10.

Storage Batteries: HARDY and HUNGERBÜHLER, 4,320/10.

Switchgear, Fuses, and Fittings: LEBEDENKO [Cable sockets] 30,491/09; HINSKY [Insulated wiring conduit] 5,048/10; MORRIS and LISTER [Switches] 5,221/10; BRIDGE [Automatic make and break device] 6,719/10; COLLINS [Lamp-holders] 8,913/10; ADAMS MANUFACTURING CO. *(Cutler Hammer Manufacturing Co.)* [Motor starters] 9,101/10 and 17,340/10; LOBEL and BRITISH EVER-READY ELECTRICAL CO. [Lamp-holders and fittings] 11,051/10.

Telephony and Telegraphy: COOPER and BRITISH INSULATED AND HELSBY CABLES, LTD. [Automatic cradle switches for telephones] 7,361/10; BALDWIN [Sound-reproducing device of telephone-receiver type] 10,774/10; DYMOND *(Ges. für Drahtlose Telegraphie)* [Production of slightly damped oscillations by shock-excitation method] 18,545/10; LAMKIN and PACE [Sound-magnifying device for telephones] 20,399/10; GOLDTHORP [Wireless receiving apparatus] 25,280/10; AMERICAN AUTOMATIC TELEPHONE CO. and GOODRUM [Automatic telephone exchanges] 28,057/10; DICKER *(Automatic Electric Co.)* [Impulse-transmitting devices for automatic telephone systems] 29,654/10.

Miscellaneous: DE FERRANTI [Thrust bearings and shaft packings] 5,035/10 and 5,169/10; HIRST [Coal-cutters] 10,358/10; MUREX MAGNETIC CO. and LOCKWOOD [Separation of ores] 13,009/10; MIRAM and SEIDEL [Electromagnetic clutches] 19,952/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: SIRE [Machines] 2,903/11.

Electric Ignition: MAZELLIER [Sparking plug] 3,859/11; UNION-WERKE MEA GES. ELEKTROTECHNISCHE FABRIK EISENWERK [Magneto apparatus] 4,085/11.

Electrometallurgy: MELLEN & MELLEN [Manufacture of aluminium and copper alloys] 3,361/11.

Incandescent Lamps: ROYER, 3,541/11; WEISSMANN [Filaments] 3,950/11.

Instruments and Meters: WEINTRAUB [Electrolytic meters] 3,648–9/11.

Telephony: CAMPBELL and SHAW [Loaded phantom circuits] 3,422/11; SHAW [Loaded phantom circuits] 3,423/11.

Miscellaneous: MIRAM and SEIDEL [Electromagnetic clutches] 19,786/10.

The following amended Specifications can now be obtained.

STEINWEG [Soldering aluminium] 6,138/09; SCOTT [Disc coal-cutters] 4,357/10.

Opposition to Grant of Patents

25,231–2/07. **Exhaust Steam Accumulators.** JAMES HOWDEN & CO., LTD., and W. H. OWEN. The Law Officer has confirmed, on appeal, the decision of the Comptroller to grant these two patents. The first covers the use of a minimum-pressure boiler intermediate between the high-pressure engine and the low-pressure turbine, which acts both as a steam accumulator and as a source of steam when the supply of exhaust steam fails. The second patent covers the use of a superheater between the steam accumulator and the turbine.

21,008/09. **Arc Lamp.** L. D. CIBIE. The grant of this patent has been allowed in spite of opposition, but the Comptroller's decision requires an amendment to the specification. This was abstracted in ELECTRICAL ENGINEERING, Oct. 13th, 1910, p. 648, and describes a lamp in which one carbon is guided in a socket having a spherical bearing and rests on a stop attached to this socket.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

7,011 of March 17th, 1897. **Time Switch.** J. GUNNING. This patent covers a time switch for extinguishing lamps at a predetermined time, and consisting of a clockwork mechanism driving a dial on which is an adjustable arm. The latter is caused to open a switch when the dial has carried it round so as to engage with the switch.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: BRITISH THOMSON-HOUSTON CO. *(General Electric Co., U.S.A.)* [Vapour rectifiers] 24,025/05.

Distribution Systems, &c.: E. T. RUTHVEN-MURRAY [Supports for cables laid in troughs on solid system] 25,284/03; A. M. TAYLOR [Load-equalising plant] 25,620/04.

Electrometallurgy, &c.: COMPAGNIE FRANCAISE DE L'OZONE [Ozone apparatus for treatment of water] 12,061/04; J. HARGREAVES [Electrolytic apparatus] 25,331/04.

Instruments, &c.: BRITISH THOMSON-HOUSTON CO. and F. HOLDEN [Prepayment meters] 25,658/03.

Switchgear, &c.: C. SMART [Automatic switch for substituting incandescent lamps for arc lamps, &c.] 25,235/03; ZAPF [Lightning arresters] 25,657/03; BRITISH THOMSON-HOUSTON CO. and J. M. WALLACE [Oil switches] 23,894/05; F. E. IMESON [Contact fingers for controllers] 24,183/05.

Telephony, &c.: G. MAGINI [Use of coherers in line telegraphy] 25,191/04.

Miscellaneous: SALWÉN [Magnetic separators] 23,823/01; SIEMENS & HALSKE A.-G. [Tantalum electrodes for vacuum tubes] 25,282/04; P. C. HEWITT [Use of vapour lamp to intensify current variations] 25,406/04; J. T. SCHAAFF [Electrically-actuated typewriters, &c.] 25,431–2/04.

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FIRE EXTINGUISHER

An arc and fire extinguisher, especially designed for use in electricity works, mines, factories, and motor garages, has been introduced by Simplex Conduits, Ltd. (113 Charing Cross Road, London, W.C.). This extinguisher is claimed to be equally as efficient as any other at present on the market, with the addition that it will extinguish an electric arc and put out burning petrol. The fluid used is a non-conductor of electricity, and can therefore be used on burning cables, &c., which are still alive, without fear of assisting the formation or persistence of an arc. It can also be directed on to machinery in motion to extinguish a temporary short-circuit. The device consists of a cylindrical vessel full of a patent liquid which is forced out by means of compressed CO_2. The gas is contained in a small cylinder attached to the main cylinder; the jet is said to carry 40 ft. Tests made at the Birmingham Municipal Technical School have proved that the liquid does not damage the insulation of cables, and that arcs of several hundred amperes were immediately extinguished by the jet, whether between carbon electrodes or insulated cables.



Arc and Fire Extinguisher.

NEW HOLOPHANE SHADES

Through the courtesy of Messrs. Drake & Gorham we are able to illustrate a pair of new designs of holophane reflectors, specially intended for household use. While retaining the reflecting features of the well-known stiletto pattern of shade in the vertical flutings of the upper part, they are, as can be seen in the illustrations, provided with a more ornamental lower border, giving very much the effect of a bead fringe, but with very much greater efficiency of distribution. In appearance they are an advance on any holophane ware that has been produced.



New Patterns of Holophane Reflectors.
(*Messrs. Drake & Gorham.*)

AUTOMATIC TIME BALL

An interesting time-indicating equipment has been installed at the offices of Messrs. S. H. Benson, Ltd., the well-known advertising contractors, of Kingsway Hall, Kingsway, London. A time ball of 4 ft. diameter has been mounted on the summit of the dome of the building, and is dropped precisely at each hour by a current impulse direct from Greenwich Observatory. Unlike other time balls which only work once a day, and require to be set up by hand daily before their fall, this one is wound up automatically shortly before each hour of daylight by a ¼-h.p. motor through a double-worm reduction gear, with a ratio of one to 10,000. Messrs. Benson's have their offices equipped with the "Synchronome" system of electric clocks, and the installation has now the additional duty of switching on the motor to raise the time ball at ten minutes before each hour. The ball is lifted to the top of the mast in about five minutes, and a clutch falls out of action automatically, leaving the ball held up on a hair trigger ready for release by the Greenwich time signal, which is transmitted over the lines of the Standard Time Co., Ltd. The architects specified that there should be no shock occasioned by the fall, and this has been overcome by a system of counterbalancing. Just before the ball reaches the bottom, the switches are replaced, leaving the motor ready to raise the ball before the next hour. The equipment was designed by Mr. Hope-Jones, and carried out by the Synchronome Co. (32-34 Clerkenwell Road, London, E.C.).

HOLBORN STREET LIGHTING

When the report of the Works Committee of the Holborn Borough Council on the question of public lighting came before the Council at the meeting on Wednesday last week, the action of the Committee in recommending that further tenders be invited from both the Gas Light & Coke Co. and the Metropolitan Electricity Supply Co. was severely criticised. A councillor complained that the statements made at a previous meeting as to the reversion of several Boroughs to gas (Electrical Engineering, February 16th, p. 81) were wholly inaccurate, and Councillor Angel admitted that they were. He said that this list was not prepared by the Borough Surveyor, as had been suggested, but he believed that it originated from the Gas Light & Coke Co. An amendment that the Council should accept the tender of the Metropolitan Electric Supply Co., which was lower than that of the Gas Co., was rejected by the Mayor as being out of order, and it was argued that the competing undertakings had not had an opportunity to tender on equal grounds to a specified schedule. Alderman Green moved an amendment that the 5-year contract proposed by the Works Committee should be altered to a 10 years contract, with the option on the part of the Council of terminating it at 5, 6, 7, 8 or 9 years on payment of a sum to be specified in the tender. He thought it unreasonable to ask the Metropolitan Electric Supply Co. to tender for a shorter period in view of the capital costs which they would have to allow for.

Councillor Clarke, Chairman of the Works Committee, said everyone had warned him against a 10-years contract, as something might happen in the meantime which would considerably reduce the cost of lighting. It had been agreed between the Borough Surveyor and the Metropolitan Electric Supply Co. that in the event of electric lighting being adopted only, between four and five miles of road in back streets and mews would have to be disturbed, and that there would, therefore, be no inconvenience to the public.

Eventually the Committee's recommendation was accepted as amended by Alderman Green, and the Gas Light & Coke Co. and the Metropolitan Electric Supply Co. will therefore be asked to submit fresh tenders according to the schedule prepared by the sub-committee (see Electrical Engineering, March 2nd, p. 110), and a new specification.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

SEARCHLIGHTS.—An illustrated brochure from the Allgemeine Elektricitäts-Gesellschaft of Berlin contains full descriptions of this firm's various patterns of searchlights with Zeiss mirrors and other novel features. Different methods of electrical and mechanical operation are described, and the dimensions and weights of the various types are listed. The forty-four figures include some night photographs and illustrations of special equipments for naval and military purposes.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

COUNTRY HOUSE LIGHTING.—A booklet from the Crypto Electrical Co. (149-159 Bermondsey Street, S.E.) contains particulars of a compact generating set of small size, consisting of one of the firm's continuous-current generators, direct-coupled to a vertical single-cylinder petrol or paraffin engine. The sets are made from 2 to 20 h.p. A series of sets with horizontal engines and belt-driven generators is also included, and the list deals with suitable batteries and switchgear.

We have received an illustrated prospectus of the Working Men's College (Incorporated), Melbourne, for 1911. The college embraces a large number of departments, and courses in electrical engineering are included in the engineering section. There is a special telephone artificer's course, and a separate department is devoted to mining work.

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LOCAL NOTES

Bournemouth: *Tramway Reconstruction.*—The General Manager of the tramways hopes to have the change-over from conduit to the overhead system in the centre of the town completed in time for the Easter traffic.

Glasgow: *Tramway Assessment.*—The Tramways Committee's recommendation that the Corporation should appeal against the assessment of the tramways, which is at present based upon the full valuation instead of one-quarter, as is claimed should be the case, has been passed by the Corporation. The Tramways Committee have paid on the present basis for the past two years, but under protest, and now desire to have the point settled.

Grimsby: *The Proposed Tramway Purchase.*—A sub-committee of the Tramways Committee, after having considered the matter carefully, have recommended that the tramways undertaking should not be purchased by the Corporation at the present time.

India: *Calcutta: Street Lighting.*—Last year the Calcutta Corporation carried out a series of tests of various arc lamps over a period of four months, and Mr. Reynolds, who was appointed for the purpose, recommends the adoption of the "Excello" arc lamps, which he states are more expensive in capital cost, but are more economical in working. It is, therefore, proposed to install 140 arc lamps to displace 209 gas lamps. It is recommended that they should be placed not more than 75 yards apart. The working expenses per lamp per annum are put at £2 18s. 8d.

London: *Marylebone: Sales Department.*—Dealing with the district auditor's report for the year to March 31st, 1910, which is mainly confined to the working of the Sales Department, the Finance Committee point out that no attempt is made in the accounts of this department to credit the value of the sale of current arising from the profits of the department, nor to debit it with any theoretical apportionment of the various management and establishment charges, salaries, &c., which it would be necessary to readjust and alter from time to time. It is impressed upon the Council that the Sales Department does not exist as a separate entity. The committee recommend the continuance of the present method of keeping the accounts, namely, to show as nearly as possible the exact cost of the department, *i.e.*, the additional cost due to its setting up, and to set against this the income derived from the gross profit of the sale of apparatus, &c., effected by it. At the same time, it is proposed to submit at the close of each financial year a combined report of the Finance and Electric Supply Committee with a view to stating as far as possible the exact financial effect of carrying on the sales branch.

Nottingham: *Charges for Electricity.*—At a meeting of the Notts and Derbyshire Traders' Association last week discussion took place upon the high charges for electricity supply in Nottingham. It was alleged that the charges to consumers are on the average considerably more than in other towns, and that the generating costs exceed by 33 per cent. the average cost in eighteen towns of similar output. A resolution calling for an examination of the cost of the department with a view to a reduction in charges was carried.

Sunderland: *Street Lighting.*—The Electricity and Lighting Committee recommend that 47 gas lamps upon the route of electricity mains be converted to electricity.

Torquay: *Tramway Arbitration Costs.*—The Electric Lighting Committee have decided to make a grant of £500 towards the costs of the tramway arbitration, in spite of opposition from several members, who complained that the electric light consumers should not be deprived of this sum of money.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Barnstaple.—A Local Government Board inquiry was held last week into an application for a loan of £1,970 for electric lighting extensions.

Glasgow.—A twelve months' supply of cables and meters is required by the Electricity Department. (See an advertisement on another page.)

Handsworth.—The Electricity Committee invite tenders by March 28th for a 600-kw. mixed-pressure D.C. generator, jet condensing plant, motor-driven pumps, natural draught cooling tower, pipes, valves, &c. Particulars from the Town Clerk.

Hull.—The Electricity Committee invite tenders by March 28th for two 2,000-kw. turbo-alternators. Particulars from the City Electrical Engineer.

South Africa.—The Krugersdorp Municipality is negotiating for a supply of energy from the Victoria Falls and Transvaal Power Co.

Stoke-on-Trent.—At a special meeting of the Council on Thursday it was decided to proceed with Mr. Yeamian's scheme for the construction of a new power station, and the generation of high-tension three-phase current, at an estimated expenditure of £60,000. The new power station will be erected on land adjoining the present Hanley works. The committee's recommendation to proceed with the scheme was carried by 40 votes to 22.

Wednesbury.—Mains are to be extended to the Newtown district at an estimated cost of £480.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

H.M. Commissioners of Works invite tenders for electric bell-hangers' work in their buildings. (See an advertisement on another page.)

King Edward Memorial Hospital at Ealing.

PROVINCES.

Accrington.—Elementary school at Clayton-le-Moors.

Birmingham.—Warehouse in Southern Street for Messrs. A. Brown & Co. Architects, J. & L. Lea & Sons, 19 Cannon Street.

Bradford.—Workhouse at Daisy Hill.

Bridgewater.—Quarter House and Police Station in Northgate.

Edinburgh.—Foundries in London Road. A Hunter Crawford, 10 Randolph Place.

Handsworth.—Additions to Rookery Road Junior School. Architects, Messrs. Wood & Kendrick, High Street, West Bromwich.

Ilkeston.—New school in Cotmanhay district.

Keighley.—Plans are being prepared for new swimming baths.

Perth.—Alterations and extensions at the County of Perth Infirmary. Architect, James Miller, 15 Blythswood Square, Glasgow.

Southampton.—School buildings in French Street. Borough Engineer.

Stockport.—Hotel in Northgate Street.

MISCELLANEOUS

Edinburgh.—Tenders are invited by March 27th for a year's supply of bitumen, arc lamp globes, pavement boxes, and conduits. Particulars from the City Electrical Engineer.

Govan.—Tenders are invited by March 28th for a twelve months' supply of stores, including arc lamp carbons, joint boxes, cable accessories, house services, meters, fuse boxes, &c. Particulars from the Borough Electrical Engineer. (See an advertisement on another page.)

London: *County Council.*—Tenders are invited by March 28th for four electric watering cars with rail grinding apparatus, and four electrical equipments for the watering cars for operation upon both the conduit and overhead systems of traction. Particulars from the Chief Officer of Tramways.

Wallasey.—The Electricity Committee invite tenders by April 13th for mains, cable and junction boxes, switches and cut-outs, &c. Particulars from the Borough Electrical Engineer.

TENDERS RECEIVED AND ACCEPTED

Birmingham.—Considerable comment has been going on in the daily papers with regard to the decision of the Birmingham Tramways Committee to pass an order for German tramway rails of a value of £11,000. The saving to the committee by the acceptance of the German rails is £900. A condition of the contract is that the standard rate of wages in the district in which the rails are manufactured is to be paid.

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Burnley.—The tender of the British Westinghouse Co. for a steam turbine driving two 250-kw. generators has been accepted.

Canada.—The Brush Electrical Engineering Co., Ltd., through their agents, the Canada Ford Co., of Montreal, has received the contract for the supply of six cars (four single truck single deck, and two double truck single deck), for the municipal tramway system at Regina. The cars will be fitted for the overhead trolley system, and will have standard D.C. equipments.

Edinburgh.—Tenders for the cooling towers at Dewar Place have been received, and are now in the hands of the consulting engineer, Sir Alexander Kennedy, for report.

Leith.—The Dock Commission have accepted the tender of the Chloride Electrical Storage Co., Ltd., at £2,032, for extensions to the electrical plant.

Tenders have been received for cables from all the principal British makers and one German firm. In the case of the British firms the tenders were all about £4,000, whilst the German tender was slightly higher. The latter was subsequently asked for a definite tender, and, knowing that they were in competition with British firms, they reduced their prices by about 16 per cent. The Works Committee recommend that a British tender should be accepted, but the matter has been referred back to the sub-committee.

Loughborough.—The tender of the Brush Electrical Engineering Co., Ltd., for two 350-kw. turbo-alternators at £1,368, has been accepted. The full list of tenders was given in our last issue. The Brush Co. are also to supply a commutator grinder.

Sunderland.—Messrs. Lucy & Co. have been given an order for street lighting fittings.

Whitehaven.—Messrs. Chamberlain & Hookham, Ltd., have received a contract for prepayment meters.

The order for 3-ampere meters for the coming year has been placed with the Bastian Meter Co., Ltd.

APPOINTMENTS AND PERSONAL NOTES

Professor J. A. Ewing, F.R.S., Director of Naval Education, was married at Christ Church, Westminster, on Thursday, to Miss Ellen Hopkinson, daughter of the late Dr. John Hopkinson, F.R.S.

Mr. T. Petersen has been appointed acting secretary to Messrs. Callender's Cable & Construction Co., Ltd., to fill for the present the vacancy occasioned by the death of Mr. H. E. Harrison.

Mr. J. W. Dugdale has been presented with a fumed oak smoking cabinet and a silver-mounted pipe by the tramway employees at Ashton-under-Lyne, on the occasion of his appointment as tramways manager at Oldham.

Electricians, fitters, turners, &c., are required in the Mechanical Transport Section of the Army Service Corps. (See an advertisement on another page.)

The Bristol Corporation Electricity Department have a vacancy for an improver. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5, Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 to £57 10s. per ton (last week, £57 to £57 5s.).

Dissolution of Partnership.—J. Petkin and H. B. White, carrying on business as J. Petkin & Co., electrical engineers, Red Lion Street, Clerkenwell, has been dissolved.

D. L. Selby Bigge and R. G. Bell, trading as D. Selby Bigge & Co., electrical engineers and contractors, Newcastle-on-Tyne, have dissolved partnership. Debts by D. L. Selby Bigge.

Duralumin.—The Electric and Ordnance Accessories Co., Ltd. (Cheston Road, Aston, Birmingham), inform us that they have appointed Mr. A. W. Wingate (Gisburn, Clitheroe) as sole agent for the sale of "Duralumin" in Lancashire, Yorkshire, Westmorland, and Cumberland. He is prepared to give advice as to the best method of employing the new alloy, which the company are now prepared to supply in various forms.

Plant for Sale.—The Edinburgh Electricity Department have for sale two 100-h.p. Willans-Siemens 250-volt D.C. generating sets, and three 350-h.p. 500-volt D.C. sets. Offers to the Town Clerk by March 25th.

Felten & Guilleaume Carlswerk Aktiengesellschaft.—Communications should now be addressed to the above name instead of to the Felten & Guilleaume-Lahmeyerwerke Aktiengesellschaft, at Mülheim-on-Rhine, Germany.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

British Insulated & Helsby Cables, Ltd.—The net profit for 1910 was £72,320, and after declaring a dividend of 10 per cent. for the year, a sum of £42,320 is carried forward. The directors report that the business during the last year has shown satisfactory growth, largely due to orders obtained through the foreign agencies and connections.

Oxford Electric Co., Ltd.—At the annual meeting last week Sir Henry Mance, who presided, said he agreed with the Tramways Company in shrinking from incurring the heavy expense of installing the conduit system. Whilst there might be objections to the use of overhead trolley system, he thought it was not impossible to design a standard which should be graceful, and to which even the most fastidious could not object. The only alternative to the overhead trolley system was to adopt battery tramcars, which, while more expensive to run, cost considerably less in capital expenditure. He was surprised that this system, which was so popular in America, should be regarded with such disfavour in this country.

W. T. Henley's Telegraph Works Co.—At the annual meeting last week, Mr. George Sutton, the managing director, said whilst the home trade during the past year had been satisfactory, the greatest expansion had been in foreign trade. They had done the largest business on the telegraph side since they began making cables twenty years ago.

Brompton & Kensington Electricity Supply Co.—The net profit for 1910 was £27,583, after meeting interim dividends. A final dividend on the ordinary shares, making 10 per cent. for the year, is recommended, carrying forward £7,443.

South London Electric Supply Corporation.—The net profit for 1910 was £14,002, and a dividend at the rate of 5 per cent. per annum is declared on the ordinary shares, carrying forward £1,002.

Vickers, Sons & Maxim.—A final dividend of 5s. per share, making 10 per cent. for the year, is recommended for 1910, carrying forward £103,970.

South London Electric Supply Corporation.—The net sum available for 1910 is £24,594, and, after setting aside £5,000 for depreciation and meeting debenture interest, a 5 per cent. dividend is declared on the ordinary shares, carrying forward £1,002. Since the installation of turbine generating plant there has been a considerable reduction in the generating costs.

County of London Electric Supply Co.—Mr. J. B. Braithwaite presided at the annual meeting on Monday. The result of the trading for 1910 was given in our last issue. The Chairman remarked that it has not yet been possible to link up the northern and southern stations, owing to the formalities required in connection with the consents of various authorities, but all these were now practically settled with. After a reference to the position with regard to street lighting in Holborn, the facts of which have already been given in our columns, the Chairman mentioned the London Electric Supply Act of 1908, and in reply to questions assured the shareholders that it was by no means a dead letter. The companies and local authorities were now considering a well-thought-out scheme, and they preferred to go slowly rather than have a hasty and patchwork system which might have to be undone afterwards. All the companies were quite alive to the position, and the County Company had interchanged *pourparlers* with one or two of its neighbours with regard to supplying electrical energy in bulk, which was permissible for the first time by the 1908 Act.

The Batti-Wallahs' Society.—The annual general meeting of this Society will take place on Wednesday, March 29th, at the Golden Cross Hotel at 8 p.m. Nominations for officers and committee should reach the Secretary before 20th inst.

Messrs. Drummond Bros. Employés Dinner.—Last Friday Messrs. Drummond Bros., Ltd. (Churchhill Works, near Guildford, Surrey), entertained their employés, to the number of over 250, to dinner at the Large Hall, Guildford. The chairman of the company, Mr. E. E. Pullman, presided, and was supported by Mr. A. Drummond, managing director, and other officials of the firm. The Mayor of Guildford was present. In one of the speeches Mr. Triggs Turner gave a very interesting *résumé* of the history of the firm, which, starting about ten years ago with a man and a boy, had made continuous and rapid progress until now the buildings covered 1½ acres, and about 250 hands were employed. He attributed their success to the fact that they supplied a useful article at a reasonable price. They had now agencies in nearly every country in Europe. During the proceedings a presentation of a silver tea and coffee service was made to Mr. A. Drummond, and the opportunity was taken to contradict the rumour that he was about to leave the firm.

OSRAM-LAMPS

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Cable Accessories Co., Ltd., Britannia St. Works, Tividale, Staffs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Tudor Accumulator Co. Ltd., 119, Victoria St., S.W.

AIR COMPRESSORS.
Belliss & Morcom, Ltd., Birmingham.

AUCTIONEERS AND VALUERS.
Wheatley Kirk, Price & Co., 46, Watling St., E.C.

ALUMINIUM.
British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

ARC LAMPS AND ACCESSORIES.
British Thomson-Houston Co., Ltd., Rugby.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.
Jandus Arc Lamp and Electric Co., Ltd., Hartham Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Union Electric Co., Ltd., Park Street, Southwark, S.E.

ARMATURE REPAIRS.
Higginbottom (J.) & Co., Blenheim St., Chelsea, S.W.
Marryat & Place, 28, Hatton Garden E.C.

BOILERS.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, E.C.
Hawksley Wild & Co., Ltd., Brightside, Sheffield.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Rickard (Wm.), Ltd., Ashbourne Road Mills, Derby.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Mirrlees Watson & Co., Ltd., Glasgow.
Willans & Robinson, Ltd., Rugby.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

FIRE EXTINGUISHERS.
"Kyl Fyre," Ltd., Eastbourne.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Crossley Bros., Ltd., Openshaw, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.

HEATING AND COOKING APPARATUS.
Bastian Electric Heating Syndicate, Ltd., Palmerston House, Old Broad St., E.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87–89, Cleveland Street, W.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.

INSULATING MATERIAL.
Weidmann (H.), Rapperswil, Switzerland.

INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.
Ruberoid Co., Ltd., 81 & 83, Knightrider St., E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
The Fredk. Crane Chemical Co., 22 & 23, Newhall Hill, Birmingham.

LAMPS (Incandescent).
Boddy (G. M.) & Co., 15, Gray's Inn Road, W.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Brush Electrical Engineering Co., Ltd., 1, Kingsway, W.C.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Horvath (S.), 51, Standen Rd., Southfields, S.W.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Krupka & Jacoby, 11, Queen Victoria St., E.C.
Philips Metallic Glowlampworks, Ltd., Eindhoven, Holland.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

METERS.
Bastian Meter Co., Ltd., Kentish Town, N.W.
British Thomson-Houston Co., Ltd., Rugby.
Ferranti, Ltd., Hollinwood, Lancs.

MICA AND MICANITE.
Jaroslaw (D.), 5, George St., Tower Hill, E.C.

MINE EQUIPMENTS AND APPARATUS.
A. E. G. Electric Co., Ltd., 133-135, Oxford St., W.
British-Thomson Houston Co. Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Spagnoletti, Ltd., Goldhawk Rd., W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Electromotors, Ltd., Openshaw, Manchester.
General Electric Co., Ltd., 67, Queen Victoria St. E.C.
Ingleby & Co., Elland Road, Leeds.
J. L. Manufacturing Co., Ltd., Southall.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
Wilson-Wolf Engineering Co., Ltd., Bradford.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.
Sokal (S.), 55, Chancery Lane, W.C.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
Willans & Robinson, Ltd., Rugby.

RESISTANCE WIRE.
Drennan, Glover & Cooper, 429-431, Corn Exchange Buildings, Manchester.

SIGNS (Electric).
Electrical and Engineering Supplies Co., Ltd., 36 & 37, Upper Thames St. London, E.C.
Krupka & Jacoby, 11, Queen Victoria St., London, E.C.

STEAM CONSUMPTION RECORDERS.
Lea Recorder Co., 28, Deansgate, Manchester.

STEAM ENGINES AND TURBINES.
Belliss & Morcom, Ltd., Birmingham.
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Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
Vickers, Sons & Maxim, Ltd., Sheffield.
Willans & Robinson, Ltd., Rugby

SWITCHGEAR.
Adams Manufacturing Co., Ltd., Bedford.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Electrical Apparatus Co., Ltd., Milford Works, Queen's Rd., Battersea, S.W.
Ellison (George), Warstone Lane, Birmingham.
Ferranti Ltd., Hollinwood, Lancs.
Reyrolle & Co., Ltd. Hebburn-on-Tyne.
Spagnoletti, Ltd., Goldhawk Rd., Shepherd's Bush, W.
Union Electric Co., Ltd., Park St., Southwark, S.E.

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Cassell & Co., Ltd., La Belle Sauvage, E.C.
Constable (Archibald) & Co., Ltd., 10 Orange St., Haymarket, W.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W
Electric Journal, 422, Mansion House Chambers, E.C.
Gresham Publishing Co., 34, Southampton Street, Strand, W.C.
Griffin (Charles) & Co., Ltd., 12, Exeter Street, Strand, W.C.
Lewis's Scientific Circulating Library, 136, Gower Street, W.C.
Longmans, Green & Co., 39, Paternoster Row, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.
Western Electric Co., Ltd., North Woolwich, E.

VENTILATION AND FANS.
Wilson-Wolf Engineering Co., Ltd., Bradford.

VULCANISED FIBRE.
Mosses & Mitchell, 122–124, Golden Lane, E.C.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

A discussion at the Institution of Electrical Engineers on cable laying and jointing, in connection with the Paper published in our last issue, appears on page 151, and the whole subject is critically reviewed in an article on page 147.

At the annual meeting of the National Electrical Manufacturers' Association, a very active year's work was recorded. (Page 148.)

The petition in the action by the Attorney-General of the United States against thirty-five firms for alleged unlawful combinations to obtain the monopoly of, and prevent competition in the sale of, incandescent lamps, contains some interesting information with regard to the purchase by the combine of the Siemens Tantalum and the Auer, Just-Hanaman, Kuzel, and Bergmann tungsten lamp patent rights in America. (Page 148.)

Messrs. Evershed & Vignoles have introduced an instrument on a similar principle to the megger for the measurement of very low resistances. (Page 149.)

A short article describes a new design of electromagnetic crane brake. (Page 150.)

A number of visitors were given the opportunity of inspecting the equipment of the National Physical Laboratory last week. Notes on some of the new apparatus and a brief review of the past year's work are given on page 150.

A Paper by Mr. P. Dawson was read last week before the Institution of Civil Engineers, on the electric working of the South London line of the London, Brighton, & South Coast Railway. The equipment was fully described, and results of tests and actual running were given. (Page 152.)

Three electrically-driven fire-escapes have been supplied to the L.C.C. Fire-Brigade, and are now in use. These have hub motors of the well-known Mercédès pattern and Tudor batteries. The vehicle weighs 5 tons 5 cwt., complete with escape and five men, and attains a maximum speed of 26 miles per hour on the level. (Page 153.)

In the Appeal Court on Monday, the Master of the Rolls and Lords Justices Fletcher-Moulton and Buckley reversed the judgment of Mr. Justice Ridley for £12,000 damages in respect of certain statements made by Sir John Benn concerning the G.B. system in the Mile End Road. The reason for the Appeal Court decision is that the libels were not personal upon Messrs. Griffiths and Bedell, and the jury having been unable to find special damage, the question of trade libel did not arise. (Page 153.)

In a Paper read before the Birmingham Section of the Institution of Electrical Engineers, Mr. S. P. Smith dealt with the characteristics of turbo-alternators with cylindrical rotors, calling special attention to the ease of obtaining a pure sine wave of E.M.F. on load. The concentration of the field winding giving the best result, and standardisation were also discussed. (Page 154.)

A new process for regenerating old storage battery plates is being applied with considerable success. Of a number of 46-cell regenerated traction batteries in use by a London electric carriage company, one has completed its life with 4,500 miles, which is 1,000 miles above the average figure for a new battery. The cost of such a battery is less than one-half that of a new one. (Page 155.)

Among the specifications published by the Patent Office on Thursday last was one by the British Thomson-Houston Co. for leading-in wires of drawn tungsten for incandescent lamps. Brown, Boveri & Co. have applied for permission to amend the claims of two important patents relating to the automatic speed

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control of electrically-driven ring-spinning machines. A patent by C. L. Buckingham for a printing telegraph apparatus for high-speed telegraphy expires on Thursday next, after the full life of fourteen years. (Page 156.)

THE Marylebone Electricity Committee have agreed to the assessment of their undertaking being increased by £8,500.—Sir David Harrel has been appointed arbitrator in the Manchester Tramway dispute.—Flame arc lamps are to be used on the Victoria Embankment.—The Dolter system at Torquay has now been changed over to the trolley system.—The proposal for a company to construct tramways between Huddersfield and Halifax has fallen through.—The electrification of the Dublin and South Western Railway has been suggested. (Page 157.)

A STEAM turbo-alternator and condensing plant is required at Glasgow; high and low-tension switchgear and static transformers at Hammersmith; a steam alternator and motor generator at Rawtenstall; and a turbo-generator, condensing plant, switchgear and motor generator at Torquay. Loans of £2,083, £3,000, and £20,000 are to be taken up at Hastings, Dublin, and Bermondsey. Cables are required at Watford; and a third section of the L.C.C. Central Car Depôt is to be built. (Page 157.)

THE arbitrator in the dispute between the Underground Electric Railways Company of London and the Westinghouse Company concerning the substitution of Parsons turbines for Westinghouse machines has given his award. (Page 159.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, MARCH 23RD.

Institution of Electrical Engineers.

8 p.m. "Electricity Meters," by H. A. Ratcliff and A. E. Moore.

FRIDAY, MARCH 24TH.

Physical Society.

5 p.m. At the City and Guilds (Engineering) College, South Kensington. (1) "Experiments on the Measurement of Electrolytic Resistances using Alternating Currents," by H. F. Haworth. (2) "Oscillatory Currents in Coupled Circuits" and "Some Radio-telegraphic Apparatus in use at the City and Guilds (Engineering) College," by Prof. G. W. O. Howe.

Institution of Civil Engineers.

8 p.m. At 25 Great George Street, Westminster. "The Uses of Chemistry in Engineering," by Mr. James Swinburne.

Electro Harmonic Society.

8 p.m. Smoking Concert at Holborn Restaurant.

SATURDAY, MARCH 25TH.

Association of Mining Electrical Engineers.

3.30 p.m. *Notts and Derbyshire Branch.* At University College, Nottingham. (1) "The Use of a Milli-ampere Testing Set," by E. E. Beadsmore. (2) Discussion on the new Home Office Regulations.

3.30 p.m. *Warwickshire and S. Staffs Branch.* At Imperial Hotel, Birmingham. "Three-phase Motors for Haulage in Mines," by J. Simpson.

Association of Engineers-in-Charge.

Annual Dinner at Holborn Restaurant.

MONDAY, MARCH 27TH.

Institution of Electrical Engineers: Newcastle Branch.

7.30 p.m. At Armstrong College. "Wireless Telegraph Working in Relation to Interferences and Perturbations," by J. E. Taylor.

Royal Society of Arts.

8 p.m. Cantor Lecture IV. :—"Applications of Electric Heating," by Prof. J. A. Fleming, F.R.S.

TUESDAY, MARCH 28TH.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. Annual General Meeting, at University. "The Properties of the X-Rays from Radio-active Matter," by **Prof. E. Rutherford.**

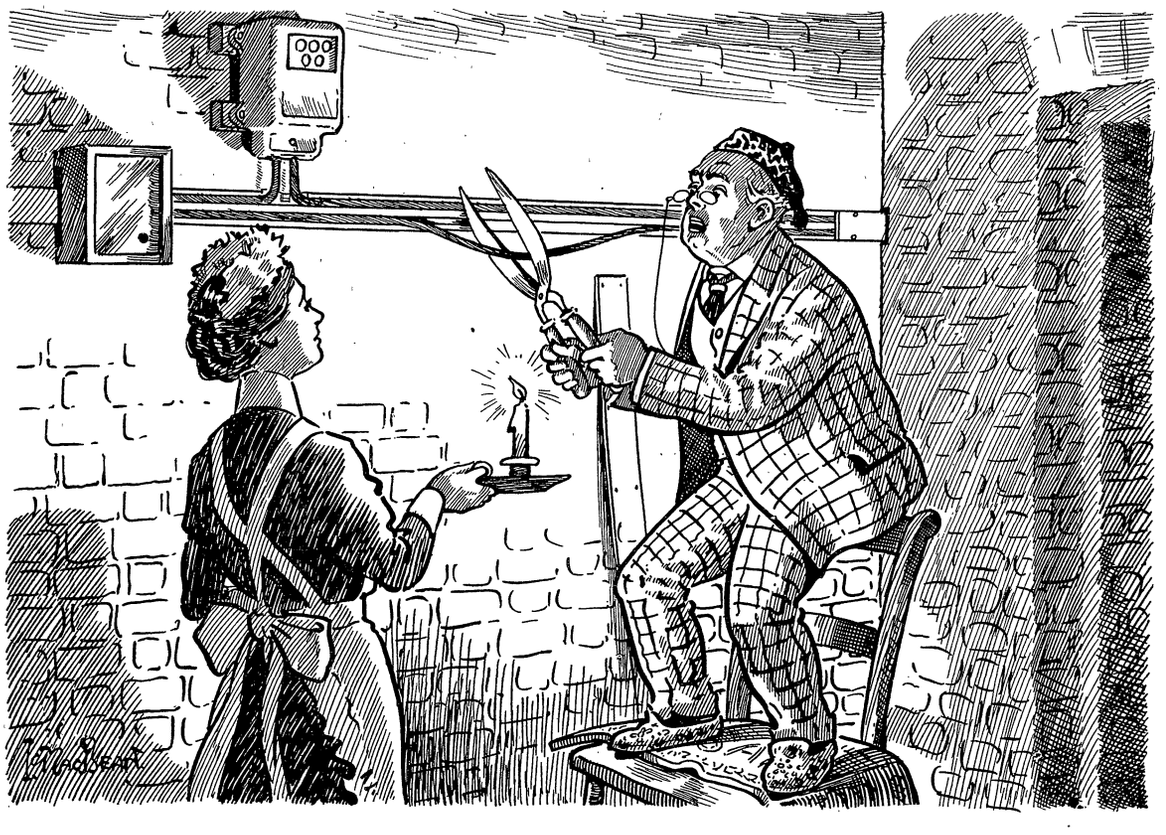
Institution of Civil Engineers.

8 p.m. Further discussion on "The Electrification of a Portion of the Suburban System of the L.B. & S.C. Rly.," by P. Dawson.

FRIDAY, MARCH 31ST.

Institution of Civil Engineers.

8 p.m. Lecture II. :—"The Uses of Chemistry in Engineering," by J. Swinburne, F.R.S.



IRATE CONSUMER:—They told you the current returned to the works through this wire, did they? No wonder my bill's high. We'll see what *this* will do!

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MAINS

WHEN a keen controversy exists in engineering circles as to alternative systems or designs, it is usually safe to assume that both have their merits, and that it is a competition of excellence, rather than a question of choice between two tools neither of which is precisely adapted to the work in hand; when the difference of opinion is with regard to the selection from three methods, this is almost invariably due to an *embarras de richesse*, rather than to an inadequacy of means. Such is the case in the triangular duel between the advocates of the "draw-in," "solid," and "direct-in-ground" system of cable-laying, which was resumed at the Institution of Electrical Engineers in connection with a Paper on cable laying and jointing. A report will be found in our issues of last week and to-day. Mr. Vernier, the author of the Paper, whose experience in laying high-tension transmission cables for the Newcastle power systems has been considerable, is an advocate of a direct-in-ground system, and in this he was supported by Mr. Welbourn, of the British Insulated & Helsby Cables, Ltd. Mr. Highfield, Engineer and Manager of the Metropolitan Electric Supply Co., prefers a draw-in system. Mr. Roger Smith, of the Great Western Railway, and Mr. J. F. C. Snell favoured the solid system. Opinions are also divided in the case of engineers of electricity supply undertakings, but among them the solid system enjoys the greatest popularity—partly on account of the fact that the Local Government Board has decided that loans for "direct-in-ground" mains must be redeemed in 15 years, whereas 25 years is the official life of mains on the solid system.

Looking at the matter broadly, it is clear that there must be less waste of material and labour if the cable is protected adequately before it is laid, and is then placed at a sufficient depth under the soil. If the lead covering and armouring are liable to be acted upon chemically, we must protect them in their turn with a suitable covering. This is in effect the process advocated by Mr. Vernier. But even his specification—which brings up the cost of the laid cable to that of the solid system—the compounded jute, which forms the outside envelope of the cable, will resist the action of certain soils no more than the armouring which it covers, and to make the latter proof against the navvy's pick would entail a costly construction similar to that of the shore-end of a submarine cable. On the other hand, when the cable is to be laid in soil that will have no action on lead and unlikely to be disturbed frequently by the muscular navvy, a lead-covered cable, with a light armouring sufficient to prevent damage during laying and reinstating the ground, and covered with a tarred plank, is certainly all that is needed in ordinary circumstances.

The solid system, if properly laid, has, however, the advantage of affording protection against the unknown and unforeseen. If the soil is so varied that its chemical properties cannot be assumed—especially if ashes may be present, or in recently "made" ground—it is risky to lay on the "direct-in-ground" system. Notwithstanding Mr. Vernier's and Mr. Patchell's eulogism of clay, this material is a snare, and we know of a case in which a beautifully soft puddle clay, fetched for the purpose and carefully placed at the bottom of the trench in a thick layer, so that the cable was absolutely embedded in it, acted upon the lead with as much certainty as a weak solution of nitric acid would have done. It is true that the solid system is not always an absolute protection for every inch of the cable. If completed under such conditions as were depicted by our cartoon artist last week, there might well be blow-holes in the bitumen filling, but, in ordinary circumstances, the chances of the position of an occasional blow-hole or serious shrinkage coinciding exactly with the presence of chemically active soil or "bad" water, is sufficiently remote. The comparative immunity of solid systems from breakdown, in fact, has been their own recommendation. The chief source of danger to be guarded against occurs on very large mains, which have to be heavily fused. Cases have been known in which short circuits have resulted in the volatilisation of the compound accompanied by volcanic eruptions from manholes, and even the flow of boiling compound along the services and into houses. Such occurrences, however, have been rare.

The draw-in system has its uses and also its abuses, its users and its abusers. In many cases it cannot be beaten for feeders and transmission cables; in others it can conduce to the presence of a permanent film of moisture around the cable, or accommodate an explosive mixture of gas and air along a length of street. A point to be remembered is that it should be a draw-out system as well as a draw-in system. If it taxes the winch and the available man-power to the utmost to draw in the cable, one of the chief advantages of the system is lost. Mains engineers should also profit by the experience of telephone engineers in preferring stoneware or cement ducts to iron pipes. With properly laid and bonded iron pipes there should be no electrolytic action on the cables, but sometimes there is, notwithstanding.

In reading Mr. Vernier's remarks about jointing, it must be remembered that, although many of them are of general application, he deals essentially with important high-tension transmission cables. For ordinary towns work, the lead sleeve joint, necessitating as it does highly efficient plumbing and careful superintendence, is less frequently employed than the joint-box with "compound glands." No matter which joint is used, however, the shrinkage of the bitumen or compound filling, on cooling must be borne in mind. Some compounds shrink less than others, but it is obvious that when the filling has assumed its solid or viscous state it will occupy less space than when it was poured in at a high temperature. Unless, therefore, a further quantity of the filling is poured in after the mass in the sleeve or joint-box has cooled, a vacuum is left, and any slight flaw in the lead joint, or, in the case of boxes with compound glands, any cracking or shrinkage of the compound in the pocket along the lead of the cable will result in water being drawn in in wet weather. We have actually observed this phenomenon in lead-sleeve joints plumbed to the lead of the cable by wiped joints, in cases where a porous plumbing metal had been employed without sufficient percentage of tin, and have actually boiled a quantity of water out through the "wipes" on a number of joints in succession, although these were laid in well-drained soil.

Both of the new conductor joints described by Mr. Vernier—the rigid one with copper braid, and the expansion joint—are admirable, and the method of insulating he described also seems applicable for all straight-through joints, whether for single or 3-core cables. For concentric cable, and even triple-concentric, the employment of narrow bands of tape, such as Mr. Vernier suggested for 3-core cable, would seem to be applicable if the jointing of the conductors is arranged so that the compound can run right through. The remarks made by Mr. Highfield as to the handling of the insulating tape are of interest; in this connection it may be noted that boiling plain tapes in oil, and wrapping them on when hot removes the moisture from handling, especially if boiling compound is poured over the insulated joint before the lead sleeve is drawn over.

We have reviewed the principal points of the Paper

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and discussion in this article, but there are numerous other matters of detail of considerable interest which were dealt with. For instance, although no new theory was put forward as to bonding, or in connection with protection against surgings, the remarks on these subjects should be read by mains engineers. In fact, the whole Paper and discussion deserve careful perusal.

THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

THE annual meeting of this Association was held on February 28th last, at the Institution of Electrical Engineers. The Chairman, Mr. H. W. Butler (Electrical Power Storage Co., Ltd.), said that the membership, now over eighty, had practically doubled itself in the last twelve months. He commented appreciatively on the activity displayed by the Northern section, and proceeded to deal with some points in the report. A joint committee of the Incorporated Municipal Electrical Association and themselves was about to consider the question of objectionable clauses in contracts, and great progress had been made as regards the Olympia Exhibition, for which practically all the ground-floor space was now allotted. Unfortunately, their efforts to promote a joint exhibit with the Board of Trade at Turin had not been successful. Mr. H. H. Berry seconded the adoption of the report. Mr. F. H. Nalder also spoke, and Mr. H. Bevis referred to the decision of the Institution of Electrical Engineers to revise their model general conditions of contracts, and to publish them in a form that would appeal to town clerks as well as municipal engineers. Mr. B. Longbottom dealt with the work of the Northern section. Mr. D. N. Dunlop suggested the appointment of an assistant secretary, and the report and accounts were then adopted. The following council and general committee have been elected :—

Council :—Berry Skinner & Co.; British Westinghouse Electric & M'f'g Co.; Bruce Peebles & Co.; Electrical Power Storage Co.; Electromotors, Ltd.; Elliott Brothers; Ferranti, Ltd.; General Electric Co.; International Electric Co.; Lancashire Dynamo & Motor Co.; A. & P. Lundberg & Sons; Nalder Bros. & Thompson; A. Reyrolle & Co.; Sunbeam Lamp Co.; Vickers, Sons & Maxim.

General Committee :—Berry Skinner & Co.; Croggon & Co.; Crompton & Co.; Electrical Power Storage Co.; Electromotors; General Electric Co.; International Electric Co.; Gilbert Arc Lamp Co.; Hart Accumulator Co.; Pirelli, Ltd.; Sterling Telephone & Electric Co.; Union Electric Co.

Institution of Post Office Engineers.—At a meeting on March 13th, a Paper on Small Prime Movers was read by Mr. H. P. Riner Moore. After some introductory remarks on the principles of the steam turbine, he described the main features of small reciprocating engines, dwelling on the use of the indicator and methods of governing, and passed on to a consideration of gas, oil, petrol, and alcohol engines. Messrs. E. W. Rees, J. Coxon, and D. H. Kennedy took part in a brief discussion.

Colliery and General Mining Exhibition, Manchester.—Arrangements are well advanced for the Colliery Exhibition at Manchester, organised by *The Engineering Review*. The opening date is now May 12th, and the Exhibition will close on Saturday, May 27th. Practically no space is now left, as a great rush of applications followed on the announcement of the change of date, which was decided in consequence of the Annual Conference of the Colliery Managers' Association of Great Britain being held in Manchester during May.

Speed Regulation of Shunt Motors.—A Paper by Mr. E. W. Short, published in the *Journal* of the Institution of Electrical Engineers, discusses the inherent speed regulation of D.-C. shunt motors. The author points out that although a shunt motor may be so designed, and its voltage drop and brush position so adjusted that it runs at the same speed on no load and on steady full load at any given temperature, yet the speed of the same machine will vary very considerably when working on a rapidly varying load such as met with in driving textile machinery, where it is highly important that the speed should be constant. The results of a number of tests in a spinning mill are given, and the author then shows from a consideration of the mutual induction between the armature and shunt windings, and between the series and shunt windings in the case of a compounded machine, that the changes in flux necessary to keep the speed constant with varying load cannot occur instantaneously, the result being that the speed may vary as much as 5 per cent. up and down. The case of a 35-h.p. motor is worked out in detail, curves being deduced to show the actual conditions under a rapidly varying load.

THE AMERICAN INCANDESCENT LAMP COMBINE

THE action brought by the Attorney-General of the United States against the General Electric Co., of America, the National Electric Lamp Co., the American Westinghouse and thirty-one other electrical and manufacturing companies for alleged unlawful combinations to restrain trade, is dealt with at some length in the *Electrical World* of New York, for March 9th. It is pointed out that, apart from the effects of the action upon the companies concerned, two highly important issues are raised. First, the extent to which the monopoly awarded by a patent may be extended, and secondly, whether any limitations can be imposed upon a manufacturer in the purchase of patents to strengthen his position.

It is stated in the petition that agreements have been made between the General Electric and National Lamp companies and Siemens & Halske A.-G., of Berlin, whereby the former acquired the exclusive right to manufacture and sell tantalum lamps under the German Co.'s patents, the filaments being purchased in Germany. Another agreement between the same two American companies and the Deutsche Gasglühlicht Gesellschaft (Auergesellschaft), of Berlin, secured the exclusive rights of the U.S.A. tungsten lamp patents owned by the Auergesellschaft. By a contract with the Bergmann Elektricitäts Gesellschaft, in 1909, this company agreed to cease importing lamps under the Bergmann patents into the United States, and in the same year the two American companies purchased the American rights of the Just-Hanaman and Kuzel patents, thus practically securing a monopoly of the metal filament lamp trade. In the first two cases, the consideration was a cash payment of £50,000 and £20,000 respectively, together with a royalty on every lamp sold, but the Just-Hanaman and Kuzel patents were apparently bought outright for £50,000 and £48,000 respectively.

Referring to the trade in carbon filament lamps, the petition states that although the carbon filament lamp patent expired in 1894, the combined companies have secured the monopoly of this trade also, by compelling dealers and contractors who enter into contracts with them for the purchase of tantalum and tungsten lamps, to purchase from them also all carbon filament lamps they may require.

Several unlawful acts by the defendants to hamper independent companies are alleged, including the sale of inferior lamps at greatly reduced prices, and contracts with manufacturers of machines, glass bulbs, caps, and other accessories used in lamp manufacture, requiring them to refrain from business with independent firms or to sell to them only at excessive prices. As the defendants now do over 97 per cent. of the lamp business, it is stated that both these manufacturing companies and the independent lamp companies are put in an unfair position.

Finally, it is urged that the combination has the effect of keeping up the prices of both metal filament and carbon filament lamps much higher than those obtaining in other countries, by preventing competition; and, as an example, it is mentioned that of fourteen tenders received for the supply of 340,000 lamps of various kinds to the United States Navy, thirteen were identical in amount, thus showing that the price was fixed in advance.

Association of Students of the L.C.C. Engineering College, Poplar.—A visit was paid to the Elephant and Castle sub-station of the L.C.C. tramways on February 18th, and a Paper on sub-station working was read at a meeting on February 25th.

Wireless Telegraph Notes.—The Eastern Extension, Australasian & China Telegraph Co., and Marconi's Wireless Telegraph Co. announce the opening of a wireless telegraph station at Keeling-Cocos Islands for communication with ships at sea. The radius of the apparatus which has been installed is 250 nautical miles.

According to the *Times* Berlin correspondent, a company has been formed to develop Herr Goldschmidt's system of wireless telegraphy. The company, which is to be called the Hochfrequenz-Maschinen Aktiengesellschaft für Drahtlose Telegraphie, has a share capital of £105,000, but no shares are to be issued to the public at present. The presidents of the company are Vice-Admiral Emsmann and Herr Goldschmidt, together with representatives of the Commerz und Disconto-Bank and the Lorenz Company, both of which are largely interested.

Phase Displacements in Synchronous Machines.—In our report on March 9th of the discussion on Mr. Firth's Paper at Newcastle on the above subject, Mr. Leake was incorrectly given as the second speaker. As a matter of fact, Mr. Leake himself was not present, but his suggestion of plotting phase displacements against total load was only quoted by Dr. Thornton, by whom the subsequent remarks were made. The second speaker was thus Mr. Maccall.

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THE DUCTER: AN INSTRUMENT FOR MEASURING LOW RESISTANCES

FOLLOWING the justly deserved success of their well known "Megger" for the measurement by direct reading of insulation and other very high resistances that can be expressed in megohms, and of its modification, the "Bridge-Megger," for moderate resistances conveniently described in ohms, Messrs. Evershed & Vignoles (Acton Lane Works, Chiswick) have turned their attention to the production of an instrument of similar simplicity of reading for the measurement of very low resistances, such as can be conveniently expressed in microhms or millionths of an ohm. This, like the megger, is provided with a pointer to read the resistance direct, and its five separate ranges enable resistances from 10 microhms to 5 ohms to be measured. The apparatus should be of great use in comparing contact resistance of switches, testing all sorts of joints, bonds, and connections, the sampling of conducting material, as well as

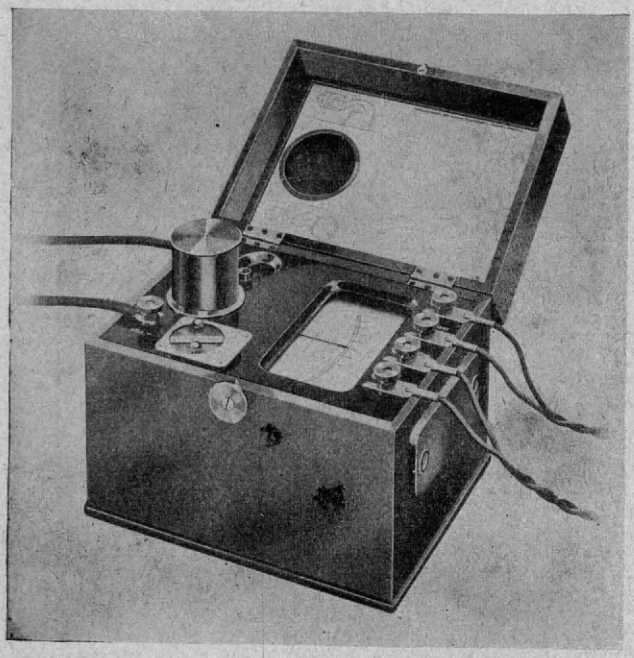


Fig. 1.—General View of Instrument.

measuring resistances of various parts of machines without loss of time. For comparing various forms of cable clamps it should be invaluable.

Speaking generally, the instrument works on the same principle as its elder brother, the megger. The moving system is composed of two coils, in planes at an angle to each other, carrying currents proportional to that passing through the resistance to be tested and to the drop of potential across it respectively. This system is free to swing in a permanent magnetic field, and the position which these coils and the pointer take up depends on the direction of the resultant of the forces due to the currents in the two coils, and is thus determined by their ratio, which is proportional to the resistance to be tested. The main differences are, however, due to the fact that whereas in the megger the drop of potential amounts to some hundreds of volts and the current through the resistance is infinitesimal, in the ducter a series current measurable in amperes is employed, but only a diminutive drop is produced. Thus the working current is supplied from a few accumulator cells instead of from a high-voltage generator, and suitable shunts are employed in connection with the current coil. There is another difference due to the fact that a much more open scale is required at the lower readings in the ducter than in the megger, and this is obtained by suitable shaping of the pole pieces of the permanent magnet and the fixed core within the coils, and slight differences in the construction of the voltage coil. The five ranges are put in action by a switch, which simply cuts in and out suitable resistances and shunts. The scale is calibrated to read direct from 0 to 500 microhms, and has nearly equal divisions. The switch has positions corresponding to multipliers of 1, 10, 100, 1,000, and 10,000. There is also an "off" position. It will

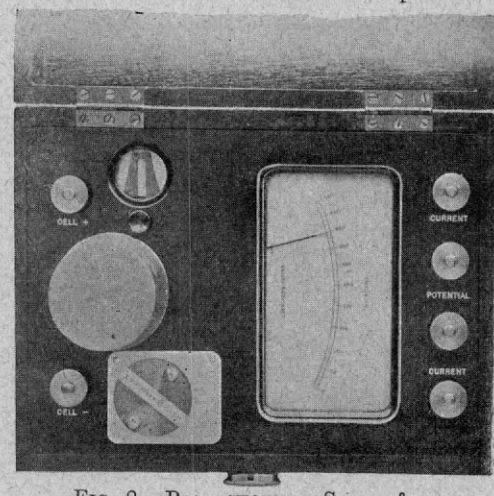


Fig. 2.—Plan showing Scale, &c.

readily be understood that with an unknown resistance to be tested, if the switch is on an unsuitable step, not only may the needle be sent hard over, but a current of sufficient magnitude may pass through the coils to burn them out. The problem of obtaining the required range without this danger was one of the most serious met with in designing the apparatus. The difficulty has been overcome by the provision of a sensitive polarised magnetic cut-out, which immediately opens when the current exceeds a safe value and thus protects the coils. Except for the features already mentioned, and the fact that the swinging coils are provided with a phosphor-bronze strip suspension, with jewelled guides not requiring accurate levelling, instead of pivots, there is much similarity in the construction with that of the indicating portion of the megger. Fig. 1 gives a view of the instrument itself, and the pointer and scale, the range switch, the safety cut-out, with the push button for resetting it and the arrangement of the terminals are also seen in Fig. 2. The projecting brass case between the cut-

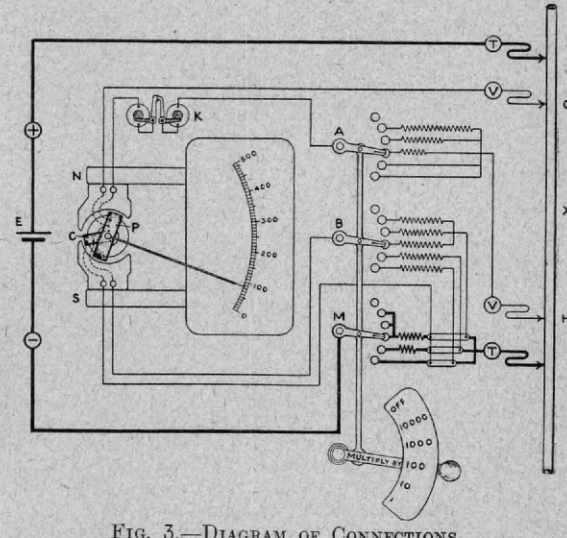


Fig. 3.—Diagram of Connections.

E. Battery.
C Current Coil.
P. Potential Coil.
N, S. Poles of Magnet.
K. Cut out.
A, B, M. Triple-pole Grade Switch.
X. Resistance under Test.
H, G. Potential Contacts.

out and the switch is simply the cover of the suspension of the coils. A general diagram of connections is given in Fig. 3.

The battery consists of four small accumulator cells of 10 ampere hours capacity each and is contained in a separate box. A switch enables either all four cells to be put in parallel to give 2 volts, or in series to give 8 volts, according to the resistance to be tested. A separate compartment is provided in the battery box for the leads and contact spikes,

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so that nothing more than the two boxes is required to complete the outfit.

Particular attention may be drawn to the points provided for making contact with the resistance to be tested. These are mounted on handles at the end of flexible leads, each carrying a circuit and potential point. These are telescopic and have sharp pyramidal points, which while pressed home against a spring turn round like an archimedian drill, and thus render the contact self-cleaning. To take a reading, all that has to be done is to take one handle in each hand and press the contacts on to the points between which the resistance is to be tested, and, having found the most suitable range, to read off the result. When testing numerous switches, &c., it is sometimes more convenient to use separate current leads in the ordinary way, connecting up a number in series, and using potential contact points only to take successively the resistances at the various parts required. For example, it can readily be found how the total resistance of a switch is divided up between the contact resistance at its terminals, the actual switch contact, and the metal of the blades and other parts.

The apparatus is quick to use, dead beat, and it is important to notice that its accuracy is practically independent of the constancy either of the permanent magnet nor of the battery voltage. To say that the workmanship is equal to that of the megger is sufficient praise, and a visit to Messrs. Evershed & Vignoles works, where it is made, showed us that as much care has been expended on the methods of manufacture of the upwards of 900 parts of which it is composed as on the suitability of those parts for the work they have to perform. There is, we believe, no other instrument with which measurements of low resistance can be made with such expedition and accuracy, and its utility is such that a very large demand may confidently be expected.

THE NATIONAL PHYSICAL LABORATORY

On Friday last, the occasion of the annual meeting of the General Board of the National Physical Laboratory, a number of invited visitors were given the opportunity of inspecting the Laboratory buildings at Teddington and their equipment. The guests assembled in the Experimental Tank Building, where they were received by Sir Archibald Geikie, President of the Royal Society and chairman of the General Board of the Laboratory, Lord Rayleigh, chairman of the Executive Committee, and Dr. R. T. Glazebrook, Director of the Laboratory.

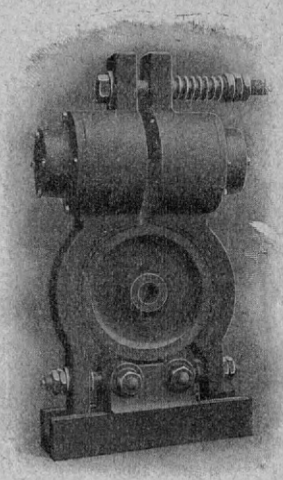
A great deal of interest naturally centred round the National Experimental Tank, the equipment of which is now nearly complete. The main tank is 550 ft. long, 30 ft. wide, and 12 ft. deep, and is spanned by an electrically-driven travelling carriage running on rails on either side, which will be able to tow models up to 20 ft. in length at speeds up to 17 m.p.h. The carriage was equipped by Messrs. Dick, Kerr & Co., and weighs about 14 tons, and is driven by four special vertical shaft motors through worm gearing, taking current from trolley wires running alongside the tank. A controller is provided on board, but normally control will be effected from switchgear on shore. The arrangement of connections is somewhat elaborate, and provision is made for very accurate adjustment of the speed by regulation of the fields of the motors, which are separately excited from a motor generator. Separate trolley wires are thus required for the field circuits, and these are exceptionally heavy to avoid variations of drop of potential. Special machinery is provided for shaping the wax models used.

Dr. Glazebrook also drew special attention to the aeronautical work now being carried on for the Advisory Committee. The special apparatus includes the large whirling table for experiments with model propellers and the effect on the air of objects of various forms, a subject also studied in an experimental wind chamber and by analogy in tanks of running water. Practically all this apparatus, some of which represents extraordinary ingenuity, is electrically driven, and, indeed, it is difficult to see how research of this kind could have been carried out before electrical appliances were available.

Turning now to the more exclusively electrical aspect of the work of the Laboratory during the past year, mention must be made of the comparisons of international standards made by Mr. F. E. Smith, who visited the Laboratorie Central d'Electricité in Paris, and the Bureau of Standards at Washington; representatives of St. Petersburg and Japan also visited Teddington, and as a result of these researches, the E.M.F. of the Weston standard cell is to be taken as 1·0183 volts at 20° C. Progress has also been made with the new Lorenz machine, which now only awaits some final measurements, and Mr. Campbell's hysteresis and eddy current tests, and his measurements on wavemeters have been continued. In the photometric division, a great deal of work has been done with a view to establishing a series of metal filament sub-standards, and a large number of specially made Osram lamps, supplied by the generosity of the General Electric Co., have enabled "cascade" observations with lamps running at graded efficiencies to be taken to surmount the colour difficulty. Interesting work is also being done in this department by Mr. Patterson, of the Board of Trade, regarding the standardisation of visibility of ships' lights. A number of investigations of suitable methods of testing have been carried on in the Electrotechnical Department, and among subjects upon which experimental work of great utility has been carried out, may be mentioned the effect of railway travelling on meters, the heating of lamp holders used for radiator lamps, and a long series of investigations into the dielectric properties of micanite, ebonite, and other insulating materials. The department gave assistance regarding the display of instruments in the British Section of the Brussels Exhibition, and most interesting results have been obtained by Mr. Rayner in his insulation research for the Engineering Standards Committee. A large amount of ordinary test work has also been carried out, but not quite as much as in 1909, and at the request of the Wiring Rules Committee of the Institution of Electrical Engineers, the tests to determine the temperature rise in the current of various sizes of cables with different styles of covering have been extended. An investigation has also been in progress for the Admiralty on the temperatures to which resistance alloys can be subjected without deterioration.

Electrical methods, of course, enter largely into the work of other departments, of which space prevents more than a passing mention here. Great progress is being made in the department of thermometry in high temperature research, and furnaces are now available up to 2,500° C. There has also been a great deal of activity in the metrology department, where a good deal of new and interesting apparatus for standard measurements was open to inspection. In this department 13,918 taximeters were tested in 1910; all those in use on London cabs are tested before taking into use. The whole establishment bears an atmosphere of great activity, the building of large extensions is in progress. The staff numbers over 130 persons, and, in addition to research and general experimental work, over 28,000 tests have been made at Teddington during 1910, of which 1,810 were in the Electrotechnical Department. The total income of the Laboratory for that year was £28,076, of which £15,363 was the net amount received for work done, and the total expenditure was £28,298.

AN ELECTROMAGNETIC BRAKE



Witton-Kramer Electromagnetic Brake.

The Witton-Kramer Electric Tool & Hoist Co. (Witton, Birmingham) have introduced the form of brake illustrated here to meet the demand for an entirely self-contained outfit which can be applied to existing couplings, &c., of electric motors, hoists or lift gears, rolling-mill machinery, and machine tools generally. They can be used either as holding or lowering brakes, and will work in any position. The shoes are leather lined, and adjustable for wear. The magnets are arranged to push the blocks apart when the current is on, while normally the brake is held on by a spring in the usual manner. This design is only used for continuous current.

British Gas-power Plant for Japanese Electric Railway.—The Power-Gas Corporation, Ltd., of Stockton-on-Tees, have received an order from the Japanese Government for a large gas-power plant for an electric railway between Tokio and Yokohama. The company inform us that the contract is well over £100,000, and may reach £150,000. The producer plant will consist of three units, each of three Mond-type gas generators, and fitted with apparatus for the recovery of sulphate of ammonia. Inferior coal with nearly 20 per cent. ash will be used. The engines will be supplied by the Lilleshall Co., Ltd., and will have two double-acting cylinders placed in tandem. They will be direct coupled to Dick, Kerr alternators of the flywheel pattern generating at a frequency of 25 cycles. Power will be conveyed over a high-tension line to sub-stations along the railway route.

Glasgow Local Section of the Institution of Electrical Engineers.—At an informal meeting of the Glasgow Local Section of the Institution of Electrical Engineers on Tuesday of last week, the announcement was made that the area embraced by the Section had been extended to include Edinburgh, Leith, and district. Mr. Sam Mavor welcomed the new members thus taken in, and Prof. Baily, of Edinburgh, responded.

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CABLE LAYING AND JOINTING

THE following is a report of the discussion on Mr. C. Vernier's Paper on "The Laying and Maintenance of Transmission Cables." The Paper itself was published in slightly abbreviated form in our last issue:—

DISCUSSION IN NEWCASTLE.

Mr. STEDMAN questioned the use of tape and braid as a protection for lead-covered cables, as the covering absorbed and retained moisture, which, if charged with chemicals, would act upon the lead.

Mr. VESEY BROWN said that to switch in 19 miles of cable on a H.-T. circuit was contrary to first principles, and he thought that Mr. Vernier had not stated all the circumstances. Would it not be cheaper to instal simple charging devices rather than to spend the money on the necessary extra insulation?

Mr. J. ROBB said that the worst case of expansion which the Post Office engineers had had was on the Forth Bridge, but the difficulty had been got over by leaving bights in the cable. He advocated the use of petroleum jelly when drawing cables into ducts, not only as a lubricant, but as a means of preventing electrolysis.

Mr. C. TURNBULL did not favour black bitumen compound, as it was apt to become full of holes. He used a yellow viscous compound, which had stood successfully for ten years. He did not approve of bonding the cable coverings to water-pipes and tram-rails, and his practice was to earth at the station only.

Mr. F. O. HUNT suggested that breakdown occurring some time after a surge had taken place was due to the cumulative action of surges at intervals gradually weakening the insulation.

Mr. J. B. JOHNSON believed in draining each manhole into a sump consisting of 2 ft. of 9-in. earthenware pipe, and also in caulking covers with yarn and sealing with a mixture of grease and whiting.

Mr. W. R. MORTON said that taped and braided cables were extremely difficult to pull out of conduits after a few years' service. The chief disadvantage of asphalt troughing was its price, but it ran cooler than any other type, except perhaps armoured cable laid direct.

Mr. P. V. HUNTER confirmed that the 19 miles of cable referred to was switched in direct, and that no surges due to switching in had occurred.

Mr. SLOAN also spoke.

Mr. VERNIER, in the course of his reply, said that the 19 miles of cable referred to had latterly been fitted with lightning arresters by the contractors, who had suspicions of surges, but the arresters had never been called upon to act so far as he knew. He could not understand how petroleum jelly could prevent electrolysis, as the armouring and iron pipe were in electrical connection, and the armouring could not be affected until the pipe had been eaten through. He thought that an instantaneous rise of pressure of 200,000 to 300,000 volts when switching in a long 20,000-volt cable was quite within reason, and cables should be able to withstand this momentarily. All the advertised soldering fluxes which he had had analysed contained acid, and his practice was to use pure resin or a mixture of resin and tallow.

DISCUSSION IN LONDON.

Mr. J. F. C. SNELL, after referring to some mains laid on the Howard solid system in which chemical impurities in the soil had corroded away the steel surrounding the asphalt, but had left the asphalt intact, mentioned the case of two 6,600-volt three-core 0·1 sq. in. armoured cables laid along a steep embankment, the soil of which had subsequently slipped and had left the cables hanging for a distance of forty yards, but they not only kept up their stoneware trough, but also something like 18 in. of clay, and stood the strain admirably. Experiments carried out by himself and Mr. Digby had resulted in a certain specification for bitumen-filling which had been used with great satisfaction. Bitumen had to be softened by the addition of a certain oil, and must be free from wood and coal-tar pitch, and also sulphur compounds and resin. It must not contain more than 35 per cent. of ash, and its viscosity was to be such that at a temperature of 82° C. it began to flow, whilst at 100° it flowed freely. On the question of electrolysis, he thought the best plan was to earth the sheathing of the cable at certain definite points. He asked the author what current densities he was able to work up to with his 20,000-volt cables under emergency conditions. Particulars had been published by the American Institute of Electrical Engineers, showing that 20,000-volt cables had been run up to 1,800 amperes per sq. in., and kept within reasonable temperature limits.

Mr. B. WELBOURN (British Insulated & Helsby Cables, Ltd.) said he knew of instances in which lead-covered cables had been in existence for 21 years with practically no deterioration. He had held the opinion for many years that armoured cables were right to use when cables could be buried at sufficient depth. It was very difficult indeed to get a proper solid system where it had to be made in the streets under varying climatic conditions, and with unskilled labour, and it was a correct plan to make in a factory, and to send out ready for laying a much better solid system than could be made in the streets. The recent regulations of the Home Office Committee on the use of electricity in mines favoured armoured cables, but the attitude of the Local Government Board in the past had militated against their use for street mains owing to the short period for repayment which was allowed, namely, 15 years, compared with 25 years for the solid system. He suggested that there was scope here for the Institution of Electrical Engineers to act in conjunction with the Incorporated Municipal Electrical Association, and to educate the Local Government Board. He emphasised the importance not only of proper bonding and of earthing at certain definite points, but also of making careful periodical inspection to see that these conditions were maintained. He expressed his admiration for the author's braided joint, and also of the expansion joint. Finally he mentioned that his practice in regard to railways was to lay cables 4 ft. deep and 4 ft. away from the nearest rail, and if under a track not less than 6 ft. deep; by adopting this rule no trouble had been experienced.

Mr. J. S. HIGHFIELD (Metropolitan Electric Supply Co., Ltd.) expressed the opinion that as long as the ground was good and no fears of subsidence existed, he thought that a drawn-in system was not only cheaper, but also superior. He gave some interesting details of experiments made on joints on his system to ascertain the causes of some failures on 10,000 volt cables. It was found that by stepping the insulation of the cable ends in four or five steps instead of tapering it down, the joint was so improved that the breakdown pressure was increased from 30,000 and 40,000 volts to between 50,000 and 60,000 volts. Later they tried making the joints entirely with paper, similar to that with which the cable is insulated, and with more steps, and putting on the paper by a reel so that the men did not handle it. The effect was to raise the test pressure to 84,000 volts; in fact, they had not broken down these joints at all. He was not at all sure that cables might not be damaged by testing at twice the working pressure with alternating current, as, when making breakdown tests up to 100,000 volts A.C., there had not been a clean electrical puncture; the breakdown had been caused by the heat generated at the joint by the energy lost in dielectric hysteresis. He had tested similar joints in cables with 150,000 volts direct current, and there was no difficulty in this case because there was no heating up, and very little power was taken. He would suggest that all H.T. cables, even those intended for A.C. systems, should be tested with H.T. direct-current to avoid this heating of the cable.

Mr. W. H. PATCHELL said that he frequently had to carry clay to the spot in order to bury his cables in it. This was a necessary practice very often in colliery districts. He had got over many of the troubles in cables due to dirty handling of the jointing material in connection with the mains from Bow to London by the use of micanite tubes, and he agreed with Mr. Highfield that if it were necessary to put the tape on in the streets, it should be done from a reel, and not handled.

Mr. ROGER T. SMITH (Great Western Railway Co.) said that from the Park Royal Power Station of the Great Western Railway Co. there were 27 miles of high-tension three-core cables to the sub-stations, 10 miles beyond the sub-stations, and 14 miles of low-tension cables laid on the Howard solid system, and a test upon a 300-yard length of the high-tension cable gave a resistance of 2,000 ohms between the sheath and the earth through the troughing, which was quite sufficient to prevent any electrolysis. The cables were all laid by Messrs. Siemens five years ago, and of the 600 joints which were insulated with tape lapped on in the usual way, only one had failed during the contractors' period of maintenance, and none had failed since. The cables crossed the railway lines 27 times, in many places under the whole of the main lines from Paddington. In other places the trough rested on the crown of the arches, and between the end of the concrete bed of the trench and the bridge they were laid up a sloping sheet of steel fixed to the edge of the bridge, and anchored into the concrete. In this way vibration effects had been entirely eliminated. The only thing that had happened was that in the middle of many bridges the cables had splayed out sideways, but it had caused no trouble. With regard to the cost of maintaining this system of cables, in 1907 for 37 miles the cost was £9. In 1908 this figure increased to £30, largely due to the purchase of a tar boiler; in 1909 it was £17; in 1910, £18 10s., and the average was £18 12s., or less than one-tenth of one per cent. of the cost of the cables.

Mr. W. M. MORDEY, referring to the statement in the Paper that breakdowns were sometimes due to leakage of steam and hot water from neighbouring steam pipes, thought the author could find his explanation of why this should be so in the fact that the dielectric resistance goes down very considerably with rise of temperature.

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Mr. A. HOWELL (Assistant Engineer, Hornsey Electricity Works) deprecated the use of ducts laid in concrete, as, if the extra thickness of wall was required, it could be obtained by using a thicker manufactured duct. He recommended covers of the watershed type with longitudinal channels underneath to enable the pitch to flow freely. It was a mistake to fill too great lengths at a time, and he recommended not more than 12 feet.

Mr. A. P. TROTTER expressed the opinion that earthing of lead-covered cables should be carried out at definite places, viz., at the most negative points of the cable, assuming that a tramway was in the neighbourhood. If they adopted the policy of earthing at frequent intervals it was only tempting the current to get in at the other points. With regard to protecting cables from mechanical damage it seemed to be a growing practice among engineers to use a 2 in. creosoted plank in 12-ft. lengths, which could not be shifted by a navvy's pick.

Mr. VERNIER, in replying to the discussion, said that he had been told by Mr. Ferranti that some of the original cables from Deptford to London, put in 22 years ago, were still working. The method of bonding at the most negative points, as suggested by Mr. Trotter, was one which he utilised. The cables upon which his braided joint tests had been carried out were 0·1 sq. in. section, with 7,000 amperes per sq. in. on the conductor, but the joint, being larger, did not have this current density. In testing long lengths of cable of great capacity transformers of large size were required. The A.E.G. in testing their 20,000 volt cables had inserted a choking coil, for cutting down the capacity current, in parallel with the cores of the cable, but even then they had a large transformer. Another point was how were they going to get 200,000 volts D.C. readily. Faults from vibration were getting quite a serious matter, and on a small railway system with which he was acquainted they represented 20 per cent. of the whole. This was a solid system; on the other hand, with armoured cables he did not know of a case of faults having occurred through vibration. Mr. Howell had mentioned laying the solid system in 10 or 12-ft. lengths, but the usual practice nowadays was to open up a quarter of a mile at a time

ELECTRIC TRACTION ON THE BRIGHTON RAILWAY

A PAPER was read last week before the Institution of Civil Engineers by Mr. Philip Dawson, entitled "The Electrification of a Portion of the Suburban System of the London, Brighton and South Coast Railway."

In 1903 the Company obtained powers to electrify their line, and the author was called in to report on the question of experimentally adopting electric traction on the section between Victoria and London Bridge. The third-rail system was not considered suitable for general use on the railway, and in accordance with the report, single-phase alternating working, with overhead conductors at 6,700 volts at 25 cycles, was decided upon; tenders were called in 1905, the contract was let on March 30th, 1906, the first electric train ran on January 17th, 1909, and public service was inaugurated on December 1st, 1909. The trains accomplish the distance of 8·7 miles between London Bridge and Victoria, including ten stops of 20 seconds each, in 24 minutes. The results obtained were so satisfactory that the Company decided to extend the system from Battersea to the Crystal Palace and Selhurst, and from Peckham Rye via Tulse Hill to the Crystal Palace, bringing the total length of route electrified to 23 miles, or 62 miles of single track.

The minimum drop in the earth-return is limited by the Board of Trade to 20 volts, and the system of feeding was specially designed to meet these requirements, using series booster-transformers. Current is furnished by the London Electric Supply Corporation, from their power-station at Deptford, and delivered to the Railway Company at Queen's Road and Peckham Rye, where it is metered for payment.

The rolling stock comprises sixteen motor-coaches, each equipped with four 115-h.p. Winter-Eichberg compensated repulsion motors, and thirty-two trailer-cars, the trains being made up in units of two, three, or four coaches as required. The stock for the extension now nearing completion comprises thirty motor-coaches, each equipped with four 150-h.p. Winter-Eichberg motors, and sixty trailer-coaches, the train units being composed of two, three, four, six or nine coaches. Owing to the flexibility of the design employed, no trouble has been experienced with the overhead construction, and the extensions are being constructed to exactly the same design. The diameter of the trolley-wire is ½-inch, and it is supported by two catenary wires, by means of specially-designed insulators of a type not hitherto used for railway work. In the terminal stations the height of the conductor is 20 ft., but the normal working height is 16 ft., and the lowest position under certain bridges is 13 ft. 9 in. Double-insulation is used throughout, and the only insulation employed is porcelain. The overhead conductor has interfered very little with the signalling system.

The motors have four poles and are fitted with six sets of brushes. The air-gap is 3 millimetres and the synchronous speed is 750 r.p.m., although the motors are capable of developing torque at higher speeds. The gear-ratio is 4·24 to 1. The current taken per motor at starting on the low-tension side is 210 amperes, with a power factor of 29 per cent. Each motor-car is fitted with two main 220 kw. transformers, one for each pair of motors. None of the high-tension circuits on the car are accessible except when the collector-bows are lowered and when all the high-tension gear is earthed; the collector-bows are kept against the trolley-wire with springs which are brought into operation by means of a piston worked by compressed air. The contact-surface is aluminium and easily renewable, one contact-strip running 5,000 to 6,000 miles and taking practically all the wear; after thirteen months' running no appreciable wear can be measured on the trolley-wire. The pressure of the bow-strip against the trolley-wire varies between 8 and 12 lbs. The control of all the motors on the train is effected by means of contactors worked by master-controllers on the multiple-unit control system in every way similar to that in use with direct-current motors. Special repair-shops are provided at Peckham Rye, and are fitted with electrically-driven travelling cranes, machine-tools, capstans, &c., and all the motors, as well as the lights, are taken off the single-phase traction circuit.

The motors were tested at the maker's works on a complete equipment rigged up as for service conditions with an artificial load on the motor. As much as 180 h.p. was repeatedly thrown suddenly on and off without any tendency to flash over. The largest starting-torque measured was 255 kilogram-metres (1,847 pound-feet). Tests of the heating of the motors when run with open covers gave a temperature rise not exceeding 75° C. (167° F.) for the following loads :— 187 h.p. for 17 mins., 129 h.p. for 46 mins., 91 h.p. for 1 hr. 50 mins., or 57 h.p. continuously.

A three-car train consisting of two motors and one trailer, loaded up to a total weight of 146 tons, was run continuously for 12 hours with 20-second stops at each station as a trial, and covered in this time a distance of 173·58 miles, the average length of run being 0·79 miles. At the conclusion of this run the maximum rise of temperature of any part of the electrical equipment was 66° C. (151° F.). During this test the following results were obtained: power-factor, 80·8 per cent.; maximum current at starting, 126 amperes; average acceleration, from 0 to 25 miles per hour, 1·75 ft. per sec. per sec.; and the power consumption on the train 73 watt-hours per ton-mile. Subsequent tests gave in the case of a single trip from Victoria to London Bridge an energy-consumption of 65·7 watt-hours per ton-mile for a schedule speed of 22 miles per hour, including 20-second stops at each station, and for a through non-stop trip from Victoria to London Bridge at an average speed of 37 miles per hour, the energy consumption was 34·4 watt-hours per ton-mile; the maximum speed reached during the run being 50 miles per hour. The following are some of the weights of the various component parts of this train :—Complete motor-car on rails, 53·95 tons; one motor-bogie without motors, 7·51 tons; motor-coach body and under-frame without electric gear, 19·83 tons; total weight of all electric gear, including bows, wires, lighting, compressor, &c., for one motor-coach (four motors), 18·16 tons. For the four-motor equipments consisting of 150-h.p. motors for the extension, the total weight is only increased by 19 cwt.

The results obtained during actual running more than confirm the test results. The average energy-consumption for the first eight months of 1910 was 75·4 watt-hours per ton-mile, no allowance being made for weight of passengers carried, or for shunting or empty running, and including the energy used for light and power at the repair-shops. The efficiency between the high-tension bus-bars of the power-station and the trains was 96·6 per cent., and the efficiency of the system during controller notching was 67 per cent. The traffic results obtained have been as satisfactory as the technical results. The increase in passengers carried, as compared with those carried previously by steam, show that whilst for the first month's working the traffic had increased over 54 per cent., the month of December, 1910, showed an increase of over 125 per cent.

The first thirteen months' experience show no reason why the maintenance of single-phase should be higher than that for direct-current apparatus. The system is, in the opinion of the author, more economical than the direct-current system as regards energy-consumption at the power-station, as well as regards first cost, and experience has shown it to be

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eminently suitable, not only for long-distance work, but also particularly for working in and out of large terminal stations with their necessarily complicated approaches, and for short-distance work.

The principal contractors were the Allgemeine Elektricitäts Gesellschaft, of Berlin; all the overhead work has been carried out by Messrs. R. W. Blackwell and Co., and the rolling stock was constructed by the Metropolitan Amalgamated Carriage and Waggon Co., of Saltley, Birmingham. Great credit is due to the contractors for the excellent way in which the work has been carried out.

ELECTRICALLY-DRIVEN FIRE-ESCAPES FOR LONDON

WITHIN the last few months three electrically-driven fire-escapes, for use at different stations of the London Fire Brigade, have been delivered to the London County Council by Cedes Electric Traction, Ltd. (15 Cockspur Street, London, W.C.). Previous to placing the order the Fire Brigade Committee carried out a long series of tests, extending over four months, on a chassis put at their disposal by Cedes Electric Traction, Ltd., and the results of these tests, and the satisfaction given by the two hundred or more similar vehicles in use on the Continent, have led the London County Council to give the vehicles a thorough trial in London service.

The construction of the vehicle is illustrated in Fig. 1. It consists of a chassis with battery, motors, and control

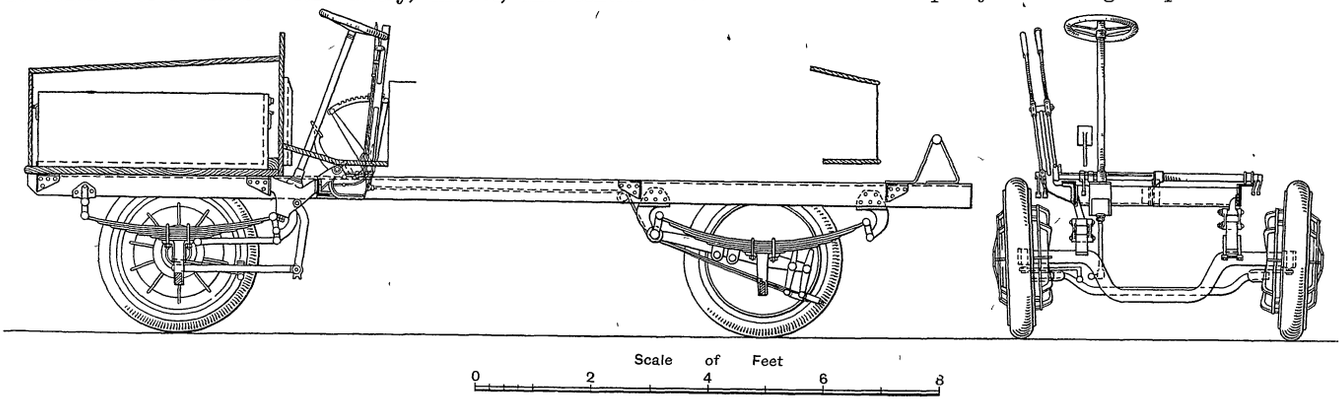


FIG. 1.—CHASSIS OF L.C.C. ELECTRICALLY-DRIVEN FIRE-ESCAPE.

equipment, a light body with the gear for holding the fire-escape, and a small pumping set, which is used previous to the arrival of the fire engines. The total weight, including the escape and a crew of five men, is 5 tons 5 cwt. The battery is of the Tudor Co.'s make, and comprises 84 cells of a total weight of 26 cwt., and giving 200 ampere-hours at the four-hour rate. Two hub motors of the well-known Mercedes pattern are provided, one in each of the front wheels. These motors are rated at 20 h.p. each, and are controlled by an ordinary traction controller on the usual series-parallel system. Electric braking can be effected by means of the motors on the front wheels, while the rear wheels are provided with band brakes. The motor wheels have solid rubber tyres, and each weighs 5 cwt. complete with motor. It will be remembered that the field system is in the shape of a star mounted on the stub axle, while the revolving armature surrounds this and is built into the wheel. The main leads are taken through the axle to the brush gear, which is fixed over a radial commutator. Ball bearings are provided. The speed of the motors is only 170 r.p.m. at the full speed of the vehicle, but an efficiency of over 80 per cent. on full load is obtained.

The Council specified that the fully-loaded vehicle should attain a speed of 25 miles per hour on the level. Tested on the embankment, a speed of over 26 miles per hour was reached. It was also specified that it should climb Pentonville Hill (1 in 24) at a speed of 15 miles per hour, and it accomplished it at 16 miles per hour. Finally, the vehicle had to perform a run of 25 miles out from Pentonville and back in one and a half hours on one charge, and this, of course, it did easily. One vehicle has already been run some 800 miles, and has repeatedly given 35 miles on one charge, while 40 miles is sometimes reached. One of the chief advantages of these electrically-driven vehicles is the fact that they are always ready for instant use. Thus, on the occasion of a certain call recently, when the men were timed, it was found that the men were in their places and the vehicle clear of the station in seven seconds from the instant when the alarm-bell rang. A charging plug and switchboard are provided in the station where the vehicle stands, and the cells connected up for charging directly the vehicle returns. On a call being given, the cells can be instantly disconnected from the plug and the vehicle is ready to leave. With regard to the life of the battery, it may be mentioned that the Tudor Co. supply a special plate for this severe traction work; we understand that the positive plates last 5,000 miles and the negative plates 10,000 miles.

THE G.B. SYSTEM IN THE MILE END ROAD

Successful Libel Action Appeal

IN the Appeal Court on Wednesday, before the Master of the Rolls and Lords Justices Fletcher-Moulton and Buckley, Sir John Benn appealed against the verdict of £12,000 awarded by a special jury in respect of certain statements made by him concerning the G.B. surface-contact system, which was laid down by the London County Council in the Mile End Road. We reported the details of the action before Mr. Justice Ridley, in ELECTRICAL ENGINEERING, Vol. VI., 1910, pp. 735, 743, 759, and 782. In the course of his political campaign, Sir John Benn made a number of speeches and wrote certain articles, in which he attacked the Moderate party for having adopted the G.B. surface-contact system in London, and at the same time referred to the system as an impossible one, which all competent tramway experts had declared unsuitable for London. He also referred to the system as the "live"-stud system, and used various other expressions. The jury disagreed as to whether there had been special damage in the way of a trade libel, but awarded £12,000, to be equally divided between Messrs. Griffiths and Bedell for personal libel.

Sir Edward Clark, in opening the appeal for Sir John Benn, said that the case to be considered by the Court was one of personal defamation, the jury having disagreed on the question of trade libel and special damages. The appeal was for judgment for Sir John Benn or a new trial by reason of the misdirection of the jury by Mr. Justice Ridley. He argued that from the beginning the action was one for trade libel, and that when the jury disagreed upon this point the question of personal libel should have been withdrawn from the jury by the judge. The onus was now upon Messrs. Griffiths & Bedell to show that the statements complained of were in the nature of personal libels. His contention was that all through Sir John Benn had attacked the G.B. system, and had not on any occasion cast any reflection upon Messrs. Griffiths and Bedell personally. Neither in examining his own witnesses, nor in cross-examining Sir John Benn, had Mr. F. E. Smith, who appears for Messrs. Griffiths and Bedell, put any questions relating to personal libel, and it was clear that the case did not fall within that category.

The appeal for judgment for Sir John Benn was taken first, as if this succeeded there would be no need for the case for a new trial to be gone into.

Mr. F. E. Smith, for Messrs. Griffiths and Bedell, argued that there were numerous statements in the libels which personally reflected upon Messrs. Griffiths and Bedell, and these undoubtedly brought the case within personal libel, although it had been made by way of an attack upon their business. Throughout his argument Mr. Smith found himself opposed frequently to the views of Lords Justices Fletcher-Moulton and Buckley. The former put it to Mr. Smith that Messrs. Griffiths

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and Bedell had merely granted a licence to the London County Council to use their patents, and that they had not themselves laid down the tramways in the Mile End Road. He failed to see how it could be libellous upon the patentee to say that the licensee of the patents had failed to make them work. The most that could be said was that Messrs. Griffiths and Bedell had supplied certain parts, but after reading carefully through the libels he had come to the conclusion that there was no allegation of bad workmanship anywhere.

Mr. Smith pointed to statements such as "jerry-built tramways" and "live studs," but Lord Justice Fletcher-Moulton implied that as Messrs. Griffiths and Bedell did not supply the tramways in the Mile End Road, these statements could not be held to apply to them personally. As an attack upon the Moderate party of the London County Council, he thought a great deal could be said with regard to the libels.

Mr. Justice Buckley said it seemed to him that the proposition really was that the purchaser of the goods used them in a place where they were not suitable, and surely that was not libel. It certainly had been said by Sir John Benn that all competent experts had declared the system to be entirely unsuitable for London, but in order to make that a personal libel it would be necessary to have the further suggestion that Messrs. Griffiths and Bedell knew that the system would not work in London when they entered into the arrangement with the London County Council.

Mr. Smith disagreed with this, and said he had contended all through that the system in the Mile End Road was the G.B. system, and that Sir John Benn had intended to attack it as such. The effect was to charge Messrs. Griffiths and Bedell with being inexpert in their business.

On Monday the Master of the Rolls said that in his opinion the whole of the criticisms complained of had been directed against the system, and he could find no statements which, in his opinion, were personal defamations of Messrs. Griffiths and Bedell. It was extravagant to contend that an attack on a system was an attack on the patentees when these patentees had only supplied parts and granted a licence to someone else to use their system. In his opinion, therefore, the appeal must be allowed and judgment entered for defendants. Lords Justices Fletcher-Moulton and Buckley agreed.

In a discussion as to costs, the Master of the Rolls decided that, having regard to the peculiar circumstances of this case, the Court must give the strict order for judgment for Sir John Benn with costs in the Appeal Court and the King's Bench action. Mr. Smith indicated that the case would be carried to the House of Lords.

TURBO-ALTERNATORS WITH CYLINDRICAL ROTORS

IN a Paper read on March 8th before the Birmingham Section of the Institution of Electrical Engineers, Mr. S. P. Smith, of the General Electric Co., Witton, dealt with the characteristics of turbo-alternators with non-salient poles, giving special attention to the shape of the E.M.F. wave-form. The author points out that the general opinion is that a sine-wave is the best, and states that the non-salient pole machine closely approaches the ideal in this respect. Taking a rotor slotted uniformly over the whole periphery with equal-sized slots containing the same number of conductors, and a few slots in the middle of each pole left unwound, the ratio of the number of wound to the number of unwound slots may be called β. Formulæ are developed giving the harmonics which will be present in the M.M.F. curve for any value of β, and the results given in tabular form show that the more the winding is concentrated (*i.e.*, the lower the value of β), the greater is the amplitude of the fundamental curve, and consequently the higher the E.M.F. By concentrating the winding, therefore, the output is increased, or, conversely, fewer ampere-turns are required for a given output. Thus, taking the amount of copper required for a given output at 100 per cent. with $\beta=1$, the amount of copper for $\beta=0{\cdot}8$ is 84·5 per cent, 78·5 per cent for $\beta=0{\cdot}7$, and 74 per cent. only for $\beta=6$, which is the lowest value of β found in practice, owing to the difficulty of accommodating the winding in the slots.

Turning to the question of harmonics, the author points out that all harmonics above the 5th are negligible because of their small magnitude and low winding factors. The 3rd and 5th, however, may reach 10 and 5 per cent. respectively of the fundamental in the flux wave in passing from $\beta=0{\cdot}9$ to $0{\cdot}6$, but on account of the influence of the winding factors with distributed windings, the amplitude of the 5th harmonic in the E.M.F. wave is generally less than 1 per cent., and in a non-saturated machine can also be neglected. At $\beta=0{\cdot}66$, the 3rd harmonic is zero, but for other values this harmonic becomes appreciable, and may reach nearly 7 per cent. in the E.M.F. wave of a three-phase machine. In order, therefore, to obtain a sine-wave flux and E.M.F. curve, the value of β should be chosen between $0{\cdot}7$ and $0{\cdot}6$. The best distribution from all points of view is obtained with $\beta=0{\cdot}85$ to $0{\cdot}65$, as then there is plenty of space for the copper, and the heating is more distributed.

Considering the influence of saturation, Mr. Smith shows that this causes the flux curve to be rounded off, and tends to improve the shape of the wave. He then explains how the flux and E.M.F. waves can be constructed from the data of the machine, and works through an example of a 600-kw. four-pole 50-cycle alternator. He gives two alternative methods of calculating the open-circuit characteristic, and then proceeds to consider the effect of load upon the E.M.F. wave-form. The armature M.M.F. of a three-phase machine is distributed practically sinusoidally over the pole pitch when the load current follows a sine law, and by compounding this with the main M.M.F. at the proper phase displacement, the effects on the excitation and the E.M.F. wave can readily be deduced. In a salient pole machine, the flux and pressure curves are more or less skewed and distorted, but this does not occur in a non-salient pole machine, because both stator and rotor M.M.F. curves are practically sine curves; and as the reluctance of the magnetic path is constant for any position, the flux on load is simply the sum of these two curves at the proper phase displacement, and is therefore also a sine curve. The E.M.F. curve will also be a sine curve. It should be mentioned, however, that the constant reluctance of the magnetic path holds only for the uniformly slotted rotor with constant air-gap. Finally, Mr. Smith points out how the non-salient pole machine adapts itself readily to standardisation. For 50 cycles, machines up to 2,000 kw. are made two-pole for 3,000 r.p.m.; up to 5,000 kw., four-pole for 1,500 r.p.m.; and up to 5,000 kw., six-pole for 1,000 r.p.m. A very few diameters are chosen for each speed, and the outputs are varied by altering the core-length. The air-gap, teeth and cores are identical. The open-circuit characteristic will thus be the same for all machines of one diameter.

DISCUSSION.

Mr. A. M. TAYLOR (Birmingham Corporation), referring to some figures in the Paper, showing the increase of output rendered possible by letting the regulation go, inferred that it was desired to push the alternator with bad regulation, and said that the only advantage gained was that the ratio of the short circuit to the normal current was reduced. This minimised the risk of damage to the alternator itself, but in case of a heavy short the sub-station machinery might be thrown out of step.

Dr. KAHN (Brush Electrical Engineering Co.) saw no reason why alternators up to 3,000 k.v.a. should not be built to run at 3,000 r.p.m. The slots in the rotor should not be made too deep, so as to avoid excessive mechanical pressure on the insulation. It was important to make the best use of the copper space available on the rotor.

Mr. PENSABENE (Electric Construction Co.) complained that the author had taken no account of the effect of the slots and the fringing of the flux. He preferred the graphical method of building up the wave form, which was not a trapezium as stated by the author, but had ripples caused by the teeth. He did not consider that the distributed winding used in cylindrical rotors lent itself any more readily to standardisation than the salient pole type. There was no difficulty in the latter case in shaping the poles so as to produce a sinusoidal wave.

Mr. H. W. TAYLOR (British Thomson-Houston Co.) referred to the reduced excitation required with a concentrated winding, and asked whether the diminution in the excitation losses in a distributed winding due to the proportion between the coil inside the slot and the overhanging portion had been considered. He thought it was usual to leave no unwound slots in the rotor in order to avoid the saturation trouble. The tendency was to manufacture 50-cycle machines of only two speeds, and to build more of 3,000 r.p.m. than of 1,500 r.p.m. even for very large outputs. With reference to the effect of a short on sub-station machinery alluded to by Mr. A. M. Taylor, an alternator with poor regulation would stand the strain, and the sub-station machinery should also be designed with the same factor of safety. Rotaries were usually provided with reactances which limited the short-circuit current. If automatic voltage regulators were used, a machine of poor inherent regulation and, therefore, of low price could be used, and the cost of the regulator would be more than balanced by the decreased cost of the alternator.

Mr. SMITH, in reply, emphasised that the Paper treated the problem in general, and did not, therefore, include the effect of the teeth and different forms of slots. He denied having advocated the machine with bad regulation; he had simply pointed out that it was a cheaper machine, and discussed its characteristics. There was no difficulty in obtaining a true sine wave without the ripples referred to by Mr. Pensabene. The type of rotor in which the unwound portion of the circumference was left solid and not slotted was protected by a patent, and could not, therefore, be generally adopted.

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REGENERATING OLD BATTERY PLATES

CONSIDERABLE success has attended the application of a new chemical process for the regeneration of old storage battery plates. A number of complete batteries, made up entirely from the negative plates of exhausted cells of different makes, have been proved to give, in some cases, even better results than the original batteries, while the cost of making up such a regenerated battery is less than half the cost of a new one. The process is the invention of Mr. E. H. Naylor, and is being worked by the Regenerating Battery Co. (3A Blenheim Street, Chelsea). The old negative plates, riddled with cracks between the active material and the grid, are dipped in a bath of certain chemicals, baked for a short time, and then reduced electrolytically to eliminate all impurities. This treatment has the effect of expanding the material so that it fills up all interstices and cracks. The treated plate is more uniform, of higher conductivity, and, as the material has expanded, is more porous than before the treatment. Furthermore, the material is much harder than that of a new plate, and is claimed to retain this hardness after formation. A complete battery is made up from the negative plates of two old ones, one of the outer of each set of plates which is to be positive being cut off, so that both outside plates are negative. It is stated that apart from the saving effected by the regeneration of exhausted plates, the regenerated batteries have a longer life and an efficiency 10 to 15 per cent. higher than the original batteries, and at least equal capacity.

By the courtesy of the Krieger Electric Carriage Syndicate, Ltd., we are enabled to publish the results of their experience with batteries regenerated as above from some of their scrap negative sections. The cells used by this company are of the French Chloride pattern, and are purchased from the Société Anon. pour le Travail Electrique des Métaux. They have an average life of from 3,000 to 3,500 miles, and generally require washing after three months' use, corresponding to about a thousand miles' run. Twenty complete regenerated batteries, each of 44 to 46 cells of 15 or 21 plates each, have already been made up from the company's old batteries, and the following are some of the results obtained: No. 1 battery of 46 cells, each with 21 plates and weighing 30 lbs. with electrolyte, put in service in April of last year, had given, when it was scrapped in January last, a total mileage of 4,500, or 1,000 miles more than the average figure for the new batteries. During that period the cells were washed out three times only, the hardness of the regenerated material apparently reducing the amount of deposit. Only half the cells were actually scrapped; the others are in use in other cars replacing damaged cells. Further, some of the negative plates of the scraped regenerated cells have been regenerated a second time. This particular battery did 47 to 48 miles on one charge, and that in the bad weather. The maximum capacity of the cells has been from 170 to 180 ampere-hours—if anything, slightly higher than the capacity of new cells. No. 2 battery, put in service in August, 1910, has run 2,960 miles up to date, but has required three washings, due to a slight accident; No. 3, put in in September, has run 3,480 miles up to date with only two washings; No. 4 (October) has run 2,730 miles with one washing only; No. 5 (November), 2,740 miles with two washings; and No. 6 (December), 1,560 miles with one washing. The other batteries put in since are behaving satisfactorily. Mr. F. S. Coles, works manager of the Krieger Co., is most enthusiastic about the new process, and expressed himself highly satisfied with the results. He said that the only respect in which the regenerated batteries did not equal new batteries was the larger number of charges and discharges before they reached their full capacity. Mr. Coles receives the plates unformed, and tells us that they appear to stand storage well, showing no signs of sulphating. He considers that the process will materially assist in popularising electric vehicles of all kinds for town and suburban use for a range within fifty miles.

The Regenerating Battery Co. have already delivered over thirty regenerated batteries to different electric carriage companies, and are now beginning to deal with train-lighting batteries. Ignition batteries are, of course, easily dealt with, but large station batteries are more difficult to handle. Practically any make of cell can be regenerated, and among those already dealt with are E.P.S., Tudor, and Hart cells, but the results naturally depend a good deal on the original quality of the cell when new.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ELECTRICAL THERMOMETERS.—We have received a pamphlet on electrical distance thermometers from the Leskale Co. (Palace Works, Enfield). The Leskale instrument when used for temperatures up to 900° F. is a resistance thermometer employing pure nickel wire. The resistance is measured on a galvanometer by comparison with standards in the arms of a bridge arrangement. The resistances are adjusted so that the pointer remains at rest when the thermometer element has the desired starting temperature of the scale, but moves as soon as the temperature rises, indicating it direct in degrees. The indicating instrument and all necessary switches, &c., are mounted conveniently on a marble panel. Current is supplied from a single secondary cell. For higher temperatures, outfits on the thermo-electric principle are employed, using iron-constantan up to 1,000° F., a carbon-nickel combination up to 2,300° F., while for the highest temperatures platinum and platinum-rhodium are made use of. A copy of a test certificate from the National Physical Laboratory accompanies the pamphlet.

ELECTRIC FURNACES.—A leaflet from Messrs. Verdon, Cutts & Hoult gives a drawing of their "Electro-Bessemer" furnace for the production of high grades of steel, in which the conversion is first effected by the ordinary Bessemer process, and the subsequent refining is carried out electrically in the same vessel without any pouring being required.

THREE-PHASE MOTORS.—The Sandycroft Foundry, Ltd. (near Chester), have sent us a copy of a reprint of a Paper by Mr. Williams-Ellis, describing Mr. L. J. Hunt's "cascade" induction motor, which is manufactured by the firm, read at a meeting of the Association of Mining Electrical Engineers last summer.

DRAWING AND SURVEYING INSTRUMENTS.—A supplement to the instrument catalogue of Messrs. A. G. Thornton, Ltd., deals with a new gradient measure and several novelties in pens and drawing office accessories. A separate leaflet describes an entirely new system of adjustment for spring bows.

OSRAM LAMPS AND FANCY DRESS

AT a recent fancy dress rinking carnival, held in Carnarvon, where prizes were offered for the most original costumes bearing on present-day street posters, Mr. J. T. Rees was successful in securing an award for his representation of Electric Light, the attractions of which he chose to demonstrate by means of Osram lamps, which he had secured to various parts of his suit of overalls, and each of which was controlled by a



Osram Lamp Costume.

switch, the current being obtained by means of a 4-volt accumulator. In addition, as will be seen by the above illustration, the successful competitor displayed on his costume examples of various Osram advertisements, using for his helmet the popular Osram lamp shade, illuminated from within by means of an Osram battery lamp. We are informed by the General Electric Co. that this is the tenth instance during recent weeks in which competitors at fancy dress carnivals have secured awards by representing Osram lamps.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published March 16th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

8,913/10. **Lamp Lock.** W. P. COLLINS (Dublin). A ring screwed down on the top portion of a standard lamp-holder by means of a special key, presses the brass cap down on to the porcelain contact holder and prevents the lamp being pushed upwards to free the pins. Three figures.

13,295/10. **Leading-in Wires.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*). A short length of drawn ductile tungsten or molybdenum wire is used as a leading-in conductor for incandescent lamps. The wire is dipped into fused potassium nitrite before sealing it into the glass, as it is necessary that it should be free from dirt and oxide.

Opposition to Grant of Patent

27,380/09. **Recording Instruments.** H. HAMMARLUND. This patent has been allowed in spite of opposition. The specification was abstracted in ELECTRICAL ENGINEERING, October 20th, 1910, Vol. VI., p. 666.

Amendments

19,626/06. **Textile Machinery.** BROWN, BOVERI & Co., LTD., desire to insert the following words (in italics) in the first claim of this patent, which will then read as follows:—"In an electrically driven ring spinning machine, automatically altering the number of revolutions *of the machine shaft to give a high main and lower initial and finishing speeds* by a regulating apparatus of the motor controlled from one of those parts of the spinning machine adapted to regulate the movement of the ring rail." It is also desired to correct the drawings.

7,612/08. **Textile Machinery.** BROWN, BOVERI & Co., LTD., desire to correct a figure, and to amend the claim of this patent, which will read thus:—"An electrically driven ring spinning machine wherein the number of revolutions is automatically varied with varying diameters of the bobbin or cop, as already known, and wherein the number of revolutions for equal diameters is diminished towards the end of the spinning period, in relation to the number of revolutions during the main portion of the spinning period, *whereby increased production is obtained.*"

24,643/08. **Storage Battery Plant.** A. M. TAYLOR. This specification has been amended as detailed in the Official Journal of the Patent Office of March 15th, 1911. The specification was abstracted in ELECTRICAL ENGINEERING, October 20th, 1910, Vol. VI., p. 666.

27,478/09. **Electrical Marine Propulsion.** H. A. MAVOR and MAVOR & COULSON, LTD. As a result of the extended investigation under Section 8 of the Patents Act, a disclaiming note has been inserted in this specification. The patent (abstracted in ELECTRICAL ENGINEERING, Nov. 10th, 1910, Vol. VI., p. 718) covers an alternator for generating at two different frequencies without any change in speed.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.
Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: JANDUS ARC LAMP & ELECTRIC Co., JONES and CASTELL-EVANS, 5,965/10; RIDINGS, 13,535/10; AUGUST SCHWARZ [Double-carbon lamp] 16,841/10.

Distributing Systems, Cables & Wires, Insulating Materials, &c.: MURDOCH (*Robinson*) [Connecting wires to insulators] 5,383/10; HOFLE [Manufacture of insulating tubes] 25,555/10.

Dynamos, Motors, and Transformers: HOLLICK [Control of electrically-driven winding gear and hoists] 10,245/10; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Motor control] 12,265/10; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke Ges.*) [Speed regulation of polyphase motors] 25,964/10; KULKA [Oil-cooled transformers] 2,241/11.

Electrometallurgy and Electrochemistry: PRESSER [Electric welding] 15,031/10, and [Electric welding with continuous current] 15,032/10; GIBBS [Electrolytic manufacture of wire] 19,593/10; CONSIGLIERE [Electro-deposition] 20,776/10.

Heating and Cooking: ELY and FOSTER ARC LAMP & ENGINEERING Co. [Water heaters] 6,065/10; HAWKES [Heating and cooking apparatus] 19,466/10.

Incandescent Lamps: LEDERER and WESTINGHOUSE METAL FILAMENT LAMP Co. [Manufacture of metal filaments] 5,388/10.

Instruments and Meters: ROBISON and JONES [Recording apparatus] 27,904/09; DRYSDALE [Electrical dynamometer] 4,669/10; GODDARD [Prepayment meters] 7,587/10; BURROWES [Electrostatic voltmeter] 10,722/10.

Storage Batteries: HEAP, 2,062/10; SCHMIDT [Charging systems] 22,888/10.

Switchgear, Fuses, and Fittings: TURNER and FENWICK [Contacts for contact-breakers] 30,101/09; BAKER and LONGSTRETH'S, LTD. [Lamp-holders] 11,275/10; LAKE (*Crawford*) [Machines for running fish wires through conduits] 17,165/10; WEISSMANN [Lamp-holders] 18,738/10; BROUGHAM (*Moore Electrical Co.*) [Vacuum tube lighting apparatus] 20,661/10; FAIRWEATHER (*Stein*) [Switch] 22,412/10; SOC. ANON. "PHI" [Commutator switch] 24,851/10.

Telephony and Telegraphy: VON LEPEL and BURSTYN [Oscillation generator] 30,030/09; FESSENDEN [Wireless telegraphy] 5,133/10; MURDOCH (*Robinson*) [Connecting wires to insulators] 5,383/10; SIEMENS BROS. & Co. (*Siemens & Halske A.-G.*) [Automatic telephone exchanges] 6,654/10; GOLDSTEIN [Central battery signalling systems] 16,336/10; VON KRAMER [Inductive wireless telephony] 21,451/10.

Traction: ROSENGREN [Automatic pipe couplings] 5,381/10; BATCHELDER [Electrically-driven vehicles] 8,363/10; CROSS (*Krizik*) [Electrically-actuated brakes] 17,597/10; SIEMENS BROS. & Co. and FERRIERA [Signalling on single lines] 24,158/10; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Rail bonds] 30,138/10.

Miscellaneous: ADAIR [Conveyors] 19,642/09; JORDAN [Electric device for branding meat] 4,858/10; LICHTENFELD [Alarm] 5,385/10; BRITISH THOMSON-HOUSTON Co. (*Allgemeine Elektricitats Ges.*) [Regulating valves] 6,791/10; BICHEL [Submarine mines] 19,268/10; VICKERS, SONS & MAXIM, LTD. (*Elia*) [Submarine mines] 21,933/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: KÖRTING & MATHIESEN A.-G. [Enclosed arc lamps] 3,891/11.

Distribution Systems, &c.: ALLGEMEINE ELEKTRICITÄTS GES. [Suspension of conductors] 4,623/11.

Dynamos, &c.: A.-G. BROWN, BOVERI ET CIE [Compounding of commutator machines] 4,256/11; HEYLAND [Starting and regulating A.-C. motors] 4,627/11.

Telegraphy: CEREBOTANI [Wireless operated signalling apparatus] 16,360/10.

Traction: COMPAGNIE DE SIGNAUX ELECTRIQUES POUR CHEMINS DE FER [Warning apparatus for signalling systems] 3,978/11.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

8,180 of March 30th, 1897. **Printing Telegraphs.** W. L. WISE (*C. L. Buckingham, U.S.A.*). This patent covers a printing apparatus for receiving and reproducing in page form telegraphic messages which have been transmitted at a high speed by a Wheatstone or other transmitter. The sheet of paper is placed on a cylinder in the form of a tube, and the chief claims of the patent cover mechanism to produce a positive rotary and axial feed of the paper tube.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Vapour lamps and rectifiers] 24,856/05.

Distribution Systems, &c.: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Insulation of conductors with nitrocellulose] 26,456/03.

Dynamos, &c.: H. LEITNER and R. N. LUCAS [Train-lighting dynamo] 26,764/02, and [Train-lighting system] 26,082/04; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Armature windings] 26,171/04; A. F. HILLS, D. URQUHART and A. E. HONEY [Use of armature binding wires as equaliser rings] 24,877/05.

Instruments, &c.: A. WRIGHT and MUTUAL ELECTRIC TRUST [Maximum demand indicator] 24,126/99; W. CHADBURN [Speed indicator] 21,328/00; C. W. ATKINSON [Maximum demand indicator] 26,267/03.

Switchgear, &c.: A. HEPKE and K. DIENER [Multiple fuse plug] 26,180/03; VICKERS, SONS, & MAXIM, A. D. WILLIAMSON, and C. L. SUMPTER [Control of variable speed motors] 26,288/04; W. ANDERSON [Lamp globe gallery] 24,475/05; C. W. ATKINSON [Motor controller] 24,729/05.

Telephony, &c.: G. M. HARDINGHAM (*Felten & Guilleaume*) [Cores of submarine gutta percha-insulated cables] 25,095/98.

Traction: P. HALLOT [Automatic brakes] 25,837/03; W. GRIFFITHS and B. H. BEDELL [Resistance studs for surface-contact system] 25,969-70/03; J. S. and A. B. RAWORTH [Control systems for shunt motor equipments] 24,810/05.

Miscellaneous: E. LYTTON [Scenery raising gear] 24,261/01; H. C. HEIDE (*R. S. Baldwin, U.S.A.*) [Electrically operated monotype machines] 24,489/05; J. CARTER [Burglar alarm] 24,630/05.

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LOCAL NOTES

Birmingham: *Tramways.*—The conversion of the cable tramway from Colmore Row to Hockley Brook to electric traction is in hand. The line will revert to the Corporation on June 30th, and arrangements are being made for running electric cars over the route on July 1st.

Carlisle: *Apprentices at Electricity Works.*—Commencing with the new financial year, the Electricity Committee recommend that apprentices shall be admitted in the Electricity Works. The number employed at the works at any one time is not to exceed six.

Dover: *Sunday Trams.*—A poll of the ratepayers has been taken, with the result that there is a majority of 1,164 in favour of running tramcars on Sundays.

Elland: *Proposed Tramways.*—The proposal that the National Electric Construction Co. should construct tramways between Halifax and Huddersfield, the Elland, Greetland, and Brighouse Town Councils borrowing the necessary money, and the company paying the capital charges, has fallen through.

Ireland: *Railway Electrification.*—At the recent half-yearly meeting of the Dublin & South Western Railway Co. a shareholder suggested that in order to improve the traffic the line should be converted to electric traction. The suggestion has been developed in some quarters, and the further proposition made that in order to reduce the cost of the conversion, power should be taken from the Dublin United Tramways Co. *The Financial Times* points out that the London & North Western Railway Co. is largely interested in the Dublin & South Western Railway Co., and in view of the construction of the Watford-Edgware electric railway by the London & North Western Railway Co., and the appointment of an electrical engineer in the person of Mr. Cortez Leigh, any suggestions regarding electric traction should receive careful, not to say expert, consideration.

Liverpool: *Tramway Accounts.*—The tramway accounts for 1910 show a gross profit of £209,252, and after meeting capital charges and placing £65,510 to reserve, renewals, and depreciation, a sum of £32,755 is transferred to relief of rates. The latter sum is about £5,000 in excess of the amount handed over in the previous year. The number of passengers carried was 125,507,283, an increase of 3,974,343 over the previous twelve months.

London: *County Council: Victoria Embankment Lighting.*—The Highways Committee recommend the use of Beck flame arc lamps on the Victoria Embankment.

Hackney: Electricity Accounts.—It is estimated that the net profit on the electricity undertaking for the year to March 31st will amount to £8,791, and the Finance Committee, in view of the substantial amount standing to the credit of reserve fund, recommend that a sum of £4,702, equal to a 1d. rate, be transferred to relief of rates.

Marylebone: Assessment of Electricity Works.—The dispute between the London County Council and the Marylebone Electricity Committee, in regard to the assessment of the electricity works, has been settled by an agreement to fix the assessment at £32,000. This is about £8,500 more than has been paid up to the present.

Manchester: *Tramway Employees.*—Sir David Harrel, K.C.B., has been appointed by the Board of Trade to sit as arbitrator in connection with the differences between the Tramways Committee and their employees.

Scarborough: *Tramways.*—It is stated that the Scarborough Tramways Co. have decided to resume the running of the trams next month, and to run them continuously during the following winter. The Corporation, however, have applied to the Board of Trade for an order revoking the company's powers, owing to their not having run a service during the past winter. Speaking at the meeting of the Scarborough Electric Supply Co. last week, Mr. A. A. Campbell Swinton expressed the hope that the Corporation would not persist in their attitude, as the Supply Company had erected a special plant to deal with the tramway load, and the complete cessation of the tramways would be a severe loss.

Torquay: *Tramways.*—The whole of the Dolter system has now been converted to the overhead trolley system, and the cars are running.

Walker: *Electricity Supply.*—The Newcastle Corporation having incorporated Walker within their district, have thought it advisable to purchase the rights which the Newcastle Electric Supply Co. have of supplying electrical energy for the tramways in that district. Sir Alexander Kennedy is sitting as arbitrator in London to determine the price.

Woodbridge: *Electric Lighting.*—Mr. Charrington, of London, has been asked to meet the Council to explain a scheme of electric lighting.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia.—The Deputy Postmaster-General, Melbourne, invites tenders by July 25th for 12 sections of a branching multiple magneto lamp-signalling switchboard, or alternatively an automatic or semi-automatic switchboard. The *Board of Trade Journal*, in giving this information, points out that the time available will only enable those firms having agents in Australia to tender.

Fiji.— The *Royal Gazette* for November 4th, says the *Board of Trade Journal*, contains the conditions under which a concession will be granted for 25 years for the supply of electrical energy and the working of an electric tramway in the town of Suva. The *Gazette* may be seen at 73 Victoria Street, London, S.W.

Glasgow.—The Electricity Committee require tenders by April 24th for a steam turbo-alternator with condensing plant.

Hastings.—The Local Government Board have sanctioned the borrowing of £2,083 for electric lighting.

London: *Bermondsey.*—The Electrical Engineer recommends additional generating plant at an estimated cost of £20,100.

Hammersmith.—Tenders are invited by March 29th for high- and low-tension switchgear and static transformers.

Merthyr Tydfil.—The Merthyr Electric Traction Co. have entered into an agreement to extend their system to Cefn.

Rawtenstall.—A 500-kw. three-phase steam alternator and a 250-kw. motor generator are required. Tenders by March 31st, and particulars from the Borough Electrical Engineer.

Roumania.—*The Board of Trade Journal*, quoting from a report by the German Vice-Consul at Craiova, states that there is a good market for electric generating stations in Roumania, as there is an increasing desire on the part of even the smaller towns to have electric lighting.

Torquay.—Tenders are invited for a turbo-generator, condensing plant and switchgear, motor generator and switchgear, and an electrically driven feed pump. (See an advertisement on another page.)

Watford.—A new high-tension feeder is to be laid at an estimated cost of £560.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings.

GREATER LONDON.

Drill Hall, Mitcham Road. Architects, Jarvis & Richards, 10 Queen Anne's Gate, Westminster.

PROVINCES.

Barnsley.—Proposed new Town Hall.

Birmingham.—Extension to Vittoria Street School for Jewellers and Silversmiths. Architects, Messrs. Cossins, Peacock & Bewlay, 83 Colmore Row.

Burnley.—Buildings on site of old barracks. Architect, W. Greenwood, Victoria Chambers, Blackburn.

Chatham.—County School, Chatham Hall. Kent County Education Committee.

Cleckheaton.—Cinematograph Theatre, Albion Street. Messrs. Howorth & Howorth, Old Bank Chambers.

Dover.—A contract has been let to a local firm for the building of an electric theatre.

Dudley.—New school to accommodate 400 scholars.

Glasgow.—Two new Roman Catholic Schools.—Music Hall and Theatre of Varieties.

Keighley.—Alterations to St. Ann's Schools. Rev. J. F. Russell.

OSRAM·LAMPS

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Leeds.—Two hostels for women students at City of Leeds Training College, Beckitt's Park. Architect, A. E. Kirk, Albion Street.

Lincoln.—Extensions to Lincoln County Hospital.

Middlesbrough.—Assembly Hall and Sunday Schools, Cemetery Road. Architect, James Forbes, 43 Albert Road.

Motherwell.—Primitive Methodist Church at corner of Avon and Clyde Streets.

Paisley.—Six four-story tenements in Seedhill Road.

Pontypridd.—New Infirmary.

Salford.—Electric lighting of Annexe at Town Hall. Borough Electrical Engineer.

Swansea.—Additions to premises at corner of Oxford Street and Waterloo Street. W. Edwards.

Wakefield.—Extensions to County Hall.

Woking.—Alterations to Head Post Office. H.M. Office of Works.

MISCELLANEOUS

Ashton-under-Lyne.—The Electrical Engineer has drafted a scheme for street electric lighting.

Dublin.—The Local Government Board is to be asked to sanction a loan of £3,000 for the purpose of lighting all the streets by electricity in which electric mains are laid.

Leeds.—The Tramways Committee invite tenders by March 31st for 25 electric tramcar trucks and 10 electric tramcar equipments. Particulars from the General Manager.

London: *County Council.*—The Highways Committee recommend the building of a third section to the Central Car Depôt at an estimated cost of £277,335.

Lancashire & Yorkshire Railway Co.—Tenders are invited for various stores, including electrical fittings, wires, &c. Particulars from the Stores Department, Osborn Street, Manchester, and tenders by April 3rd.

Wigan.—The Tramways Committee invite tenders for overhead line material, tramcar accessories, &c. Particulars from the Engineer, and tenders by March 27th.

TENDERS RECEIVED AND ACCEPTED

Aberdeen.—The Electricity Committee recommend the acceptance of a tender by Messrs. Willans & Robinson, Ltd., for a 1,000-kw. continuous-current turbo generator at £4,726. This set will take the place of two small generating sets.

Gloucester.—Messrs. Venner & Co. have received an order to supply tramcar meters on trial.

Colchester.—Messrs. Venner & Co.'s tenders for prepayment and ordinary meters have been accepted.

Dublin.—The Electricity Supply Committee recommend the acceptance of tenders by Messrs. Babcock & Wilcox, Ltd., for boilers, and the Maschinenfabrik Oerlikon for extensions to the Pigeon House Fort generating station. The total amount of the two contracts is £34,698. Although tenders were invited from thirteen firms, as a result of the short time allowed for installing the plant, namely, about six months, only three firms sent in complete tenders. The plant of the Maschinenfabrik Oerlikon has a guaranteed steam consumption of 15·95 lbs. per kilowatt hour, against 17·26 by Messrs. Willans & Robinson, 17·77 by Messrs. C. A. Parsons & Co., and 18·25 by the General Electric Co. The prices of the three latter were £11,809, £11,178, and £11,817 respectively. The accepted tender for generating machinery amounts to £11,458.

Hendon.—The Rural District Council have entered into an agreement with the North Metropolitan Electric Power Supply Co. to light the Edgware district by electricity.

Edinburgh.—The tender of the Motherwell Bridge Co. for the erection of cooling towers at the Dewar Place Electric Lighting Station is recommended for acceptance at £18,000.

Ireland.—Messrs. Francis Carr & Co., of Belfast, have received the contract for an electric lighting plant for Dungiven (Co. Derry). The dynamo will be driven by water turbines.

London: *County Council.*—The tender of Messrs. W. T. Henley's Telegraph Works Co., Ltd., at £136 11s., for laying 700 yards of feeder cable in Blackwall Tunnel, is recommended for acceptance.

Battersea.—The tender of the Sloan Electrical Co., Ltd., has been accepted for the supply of arc lamp carbons during the coming year.

Hammersmith.—The tender of the General Electric Co., Ltd., for the supply of Osram lamps for the year ending March 31st, 1912, has been accepted, after very severe competition.

Vancouver.—Amongst a number of colonial contracts just secured by the D.P. Battery Co., Ltd., is a 240-volt central station set with auxiliary plant for Vancouver.

Wycombe.—A contract has been entered into with the Wycombe (Borough) Electric Light & Power Co., Ltd., for street lighting for seven years.

Messrs. Mirrlees, Bickerton & Day, Ltd., have sent us a list of orders which they have recently received for Diesel engines varying from 50 h.p. to 500 h.p., and we select a few of the most important:—One 375-h.p. engine and one 500-h.p. engine for the London, Brighton & South Coast Railway Co.; two 150-h.p. engines for the Sale U.D.C.; one 375-h.p. engine for the Manekji Petit Mills, Bombay; one 200-h.p. engine for New Zealand; two 200-h.p. and one 132-h.p. engines for Canada; three 200-h.p. engines for Madeira; two 200-h.p. engines for the Barbadoes; and one 200-h.p. for Bulgaria.

APPOINTMENTS AND PERSONAL NOTES

A Clerk of Works is required in connection with the electrical installation at Richmond (Dublin) District Asylum. Applications to W. J. Murphy at Asylum Offices, Dublin.

Mr. L. S. Payne has left the Thorpe Meter Syndicate to take up a better position in the Testing Department with Messrs. Chamberlain & Hookham, Ltd.

Mr. P. G. Campling, Works Superintendent and Senior Charge Engineer at the Weymouth Corporation Electricity Works, has been appointed third engineer at the Bermondsey Electricity Works.

Mr. H. Parker, of the Gillingham Electricity Works, has been appointed Shift Engineer at the Dover Electricity Works.

Mr. E. W. L. Nicol and Mr. O. A. Pilcher have resigned their positions as Charge Engineers at the London County Council Greenwich Power House. Applications are to be invited for successors, at a salary of £250, rising to £300 per annum.

Mr. J. Glynn Williams, late of the Moresby Coal Co., whose name is well known in connection with the Association of Mining Electrical Engineers, has joined the staff of the Electrical Trades' Supply, Ltd., Britannia Works, Gt. Charles Street, Birmingham, as mining representative.

The salary of Mr. S. T. Allen, City Electrical Engineer at Carlisle, has been increased by £50 per annum, in addition to his usual increments of £20. The salary of Mr. J. H. Thompson, Chief Assistant Electrical Engineer, has been increased from £145 to £170 per annum. Mr. A. W. Barham, at present Charge Engineer, has been appointed Station Superintendent at a salary of £120 per annum.

The salary of Mr. C. G. Simpson, Traffic Superintendent to the Southampton Corporation Tramways, has been increased from £200 to £220 per annum, rising by annual increments of £10 to £250 per annum.

Obituary.—We regret to announce the death of Lord Airedale, which occurred in Paris on Thursday. Lord Airedale is better known to our readers as Sir James Kitson, whose name is familiar in the electrical industry in connection with the famous "Kitson clause" in electrical power Bills. Lord Airedale also presided, when a member of the House of Commons, over the committee which dealt with Mr. C. H. Merz's last power Bill for London, which, after being passed by a House of Lords Committee, was reported for third reading in the House of Commons by Sir James Kitson's Committee, but failed to become law owing to there being no time for the third reading to take place.

We also regret to have to record the death of Mr. M. B. Cotterell, of Veritys, Ltd., which occurred last week at his residence, "Waverly," Victoria Park, Manchester. Mr. Cotterell, who was only 41 years of age, died of double pneumonia, after three weeks' illness. We understand that he joined the firm as a pupil twenty years ago, when it was known as P. Verity & Sons, and dealt only with installation work. He became manager of the works, and later managed the business of the firm in the Northern districts, eventually obtaining a seat on the Board.

Telegraph Traffic.—The cable between Madagascar and Réunion was restored on the 16th inst., and on the following day the Réunion-Mauritius cable was also in working order.—The German Company announces reductions of 75 and 78 centimes on rates on the opening of their South American cable for traffic, and the Western Telegraph Co. has followed suit.—On the 18th inst. communication was broken between Villa Bocage and Chilomo in Mozambique.—On the 21st inst. communication between Lourenzo Marques and Bella Vista was down.—The Compagnie Française des Cables Télégraphique has not yet restored its connection to Brazil.

The Care and Management of Ignition Accumulators.—In the last line of the review of this book, published in our Literary Supplement last week, the words "8 volt" should read "10 volt." We are indebted for this correction to the author of the book.

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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £57 to £57 10s. per ton (last week the same).

Canadian Agencies.—A London firm manufacturing high-class electric light fittings, is desirous of getting into touch with Canadian importers. Particulars from 17 Victoria Street, London, S.W.

An Ottawa correspondent who is at present in London is desirous of getting into touch with United Kingdom manufacturers of electrical generators and motors, lamps, instruments, small transformers, &c., requiring Canadian representation. Further particulars may be obtained at the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W., on March 14th, 1911.

Change of Address.—Messrs. Balcke & Co., Ltd., notify their removal to larger offices at Broadway Court, Broadway, Westminster; telephone, Victoria 1387.

Bankruptcies.—The last day for receiving proofs in the bankruptcy of J. A. Bauer, trading as the Electrical & General Engineering Co., 17 Gracechurch Street, London, is March 29th. Mr. G. E. Corfield, 19 Finsbury Pavement, London, is trustee.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

County of Durham Electrical Power Distribution Co.—There was a net profit of £15,532 for 1910, and after paying 3¾ per cent. on the preference shares and transferring £6,000 to depreciation and reserve, a balance of £157 is carried forward.

City of London Electric Lighting Co.—It was stated at the annual meeting on Friday that the number of consumers increased in 1910 by 538. The experimental street lighting demonstration in Farringdon Street, Watling Street, Paternoster Row, and Cheapside was still awaiting the judgment of a Special Committee of the City of London Corporation. Mr. J. B. Braithwaite, who presided, also stated that if the results for 1911 were satisfactory, the directors would probably feel justified in increasing the dividend, as the equalisation of dividend fund now stood at £14,000.

Fife Tramway, Light & Power Co.—In view of the fact that this company is promoting a Provisional Order for electric lighting in an extensive area in the county of Fife, and also in anticipation of a considerable extension in the amount of power required for the tramways, the directors recommend an increase in the share capital of £300,000. Last year, after meeting the 6 per cent. preference dividend, a sum of £3,590 was carried forward

Waste Heat & Gas Electrical Generating Stations.—At the annual general meeting last week it was stated that negotiations are proceeding for the erection of further generating stations; one utilising exhaust steam from the Port Clarence Ironworks of Messrs. Bell Bros., Ltd., and the other for the utilisation of exhaust steam from the Lackenby Ironworks of the Tees Furnace Co., Ltd. Arrangements have been made with the Cleveland Power Co., in whose districts these generating stations will be, under which the company will receive a regular and remunerative return for their use. Negotiations for a third generating station are also in progress. A further issue of capital is to be made during the current year in connection with these new stations. As already announced, a dividend of 8 per cent. was paid for 1910.

New Zealand.—The Christchurch Tramway Board are issuing £61,400 4½ per cent. debentures at 103. Applications for stock should be made to the Union Bank of Australia, London.

Rhondda Tramways Co.—The Law Debenture Corporation have offered, on behalf of the International Financial Society, £200,000 5 per cent. debentures of the Rhondda Tramways Co. at 94.

Metropolitan Electric Supply Co.—At the annual meeting last week, Mr. W. H. Cripps, who presided, stated that the company's new system for supplying electrical energy to their West Middlesex area was now partly completed, the trunk mains having been laid from Willesden to sub-stations in Hanwell and Southall.

Newcastle-upon-Tyne Electric Supply Co.—The connections to this company's systems on December 31st, 1910, amounted to 139,776 h.p., an increase of 10,557. After meeting debenture and loan interest, there is an available balance of £78,925, and a 4 per cent. dividend on the ordinary shares is recommended, transferring £15,000 to depreciation, and carrying forward £2,050. The general depreciation account now stands at £115,000.

Underground Electric Railways Co. of London.—At the meeting on Wednesday last week, Sir Edgar Speyer, referring to the dispute between the company and the British Westinghouse Co. with regard to the substitution of Parsons turbines for Westinghouse machines (see ELECTRICAL ENGINEERING. January 19th, p. 32), stated that Sir Alfred Lyttelton has now issued his award. The arbitrator has decided that the British Westinghouse Co. cannot claim the balance of the purchase money of the Westinghouse machines amounting to £83,000, which was retained by the railway company as a set-off against the cost of installing the Parsons turbines. In addition, the railway company have been awarded £15,000 damages as well as costs of the arbitration. It is also stated that the British Westinghouse Co. propose to contest the award.

Brompton & Kensington Electricity Supply Co.—Mr. H. R. Beeton, who presided at the annual general meeting last week, referred to the satisfactory results which have attended the opening of the company's showrooms. The contract system of supplying electricity for lighting had been well taken up, and the increase in the demand for electrical energy for heating and cooking had been very noticeable.

Vickers, Sons & Maxim.—The report for 1910, which recommends a dividend making a total of 10 per cent. for the year, states that all departments of the company were more fully occupied during the year than in the previous twelve months. It is further anticipated that the current year will show still further improvement, as the orders in hand, both for home and abroad, are unusually heavy. After meeting the above dividend, a balance of £103,970 is carried forward. It is proposed to change the name of the company to "Vickers, Ltd."

British Insulated & Helsby Cables, Ltd.—At the annual meeting on Monday, Mr. James Taylor, the Vice-Chairman, who presided, stated that the transfer of the telephone system to the Government had resulted in the placing of a large number of orders for telephone material, a fair proportion of which had been given to the British Insulated Company.

Royal Institution.—The programme of Friday evening meetings after Easter includes a discourse, on June 2nd, on Radio-telegraphy, by Mr. G. Marconi. Among the Thursday afternoon lectures will be two by Mr. T. Thorne Baker, on "Changes Effected by Light" and "Practical Progress in Wireless Telegraphy" respectively.

Parliamentary Intelligence.—The London County Council Tramways Bill was before the Standing Orders Committee last week in respect of absence of consents of road authorities for certain tramways. It was decided to allow the Marble Arch to Cricklewood tramways to proceed, but a number of proposed tramways were struck out.

The London, Tilbury & Southend Railway Bill was before a Committee of the House of Lords last week. One of the chief proposals of the Bill is to acquire land for the erection of a generating station at Tilbury and Thames Haven. The company have hitherto obtained their supply of electrical energy for working such portions of their lines over which electric trains run from the Lot's Road power-house, but it is intended to extend the electrification over the whole of the lines. Hence the need for their own power station. There was very little opposition to the scheme, and the preamble of the Bill was found proved. Mr. Robert Hammond gave evidence on behalf of the railway company.

A clause in the Great Northern Railway Bill, which was passed by a Committee of the House of Commons on Thursday, gives authority to take a supply of electrical energy from the Great Northern and City Railway Co. At present the company get the supply of electrical energy which is required for lighting, &c., from their own power station at Holloway, but the cost of generation is very heavy, and a cheaper supply can be obtained from the Great Northern and City Railway Co.

Gas v. Electricity.—At the annual meeting of the Sheffield United Gas Light Co. last week, some strong statements were made by the Chairman, Mr. Wilson Mappin, with regard to the electricity supply in general and the Sheffield electric supply undertaking in particular. He said that the electrical industry have what is called a Publicity Department, whose occupation seems to be to turn out literature vilifying gas in all its uses. Some of these pamphlets he had seen, and they were absurdly extravagant in their inaccuracies. He referred to experiments made at the Lewisham Infirmary, which demonstrated that the use of gas, both as an illuminant and for heating purposes, assisted the ventilation, a statement which puts the results in question somewhat higher than did Mr. F. W. Goodenough, of the Gas Light & Coke Co., at the annual meeting of the Illuminating Engineering Society last week. We would also refer Mr. Wilson Mappin to Dr. Harman's views on the use of gas expressed at the same meeting, viz., that when it was contended that gas assisted ventilation, it was a sign that gas was on its last legs. Dealing with the Sheffield Electricity Department, Mr. Wilson Mappin objected to the offer which is being made to supply current for lighting at a discount of 50 per cent. on condition that all gas-burners were removed from the consumers' premises. Nevertheless, he contended that even at 2d. per unit with metal filament lamps, the cost of lighting by electricity would still be more than double that of gas. Mr. Wilson Mappin also repeated the usual statement that the City of London and the City of Westminster have displaced electricity by gas, whereas our readers hardly need reminding that only a very few lamps have been displaced in Westminster, and that in the City of London experiments are being carried out with a view to finally determining the question.

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General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd, N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Tudor Accumulator Co. Ltd., 119, Victoria St., S.W.

AIR COMPRESSORS.
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Wheatley Kirk, Price & Co., 46, Watling St., E.C.

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British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

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British Thomson-Houston Co., Ltd., Rugby.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.
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London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Union Electric Co., Ltd., Park Street, Southwark, S.E.

ARMATURE REPAIRS.
Higginbottom (J.) & Co., Blenheim St., Chelsea, S.W.
Marryat & Place, 28, Hatton Garden E.C.

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Fraser & Chalmers, Ltd., 3, London Wall Buildings, E.C.
Hawksley Wild & Co., Ltd., Brightside, Sheffield.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Rickard (Wm.), Ltd., Ashbourne Road Mills, Derby.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Mirrlees Watson & Co., Ltd., Glasgow.
Willans & Robinson, Ltd., Rugby.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

FIRE EXTINGUISHERS.
"Kyl Fyre," Ltd., Eastbourne.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Crossley Bros., Ltd., Openshaw, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.

HEATING AND COOKING APPARATUS.
Bastian Electric Heating Syndicate, Ltd., Palmerston House, Old Broad St., E.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87-89, Cleveland Street, W
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.

INSULATING MATERIAL.
Weidmann (H.), Rapperswil, Switzerland.

INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.
Ruberoid Co., Ltd., 81 & 83, Knightrider St., E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
The Fredk. Crane Chemical Co., 22 & 23, Newhall Hill, Birmingham.

LAMPS (Incandescent).
Boddy (G. M.) & Co., 15, Gray's Inn Road, W.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co, Ltd., Trafford Park, Manchester.
Brush Electrical Engineering Co., Ltd., 1, Kingsway, W.C.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Horvath (S.), 51, Standen Rd., Southfields, S.W.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Krupka & Jacoby, 11, Queen Victoria St., E.C.
Philips Metallic Glowlampworks, Ltd., Eindhoven, Holland.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn-Electric Lamp Co., Ltd., 47, Victoria St., S.W.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

METERS.
Bastian Meter Co, Ltd., Kentish Town, N.W.
British Thomson-Houston Co., Ltd., Rugby.
Ferranti, Ltd., Hollinwood, Lancs.

MICA AND MICANITE.
Jaroslaw (D.), 5, George St., Tower Hill, E.C.

MINE EQUIPMENTS AND APPARATUS.
A. E. G. Electric Co., Ltd., 133-135, Oxford St., W.
British-Thomson Houston Co. Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Reyrolle & Co., Ltd., Hebburn-on-Tyne
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Spagnoletti, Ltd., Goldhawk Rd., W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr &.Co., Ltd., Abchurch Yard, E.C.
Electromotors, Ltd., Openshaw, Manchester.
General Electric Co., Ltd., 67, Queen Victoria St. E.C.
Ingleby & Co., Elland Road, Leeds.
J. L. Manufacturing Co., Ltd., Southall.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
Wilson-Wolf Engineering Co, Ltd., Bradford.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.
Sokal (S.), 55, Chancery Lane, W.C.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
Willans & Robinson, Ltd., Rugby.

RESISTANCE WIRE.
Drennan, Glover & Cooper, 429-431, Corn Exchange Buildings, Manchester.

SIGNS (Electric).
Krupka & Jacoby, 11, Queen Victoria St., London, E.C.

STEAM CONSUMPTION RECORDERS.
Lea Recorder Co., 28, Deansgate, Manchester.

STEAM ENGINES AND TURBINES.
Belliss & Morcom, Ltd., Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
Vickers, Sons & Maxim, Ltd., Sheffield.
Willans & Robinson, Ltd., Rugby

SWITCHGEAR.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Electrical Apparatus Co., Ltd., Milford Works, Queen's Rd., Battersea, S.W.
Ellison (George), Warstone Lane, Birmingham.
Ferranti Ltd., Hollinwood, Lancs.
Reyrolle & Co., Ltd. Hebburn-on-Tyne
Spagnoletti, Ltd., Goldhawk Rd., Shepherd's Bush, W.
Union Electric Co., Ltd., Park St., Southwark, S.E.

TECHNICAL BOOKS AND JOURNALS.
Blackie & Son, Ltd., 50, Old Bailey, E.C
Cassell & Co, Ltd., La Belle Sauvage, E.C.
Constable (Archibald) & Co., Ltd., 10 Orange St., Haymarket, W.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W
Electric Journal, 422, Mansion House Chambers, E.C.
Gresham Publishing Co., 34, Southampton Street, Strand, W.C.
Griffin (Charles) & Co., Ltd., 12, Exeter Street, Strand, W.C.
Lewis's Scientific Circulating Library, 136, Gower Street, W.C.
Longmans, Green & Co., 39, Paternoster Row, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.
Western Electric Co., Ltd., North Woolwich, E.

TESTING LABORATORIES.
Electrical Standardizing & Testing Institution (Faraday House), 62-70, Southampton Row, W.C.

VENTILATION AND FANS.
Wilson-Wolf Engineering Co., Ltd., Bradford.

VULCANISED FIBRE.
Mosses & Mitchell, 122-124, Golden Lane, E.C.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

A Paper by Messrs. H. A. Ratcliff and A. E. Moore, read before the Institution of Electrical Engineers on Thursday last, discussed the merits and faults of the various types of D.C. and A.C. meters, and contained much useful information about testing. The authors are strongly in favour of watt-hour meters as opposed to ampere-hour meters. Some objections were raised against the mercury motor meter, while commutator type and electrolytic ampere-hour meters were very severely criticised. The Aron meter was highly spoken of. Tests on the effect of wave form on A.C. meters, and experiments proving interaction between the elements of polyphase motors, were described. The discussions in London and Manchester brought out many interesting points. (Page 163.)

A table of statistics of the comparative cost of street lighting by gas and electricity in different towns and boroughs has been prepared by the Wimbledon Electricity Department. (Page 165.)

Among the Specifications published by the Patent Office on Thursday last was one by the Foster Arc Lamp & Engineering Co. for a water heater comprising two concentric cylinders with a helical water passage between them, and connected to a transformer within the inner cylinder. A rail bond of fine wires to give flexibility, and armoured with heavy wire, is covered by the British Thomson-Houston Co. A patent by G. Ellison for a time-lag device for circuit breakers has been granted in spite of opposition. The patent for the Johnson-Lundell field construction for motors, in which a single field coil is used, and a patent by F. Steinert for a magnetic separator, expire during the current week after the full life of fourteen years. (Page 166.)

A system of non-interchangeable cartridge fuses is described, some curves of life tests of a particular make of metal filament lamp are given, and an instrument for calculating motor horse powers and currents is explained on page 167.

A letter from Simplex Conduits, Ltd., continues the discussion on meters and defends the commutator motor type. (Page 167.)

We describe highly satisfactory tests which we have carried out on some soldered aluminium joints. The new flux and solder used are applied in the usual manner. (Page 168.)

The Luton Corporation Bill, which was passed by a House of Commons Committee last week, contains municipal wiring powers, but the work is to be carried out through contractors. (Page 168.)

The Glasgow Assessment Committee have refused to alter the assessment of the tramways, and the Tramways Committee are appealing.—Stepney Borough Council have again refused to allow the trolley system in their district.—An increase of ½d. per unit for private lighting is to be made at Beckenham to counteract the reduced revenue due to metal filament lamps.—The Fulham Council have refused to adopt a suggestion of the L.C.C. to repay some existing loans in 20 years instead of 42 years.—The Victorian Government propose to purchase the Melbourne tramways.—The Hammersmith Council are to undertake the wiring and fitting of lamps for outside shop lighting, but to carry on the work through contractors. (Page 169.)

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SWITCHBOARD extensions are required at Handsworth; cable and troughing at Rugby; reversible booster and switchboard at York; motor-generator and balancer, and arc lamp carbons at St. Pancras; boilers, generator, and condenser at Bermondsey; flame arc lamps at Blackpool; and a 1,500-kw. turbo-alternator, condensing plant, and switchgear at St. Helens. Loans have been sanctioned as follows:—Beckenham, £6,000; Battersea, £1,400; Hackney, £20,599; Bury, £72,000; Kettering Corporation propose to take up a loan of £13,100. A generating plant is required at Cavan (Ireland), and three years' supply of electrical fittings is required at H.M. Office of Works. (Page 169.)

AFTER meeting all charges, the British Aluminium Co. is enabled to carry to reserve the sum of £4,943 as a result of the trading for 1910. A satisfactory report for 1910 is made by the South Wales Electrical Power Distribution Co. There was a loss of £9,300 for 1910 by the Durham Collieries Electric Power Co. New capital is being issued by the Lancashire Electric Power Co. (Page 171.)

The Telephone Service.—We have received from Mr. H. Laws Webb a long letter, in which he repeats his plea made in a Paper read in February before the London Chamber of Commerce for the establishment of a Board on which the Government, Municipalities, and Chambers of Commerce would be represented, to conduct the telephone system instead of the transfer of the whole to the Post Office.

Birmingham Local Section of the Institution of Electrical Engineers.—The Committee are putting forward the following list of nominations for the officers for the session 1911–12: *Past Chairmen*—R. A. Chattock, Gisbert Kapp, R. K. Morcom. *Chairman*—M. Railing. *Vice-Chairman*—A. M. Taylor. *Present Ordinary Members of Committee (remaining in office)*—J. H. Barker, W. C. Goodchild, M. Kloss, W. J. Larke, F. M. Lea, F. J. Moffett, D. K. Morris, C. E. C. Shawfield, W. E. Sumpner, R. Threlfall. *Ordinary Members of Committee*—M. Solomon, J. J. Steinitz. *Hon. Secretary*—H. B. Matthews. Any further nominations must reach the Hon. Sec. by April 19th. If none are sent in, the above gentlemen will be declared elected at the annual meeting on May 3rd.

ARRANGEMENTS FOR THE WEEK

FRIDAY, MARCH 31ST.

Institution of Civil Engineers.

8 p.m. Lecture II.: "The Uses of Chemistry in Engineering," by J. Swinburne, F.R.S.

WEDNESDAY, APRIL 5TH.

Institution of Electrical Engineers: Yorkshire Section.

7 p.m. At Leeds University. "Public Electric Supply in Country Districts," by W. B. Woodhouse.

THURSDAY, APRIL 6TH.

National Electrical Manufacturers' Association.

2.30 p.m. Council Meeting at Balfour House, Finsbury Pavement, E.C.

Institution of Electrical Engineers.

8 p.m. "Wireless Telegraphy Working in Relation to Interference and Perturbations," by J. E. Taylor.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science.

FRIDAY, APRIL 7TH.

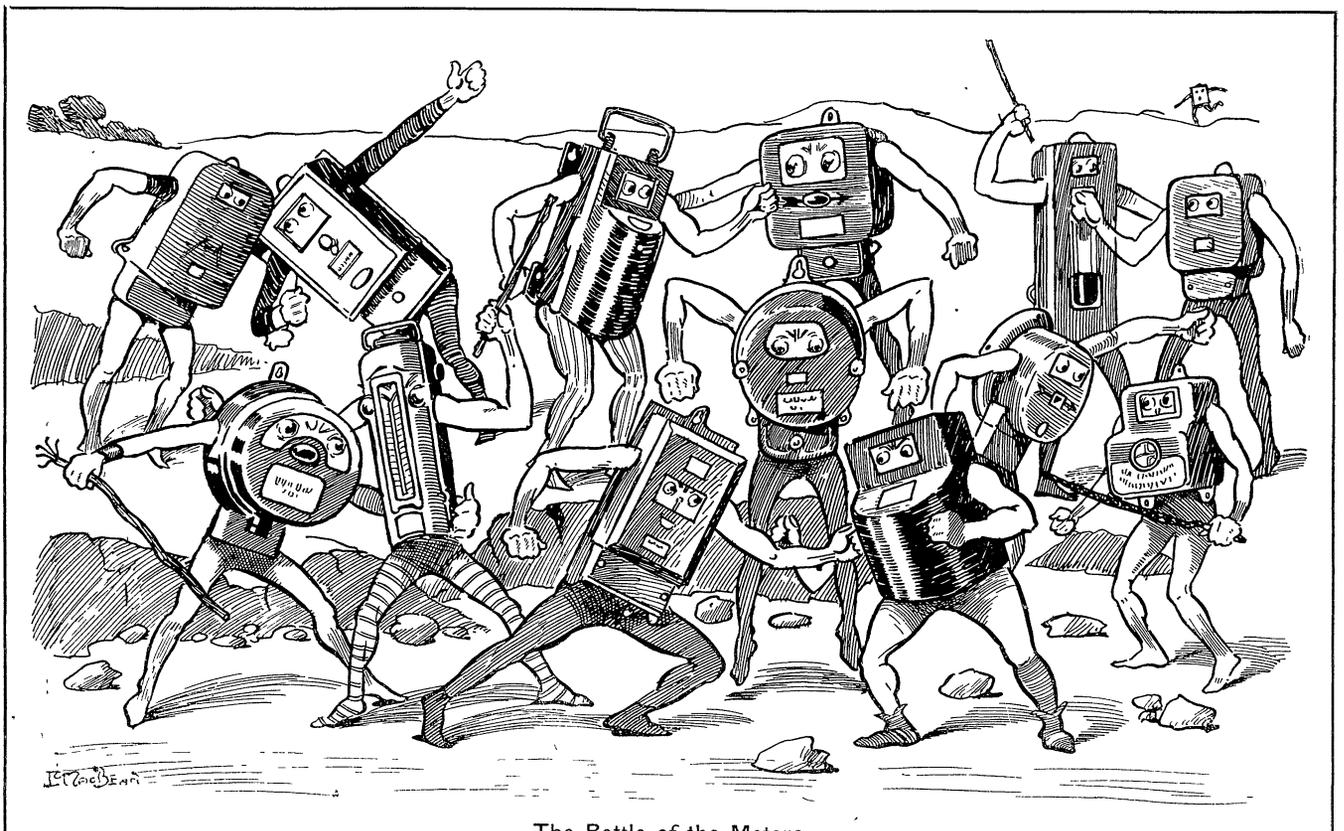
Royal Institution.

9 p.m. Evening Discourse:—"A New Method of Chemical Analysis," by Prof. Sir J. J. Thomson, F.R.S.

"Mazda" Trade Mark.—Mr. Justice Swinfen Eady on Friday granted an interim injunction against Messrs. T. L. Scott & Co. preventing the use of the trade mark "Marsa" in connection with the sale of electric lamps. The interim injunction was granted on the application of the British Thomson-Houston Co., Ltd.

Constantinople Telephone System.—After very protracted negotiations, a concession has been granted for the establishment of a telephone service in Constantinople. As we have previously pointed out, the negotiations have been carried on by Mr. H. Laws Webb, representing a combination of the National Telephone Co., Ltd., Western Electric Co., of America, British Insulated & Helsby Cables, Ltd., and the French British Thomson-Houston Co. The first exchange to be constructed will provide for 10,000 subscribers. The total area to be served is 150 square miles, and as Constantinople is divided by the Bosphorous, a number of submarine telephone cables will have to be laid.

Meters Approved.—The Board of Trade have approved the following meters:—Westinghouse, types N. and A. polyphase watt-hour meters; Chamberlain & Hookham, two-rate C.C. meter; Ferranti polyphase watt-hour alternating-current meter; Electrical Co.'s three-phase induction watt-hour meter, type D. 3; and the Aron polyphase motor-meter, type H.



The Battle of the Meters.

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ELECTRICITY METERS

A PAPER by Messrs. H. A. Ratcliff (Manchester Electricity Department) and A. E. Moore (Manchester Municipal School of Technology), read before the Institution of Electrical Engineers in London on March 23rd, and before the Manchester Section on March 21st, discussed the merits and demerits of the various patterns of A.C. and D.C. meters, and included some useful notes on testing. The authors consider that as a rule meters should be overhauled and recalibrated at the end of five years. Where low rates of charging are in force an error of 2 or 3 per cent. may make all the difference between profit and loss, and in such cases the authors suggest that duplicate meters should be installed. Considering first D.C. meters, the authors hold that only watt-hour meters should be legally recognised, as apart from measuring the energy correctly independently of voltage variations, they may be compounded so as to start with exceedingly small currents. They consider that the shunt losses in watt-hour meters are far less important than the loss of revenue with ampere-hour meters, due to the fact that the mains pressure is often above the declared pressure.

Of the three types of ampere-hour meters, the mercury motor meter is that most largely used in this country. It is difficult to get a sufficiently high driving torque in small meters of this type. The most frequent fault is amalgamation, which seems to be only a matter of time even with the best protected armatures. Oxidation of the mercury also occurs in time. A new design employs an extremely small air-gap, and an amalgamated armature devoid of compensation for friction, but this would only give good results if the copper and mercury could be kept chemically pure. It is now usual to shunt all mercury meters above 50 amperes, and some makers shunt above 10 amperes. This also reduces the temperature error, but, unless the inductances of the two circuits are balanced, errors will be introduced on fluctuating loads.

The commutator type D.C. ampere-hour meter will, the authors consider, soon be discarded on account principally of its susceptibility to changes in brush position and contact resistance. Typical curves plotted from the mean results of a large number of meters show that whereas the error of the mercury meters tested was not more than 1·5 per cent. between one-tenth and full load, that of the commutator meters averaged 7 per cent. at one-tenth load, though they were of better accuracy at medium loads, the meters being calibrated for accuracy at full load in each case.

Turning to electrolytic meters, the authors state that "their disadvantages . . . so completely outweigh their advantages that they can hardly be regarded as cheap, even at the present low prices." They have not the extreme accuracy claimed, and the lack of a continuously registering device is a serious matter. Correct reading of the scale is difficult, and the construction is generally fragile. A most frequent source of trouble is leakage of the electrolyte between the glass and the platinum leading-in wires.

D.C. watt-hour meters are nearly all on the true dynamometer principle, a notable exception being the Aron meter. The simple revolving armature type, if sold at a reasonable price, should be a serious rival to the mercury ampere-hour meter. The authors consider the small-diameter commutators frequently used to be very unsuitable, and prefer robust commutators with a larger number of segments. Footstep bearings are a frequent source of trouble, owing to the comparatively heavy weight of the rotating portion. A spherical-ended shaft is to be preferred to a pointed one, and the use of a ball-bearing is suggested. The removable spindle-tips used by one well-known firm are a distinct advance.

The Aron meter, the authors state, is probably the most complicated, but at the same time the most reliable watt-hour meter made. It is astatic, and therefore not affected by stray fields, and is not affected by momentary overloads or short circuits. A definite indication is given when the meter is out of order, and it is very unusual for a gradual error to develop. When shunted, however, it cannot be used on A.C. circuits, and in all patterns testing is difficult. A frequent source of trouble is pitting of the pendulum arbor pivots, probably due to chemical action caused by the vulcanised fibre blocks used for insulating the terminals, a material which is in any case unsuitable for use in meters or instruments. There are about twenty-four clamped connections in the shunted type, and as the drop in the shunt is only 0·2 volt at full load, troubles due to bad contacts are only a matter of time unless the contacts are soldered. After considerable experience, however, the authors consider that a meter free from permanent magnets, such as the Aron meter, is the only type capable of withstanding the severe conditions which exist in large D.C. stations, as overloads and external fields are sufficient to destroy the calibration of all meters with permanent magnets. One of the authors has seen a dynamometer watt-hour meter stop at about one-third load, and actually reverse at one-quarter load due to the effect of a stray field. The effect of the series coils of a meter in the case of a short circuit is also often very considerable. The permanent magnets should be carefully shielded and the torque-producing coils astatically wound.

The authors consider that shunts are undesirable on any type of meter, and should be avoided for all meters not exceeding 1,000 amperes capacity. With regard to tramway meters, they do not think that there is a meter on the market capable of withstanding the severe conditions for any length of time.

The induction type A.C. meter, continue the authors, probably represents 75 per cent. of the total sales of A.C. meters, but for station work and heavy-service conditions, where accuracy and reliability are essential, the dynamometer types are to be recommended. Probably the best method to increase the driving torque of induction meters is to increase the driving fluxes and to use a stronger braking system instead of increasing the size of the rotating part. A lower speed gives better accuracy. The quadrature adjustment can be made by testing the meter with a lagging and a leading power factor, and also at unity, the quadrature being regarded as correct when the error is the same under all three conditions.

Dynamometer meters are unsuitable for working off current transformers on circuits with low power factors, as the error due to the inductance of the volt coils is intensified by the effect of the lead in the transformers. This error can be partially corrected by eddy currents induced in suitable closed circuits or by shunting the series coils; but the meter will only then be suitable for one frequency, and will be affected by changes in temperature and wave-form.

The accuracy of polyphase meters, which are often only single-phase meters, depends on many assumptions the correctness of which is doubtful. The only reliable ones are those consisting of two or more single-phase elements which admit of being tested separately on a single-phase circuit, the measurement of energy being obtained on the principle of the "two wattmeter" method of measuring power.

Turning to testing, the authors emphasise the importance of connecting up the shunt coils of a meter at least half an hour before observations are commenced in order that the normal running temperature shall be reached. The shunt and series coils are supplied from different sources, and, in both cases, if transformers are used, it is important not to adjust by means of resistance in the primary, as this alters the wave-form in the secondary. Of the different methods of phase adjustment, the use of two machines, one provided with a movable stator, is considered the best. A combined phase adjuster and voltage regulator has been used successfully by the Manchester Electricity Department for several years. This consists of an ordinary D.C. drum armature surrounded with a ring of tightly fitting annealed iron stampings. The three-phase supply is connected to the winding at six equidistant points, and a rotary field is produced. The brushes bear each on one segment only of the commutator, and cannot bridge across the insulation.

The authors describe several series of tests. One set shows that it is not satisfactory to obtain different phase relations by connecting the series coils of the meters to one part, and the shunt coils to another part of a three-phase system, as the theoretical phase relations are disturbed by the unbalanced load. Other tests show that the readings of all makes of induction meters are affected by variations in wave-form, and that with certain very abnormal waves errors as high as 27 per cent. can be produced. Meters of the dynamometer type, however, are hardly affected at all. Investigations were also made with polyphase meters, and the tests show how the power factor of the system affects the ratio of the watts on the two meters, and also how the equivalent power factor of each meter is affected by the power factor of the load. Finally, some tests are given showing that there is considerable interaction between the two elements of polyphase meters, with the result that the speed of the meter is appreciably affected by the relative phases of the two fluxes.

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DISCUSSION IN LONDON.

Mr. S. H. HOLDEN (Messrs. Chamberlain & Hookham) suggested that the Engineering Standards specification should state what errors due to variations in wave form were to be allowed, and also give instructions as to how meters were to be tested. He had known many mercury meters which had been in use for seven or eight years, and still registered accurately. He knew of several makers of tramcar meters who were prepared to guarantee to keep them in working order for 20 years at 3s. 3d. per meter per annum, and in this connection he read a letter from Mr. Baker, the General Manager of the Birmingham Corporation Tramways, which stated that since December, 1909, all his cars had been fitted with meters, and that during the past twelve months a saving in current amounting to £5,000 had been effected, in spite of the cars having run 50,000 more car miles In addition, there had been considerable savings in the wear of brake shoes, wheel tyres, &c., consequent upon the more careful management of the cars by the drivers.

Mr. S. W. MELSOM (National Physical Laboratory) said that meters were usually calibrated at about 15° C., and used in a power station at about 25° C., and he suggested that makers should label their meters with the temperature at which they were standardised and the temperature coefficient. Another source of error was the heating inside. It was found at the National Physical Laboratories that some meters heated up very considerably; in one case there was a difference of nearly 5 per cent. at full load between the reading when the meter was cold and that after it had had time to heat up. The comparison of watts lost in mercury meters and watt-hour meters was very unfair. The Engineering Standards specification prescribed 4 watts per 100 volts, and records showed that the average pressure coil losses in 200-volt watt-hour meters were 6 watts, and not 4 watts as taken by the authors. Further, the losses in the main current coils of watt-hour meters were about three times as large as in the current circuit of any ampere-hour meters.

Mr. E. GARTON, referring to the new mercury meter with amalgamated armature, said that he had been obtaining both copper and mercury chemically pure for the last four or five years. He agreed that the induction meter was more efficient than the dynamometer type. He did not think that central station engineers would agree that an increase in the price of meters was justifiable. With regard to the alleged errors in shunted mercury meters due to variations in resistance of the bath, he pointed out that in a certain meter which he had tested the drop across the bath was only two millivolts, whereas that across the leads in series with it were 30 millivolts. Consequently, if the full resistance of the bath was even doubled, which was extremely unlikely, the error would only be from 6 to 7 per cent.

Mr. L. W. WILD (Westminster Testing Laboratories), referring to his own experiments on the effect of wave form, said that with peak waves he had obtained errors in one direction, and that with smooth flat-top waves the errors were in the opposite direction. According to the authors' results, however, the errors were in the same direction in both cases, but the authors' flat-top curves were not smooth, and had features peculiar to the peak wave. His practice in testing polyphase meters was to connect the current coils in series and the shunt coils in parallel, and to take two tests, reversing the connections. This often gave a difference of as much as 2 or 3 per cent., and he took the mean. Interaction troubles were bound to occur unless one could get the phases exactly as under working conditions, and he thought the above method was as good as any. He did not think it difficult to measure the ratio and phase differences of series transformers, but he agreed that it was necessary to test meters with their series transformers, as even in the case of single-phase meters there were interactions between the volt and ampere coils when transformers were used.

Mr. K. EDGCUMBE (Messrs. Everett Edgcumbe & Co.) said that a most difficult class of meter user to deal with was the isolated plant which in the ordinary course had a very small load for 360 days of the year, while during the remaining 5 or 6 days some very big functions were held and the load went up enormously. In this case he thought the right thing to do was to adjust the meter accurate for low loads and let the accuracy of the upper part of the curve look after itself. The authors had adopted a rather roundabout way of adjusting for quadrature. It was simpler to adjust for standing still at 90° out of phase, although the authors apparently raised the objection to this that the watt-meter used could not be relied upon. It was more satisfactory to use a power-factor indicator for the purpose.

Mr. C. A. BAKER (London County Council) suggested that meters of large consumers should be checked every three or six months. The references in the paper to the ampere-hour meter showed the necessity for having pressure testing stations on mains. At present there were 40 such stations in London, and others were being equipped. He agreed with the authors' criticisms of the electrolytic meter. It was surprising that these meters had ever received the Board of Trade approval. The 1 per cent. error suggested by the authors was highly desirable. On top loads most meters came well within 1 per cent. He was sorry to see the Board of Trade dropping the light load test on meters altogether, below one-tenth load, for anything except small ampere-hour meters. The difficulty with regard to country house plants also existed in connection with certain town houses, which during nine or ten months of the year were only burning a few lights, but were paying large bills because the meters were working on the low part of the curve, and were not registering very accurately.

Mr. A. P. TROTTER did not agree with the authors in regard to the relative losses of ampere-hour and watt-hour meters. The watts lost in the coils of the latter were very serious, and larger than those of the ampere-hour meter, and for this reason it was impossible to make a small watt-hour meter, *e.g.*, for a current, below three amperes. Now was the time to encourage the small meter, and if small meters were not going to be made, supply undertakers could do without meters altogether. Dealing with the Board of Trade approval of meters, he said that a commutator ampere-hour meter with an error curve such as that given in the Paper would never pass the Board of Trade test, nor would a meter which was likely to get into that state after two or three years. He had been blamed apparently for passing an electrolytic meter, but he did not want to discourage the new designs of meters that were being manufactured. There were at present 38 different patterns on the market and 20 in hand, and the various electrolytic meters that he had seen were not so bad as was suggested. The authors had high ideals as to the permissible percentage error, and he could not help feeling that a 1 per cent. error could not be had at present prices. A rather larger error might be allowed for polyphase meters than for singlephase meters, because of the great difficulty of balancing. With regard to the wave-form tests, the consumer with a big load, seeing differences of 20 per cent., might ask what was the good of having a meter at all, and the authors should have pointed out that they were somewhat fancy curves and not found in practice. Ever since the Board of Trade Laboratory had started, the inspectors were instructed to insist upon a maximum error of 2½ per cent., plus or minus, above one-tenth load for ordinary meters of ordinary sizes. Some years ago it was found that there was a very obvious demand for small meters of less than 3 amperes, and in the case of these small meters it was suggested, in order to encourage them, that the error should not be more than 3½ per cent., plus or minus. This had been going on for the past ten years. With regard to the larger meters, it was on the suggestion of the London County Council that the Board of Trade made provision for meters above 50 amperes. These were tested for a maximum error at one-twentieth full load of 2½ per cent. plus.

Mr. S. EVERSHED (Messrs. Evershed & Vignoles), referring to the demagnetisation of brake magnets, said that the short-circuit current on an ordinary 100-volt circuit, when the fuse was blown, was 30 times the full-load current. Professor Schwarz had proved that the current had ample time to reach its steady value, and this was easy to calculate. It was only necessary (by putting full-load current through the meter) to determine the ratio of the drop across the meter to the supply voltage, and this gave the figure by which they must multiply the full-load current to find the short-circuit current. If the drop was 3 volts and the supply 100 volts, then the short-circuit current would be 30 times. In most types of meters under these conditions the magnets would be either partially or absolutely demagnetised, and the only way of getting over it was to make the meter larger. Finally, he gave a formula representing the accuracy of the commutator type ampere-hour meter, and asserted that the makers had not taken advantage of any of the possible methods of improving the accuracy. The best meter of this pattern he had tested had an error of 20 per cent. at one-tenth full load.

Mr. RATCLIFFE, in reply, expressed the opinion that 12 months was the outside limit for reasonable accuracy with tramcar meters. With regard to temperature error, the authors specified a maximum limit of variation with temperature rise, although they would like to get a greater degree of accuracy. In the Aron meter the temperature error was practically nil. With regard to the calibration of meters for isolated plants or town houses, he did not know what the legal position would be if accuracy on the higher loads were ignored. He had not yet come across a really satisfactory single-phase power-factor indicator. He thought a very good small watt-hour meter could be made with a drop of 1½ volts. The trouble with the small commutators was not only mechanical, as the insulation often broke down.

Mr. MOORE also replied briefly.

A letter dealing with this discussion will be found on page 167.

DISCUSSION AT MANCHESTER.

Mr. G. NORTH (British Westinghouse Co.) said that the loss of revenue due to defective meters was usually far more important than the pressure coil loss. The saving with watt-hour meters due to increased registration at low loads as compared with ampere-hour meters would more than compensate for the pressure coil loss. Speaking as a meter manufacturer, he would point out that it was quite possible to reach high

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accuracy, but that manufacturers could necessarily only make their meters as good as was consistent with the price obtainable for them. How often was the Aron meter used as compared with other less perfect types of meters? Commutator meters could be obtained to give fairly consistent results with direct current, but were absolutely no good on A.-C. circuits, as the vibration of the moving element wore out the jewels and pivot bearings in one-quarter the length of time they lasted on D.C. circuits. The induction meter was, he thought, the nearest approach to the ideal. A high torque was not so necessary, as there was no brush friction. Induction meters were bound to be affected by wave form, but the authors' tests showed that a sufficient degree of accuracy was obtainable under practical conditions. He never recommended the balanced type of polyphase meter, but one generally had to quote customers for both the balanced and unbalanced patterns.

Mr. H. E. TRENT (General Electric Co.) said that errors were largely due to the meters being placed in abnormal positions as regards temperature and stray fields. One could not expect a cheap, thin iron case to shield a meter against the stray fields if it were placed close to the 'bus-bars.

Mr. A. E. JEPSON (General Electric Co.) thoroughly agreed with most of the remarks in the Paper. Watt-hour meters could be bought for a very few shillings more than ampere-hour meters, and the extra cost was often soon paid for where the voltage was above normal. A black powder, apparently pure mercury, was found in the mercury chambers of some meters, and this might alter the resistance of the bath and cause errors in a shunted meter. He thought that a good commutator type ampere-hour meter could be obtained if a good price were paid for it. Repairs were very simple with this pattern. A damped type meter should not require a higher working pressure across the armature. It was essential that jewel bearings should be mounted on springs to prevent breaking of the jewel. Referring to the criticisms of the Aron meter, he did not think the testing any more difficult or tedious than that of other meters. Partial shunting of the pendulum coils due to dirt between the commutator segments was rare and easily remedied. Pitting of the pendulum arbor pivots was now prevented by the use of an acid-free insulating material, "Stabilit." All the connections in the shunted circuit were now soldered.

Mr. F. WALKER mentioned a meter which had been working for eight years, and was now, if anything, more accurate than when it was first put in.

Mr. W. GRANT (Manchester Municipal School of Technology) did not think that a supply authority could legitimately charge for excess units caused by the supply pressure being above the normal. The lamps were overrun and the consumer was paying for something he did not want. Commutator type ampere-hour meters were very flimsy, and were often unprotected from external fields. With regard to polyphase meters, one firm recommended the use of two separate meters, on account of the interaction troubles with a combined meter.

Mr. R. G. CUNLIFFE (Manchester Corporation Tramways) said that about 20 tramcar meters were being used in Manchester with perfect success, the results not varying more than 5 per cent. from month to month.

Mr. BOLTON SHAW thought that the many advantages consequent upon the use of two single-phase meters on polyphase circuits justified the extra cost as compared with a combined meter. Any change in the ratio of the two instruments was readily noticeable on the log sheet before the error affected the record to any extent. Two single-phase meters also provided a means of estimating the average power-factor over any period.

Mr. L. C. BENTON (British Westinghouse Co.) understood that the authors preferred a polyphase meter to two single-phase meters. Manufacturers could not, he said, be expected to attain 1 per cent. accuracy until the tests by various standardising laboratories agreed within this degree. Tests on large meters on inductive loads were by no means in close agreement.

Mr. W. CRAMP asked whether the authors had made tests of accuracy with meters running in the reversed direction. He thought that the extreme accuracy desired might not justify the cost of obtaining it; the accuracy now obtained was far in advance of that of gas meters. Permanent magnets could be made of such a shape that the yoke shielded the poles. The accuracy of the Aron meter was due, he thought, to the fact that the timing mechanism was driven independently of the registering mechanism.

In reply, the authors held that the higher voltage drop of commutator ampere-hour meters of the damped type had been proved by tests. Experience showed that the curves of Aron meters were not always straight lines, and that tests on several loads were necessary. The testing temperature fixed by the British Engineering Standards Committee was 60° F., and was probably a fairly average one. It was not unusual for the mercury to be shot out of mercury motor meters as a result of a severe short-circuit. They had had no experience with reversible meters. D.C. meters were not, as a rule, accurate when reversed, and A.C. meters would also not be accurate if compensated for friction in one direction only. Excellent results had been attained with Aron reversible battery meters.

COST OF STREET LIGHTING: GAS COSTS NEARLY THREE TIMES ELECTRICITY

MR. H. TOMLINSON-LEE, Chief Electrical Engineer to the Wimbledon Borough Council, has sent us a table compiled by Mr. Dudley Stuart, Chairman of the Lighting Committee, and himself, which compares the cost of gas and electric street lighting in twenty-eight towns and boroughs. The table is calculated from particulars obtained from the public authorities themselves last December, and the figures include all renewals, repairs, and attendance:—

TOWN OR BOROUGH.	Cost per c.p. per ann. Electr.	Gas.	TOWN OR BOROUGH.	Cost per c.p. per ann. Electr.	Gas.
	Pence.	Pence.		Pence.	Pence.
Bournemouth ...	3·82	7 51	Kingston ...	8·21	19·27
Blackpool ...	7·28	21·60	Lambeth ...	——	10·47
Chelsea ...	——	5·52	Lewisham ...	——	14·87
Camberwell ...	——	10·57	Leyton	7·57	——
Deptford ...	——	9·46	Paddington ...	——	11·41
Ealing ...	4·20	9·39	Poplar ...	10·40	17·77
Eastbourne ...	3·31	15·93	Portsmouth ...	2·34	——
Finsbury ...	——	6·95	St. Pancras ...	3·83*	13·11*
Fulham ...	4·66	21 63	Southwark ...	2·55	5·73
Gloucester ...	5·39	9·80	Wandsworth ...	1·23*	7·88*
Hammersmith...	9·32	16·58	Woolwich ...	3·15	12·24
Hampstead ...	4·07	——	Wood Green ...	——	8·49
Holborn ...	——	9·21	Wimbledon ...	5·08	——
Harrogate ...	4·70	——	**Average** ...	**4·96**	**12·25**
Islington ...	3·13	16·56			

* Candle power estimated.

It is seen that the most extreme case is that of Islington, where electric light for the same candle power costs less than one-fifth that of gas; in this case the majority of the electric lamps are arc. At Fulham, however, where there are 914 incandescent electric lamps and 226 arcs, the ratio of the cost of gas and electricity is about the same. The best figures for gas are at Chelsea, Finsbury, and Southwark, and in the first two of these inverted burners are employed. Even these are far greater than the lowest figures for electric light, and well above the average.

The statistics sent us also give the total cost of lighting per annum per mile of street, including both gas and electric lighting, and this varies from £60 to £377, with an average of £152. The approximate lighting rate per £ per annum varies from 1·4 to 5·67 pence, with an average of 2·78 pence. The total candle power used per mile also shows wide variations—from 968 to 12,165, with an average of 4,892.

Of course the whole value of these figures depends on the way in which the candle powers have been estimated, as there are difficulties in the comparison of lamps of different distribution curves on a candle-power basis alone. In all probability, however, this error has cancelled out fairly well in the final averages, and, in any case, the superiority of electric lighting is very clearly demonstrated.

Faraday House.—We are informed that the annual dinner of the Faraday House Old Students' Association will be held at the Holborn Restaurant, London, W.C., on Wednesday, April 26th, at 7 for 7.30 p.m. The President for the year—Mr. H. H. Perry, of the North Metropolitan Electric Power Supply Co.—will be in the chair. All Faradians who wish to be present are asked to communicate with the Honorary Secretary, Faraday House.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the Institution of Electrical Engineers on Thursday:—*Members*: S. S. Moore Ede, G. M. Harriss, P. L. Riviere. *Associate Members*: H. R. Baldwin, J. Burbridge, R. W. Clark, A. C. Coward, G. F. Findley, H. G. Jeken, E. W. Kay, W. C. Kirwan, F. E. Mitton, W. O. Pepper, W. G. Pickvance, H. K. Reed, P. M. Sanger, L. M. Silver, J. H. Thomas, E. O. Turner, W. F. White, J. L. Wilson. *Students:* E. P. Ashworth, A. J. Bates, S. Burns, W. G. Corben, L. G. Dimmer, W. D. Douglas, G. H. Elsden, W. S. Flight, E. A. Gordon, W. S. Harvey, W. E. Hatfield, H. J. Henwood, G. A. Hollings, G. Hughes, E. W. King, R. Levy, L. Lewis, C. W. Marshall, J. Meikle, M. A. Moharram, L. Norris, D. V. Oppenheim, A. C. Patel, R. L. Printz, E. L. Protheroe, H. W. Puttick, A. R. Teixeira, J. A. Tilburg, F. J. Tompson, R. Wenning.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published March 23rd, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

5,388/10. **Metal Filaments.** WESTINGHOUSE METAL FILAMENT LAMP CO. and A. LEDERER. Metal filaments purchased from manufacturers are further decarbonised by heating in an atmosphere of pure dry hydrogen only, as described in patent No. 6,936 of 1909. This permits of the amount of carbon present being reduced to 0·04 per cent.

6,065/10. **Water Heater.** FOSTER ARC LAMP & ENGINEERING CO. and M. V. ELY. A water heater for A.C. circuits consists of two concentric metal or carbon cylinders with an annular space between them for the water to flow through. This space is divided by means of insulating partitions into a helical passage. A transformer is situated within the inner cylinder, and its secondary is connected to the two cylinders, so that a heavy current flows through the water. As the voltage is very low, there is no danger of shock. Three figures.

8,363/10. **Electric Locomotives.** A. F. BATCHELDER (Schenectady, U.S.A.). In heavy locomotives, the motor is mounted directly over the driving wheel, and is connected by a coupling rod to an intermediate crank and axle in the same plane as the driving-wheel axle. In one design illustrated there are three driving wheels coupled together, and two driving motors mounted directly over the two outer driving wheels are coupled to intermediate axles at the ends of the locomotive, and in a line with the driving axles. One- or two-axle leading trucks are provided at each end of the locomotive. Five figures.

11,275/10. **Lamp Holder and Plug.** LONGSTRETH'S, LTD., and A. BAKER. A lamp holder for vehicles, &c., has an ordinary bayonet coupling above for engaging with the lamp cap, but has a socket underneath with a reversed coupling for the plug. The bayonet pins projecting inwardly from the socket, and bayonet grooves are provided on the plug connected to the flexible leads. Seven figures.

12,265/10. **Electric Driving of Rolling Mills.** BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*). When an induction motor is used for the main drive, and a D.C. motor for driving the finishing strand, trouble may arise with varying load due to relative speed variations between the two motors. This patent describes apparatus responsive to speed variations of the induction motor for controlling the speed of the D.C. motor so as to maintain a proportionality of speed between the two, and thus prevent the steel from buckling as it passes to the finishing strand. One figure.

25,964/10. **Speed Control of Polyphase Motors.** SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens Schuckertwerke Ges.*). The speed of polyphase commutator motors is usually varied by altering the voltage applied to the rotor winding through the commutator. According to this invention, the control is effected either by maintaining the total of the stator and rotor voltages constant and varying the exciting field, or by altering both voltages and field. The former is suitable when the torque decreases as the speed rises, the latter when the torque decreases with the speed. Various arrangements of the transformer connection between the stator and rotor circuits are described. Five figures.

30,138/10. **Rail Bonds.** BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*). In order that a rail bond may be both flexible enough to withstand the constant vibration without crystallising and breaking, and strong enough to withstand impact and abrasion, it is constructed of small gauge wires with an armouring of heavy gauge wires. In another form described, the body consists of concentric layers of strands of increasing thickness towards the exterior. Three figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: JABURG, 13,305/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: FRANCE [Wire, cable and tube joints] 6,138/10; SHARP [Insulating compound] 9,933/10; BEAVER, PREECE and CLAREMONT [Cable] 11,792/10; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Resistance wire alloys] 14,743/10; CHAMPION [Junction boxes] 15,731/10.

Dynamos, Motors, and Transformers: SIEMENS-SCHUCKERTWERKE GES. [Speed regulation of machines] 16,997/10; JOHNSON-LUNDELL ELECTRIC TRACTION CO. (*Lundell*) [Regenerative motors and their control] 21,339/10.

Electric Ignition: HALL [Sparking-plugs] 6,104/10; SIMS MAGNETO CO. [High-tension magneto apparatus] 16,844/10.

Electrometallurgy and Electrochemistry: WASSMER [Electric furnaces] 28,813/09; URBAIN, FEIGE & SCAL [Electric arc apparatus for sterilising liquids] 5,393/10; HEROLD [Primary cells] 13,739/10; A.-G. FÜR OZONVERWERTUNG (SYSTEM ELWORTHY-KOLLE) [Ozone apparatus] 3,119/11.

Heating and Cooking: BASTIAN [Domestic apparatus] 6,207/10.

Incandescent Lamps: SCOULAR and EVERETT, 5,289/10; STODD, 11,931/10; HARRISON, 15,424/10.

Switchgear, Fuses, and Fittings: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Lightning arresters] 211/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Mfg. Co., U.S.A.*) [Motor controllers] 5,278/10; CREESE and DEDERICH [Switches] 5,465/10; HALL [Cable terminals] 6,431/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Mfg. Co., U.S.A.*) [Speed controllers for motors] 13,406/10; ELECTRIC & ORDNANCE ACCESSORIES CO. and GARNER [Motor starters] 17,344/10.

Telephony and Telegraphy: WILLIS and JOHNSON [Signalling apparatus] 101/10; CONNER and PEEL-CONNER TELEPHONE WORKS, LTD. [Telephone systems] 14,916/10.

Traction: GRESHAM and KIERNAN [Vacuum brakes] 6,284/10; A.-G. BROWN BOVERIE ET CIE. [Drive of electric vehicles] 6,403/10.

Miscellaneous: BARCLAY [Prevention of overwinding] 20,182/09; HAILWOOD [Testing miners' lamps] 7,388/10; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Watchman's clock recorder system] 13,216/10; KAY [Miners' safety lamps] 13,892/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: MAXWELL [Squirrel-cage induction motors] 4,871/11; SIEMENS SCHUCKERTWERKE GES. [Cooling of rotors] 5,247/11.

Electrochemistry: ELEKTROCHEMISCHE WERKE GES. [Synthetic production of endothermic compounds] 5,281/11 and [Synthetic production of ammonia] 5,282/11.

Telephony, &c.: SIEMENS & HALSKE A.-G. [Automatic telephone exchanges] 2,733/11; FAIELLA [Telegraphic systems] 4,920/11.

Miscellaneous: BUCHERT [Apparatus for coating articles with insulating compound] 4,185/11; FÉRY [Electric clocks] 4,889/11.

The following amended Specification can now be obtained.

SCHERL [Gyroscopic stability mechanism] 27,590/09.

Opposition to Grant of Patent

24,115/09. **Time Lag Device for Circuit Breakers.** G. ELLISON. This patent has been allowed in spite of opposition. The specification was abstracted in ELECTRICAL ENGINEERING, Dec. 15th, 1910, Vol. VI., p. 796.

Amendment

18,909/05. **Electric Welding of Sheet Metal.** A. F. RIETZEL. With certain exceptions, this specification has been amended as desired by the owners, Pontelec Welding Patents, Ltd. An abstract of the patent and the proposed amendments were given in ELECTRICAL ENGINEERING, Dec. 22nd, 1910, Vol. VI., p. 812.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

8,376 of April 1st, 1897. **Magnetic Separators.** G. KENTLER and F. STEINERT. The material is carried up the ascending side of a wheel or belt of magnetic poles, and the current of each electromagnet is continuously switched on and off so as to shake up the particles of iron as they tumble from one magnet to another, thus causing particles of non-magnetic matter to be mechanically separated from the iron particles.

8,663 of April 5th, 1897. **Johnson-Lundell Field Winding.** A. HOLMES (*E. H. Johnson and R. Lundell*). This patent covers the field construction of the well-known Johnson-Lundell motor, in which a single field coil is arranged round the two pole pieces in such a manner that the armature can be removed without disturbing the field coil.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: W. WHITNEY [Electrodes containing titanium, &c.] 26,917/04; J. HÄRDÉN [Electrode composition] 26,919/04; W. S. WEEDON [Electrode composition] 26,922/04.

Electric Ignition: A. ECKSTEIN and H. J. COATES [Ignition system for internal combustion engines] 26,527/04.

Electrometallurgy, &c.: O. FRICK [Induction furnace] 25,771/05.

Switchgear, &c.: R. H. KNIGHT and L. NAGEL [Wiring-conduit joints] 25,669/05.

Telephony, &c.: C. J. and F. X. BELIN [Photo-telegraphy with selenium cells] 26,586/04; S. EISENSTEIN [Wireless telegraphy] 26,696/04.

Traction: C. H. WILLIAMS [Brake shoes] 15,672/05.

Miscellaneous: J. MCINTYRE [Induction coil trembler] 21,834/05; W. SIMPKIN and J. B. BALLANTYNE [Magnetic separator] 25,748/05.

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DIAL FUSES

THE Electrical Co., Ltd. (122–124 Charing Cross Road, W.C.), have introduced a system of non-interchangeable cartridge fuses and fittings to which the above name has been given. There are two types; in the "Dial A" fuses (for 2 to 25 amps.), the non-interchangeability depends both on the diameter and the length, and in the "Dial B" type (from 2 to 100 amps.) on the diameter only. The construction of the A type is shown in fig. 1, where the various parts of the

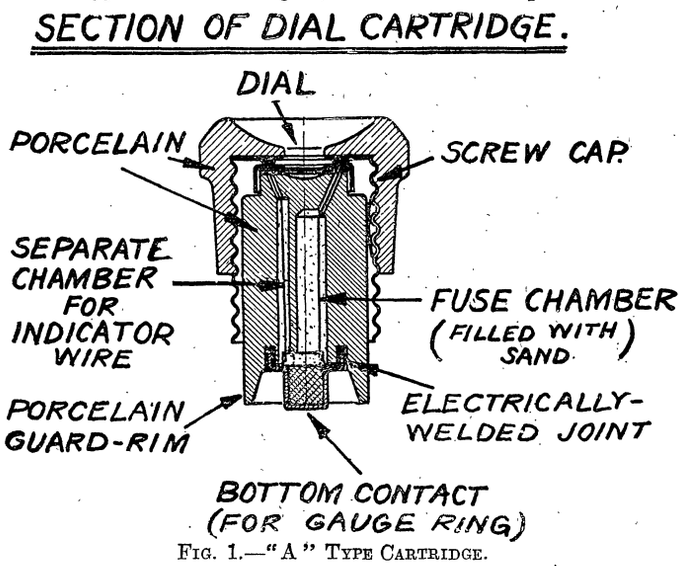


FIG. 1.—"A" TYPE CARTRIDGE.

cartridge are clearly shown. The bottom contact fits into a gauge ring forming part of the socket, and is of varying diameter, according to the capacity of the fuse. The upper contact is made by the screwing home of the cap, which carries a thread similar to that of an Edison screw lamp-holder. The complete cap, cartridge, and gauge ring of one of the B type fuses is shown in fig. 2. The principal difference is in the shape of the gauge ring and lower contact pin. The bases are made in a variety of forms, and the lower con-

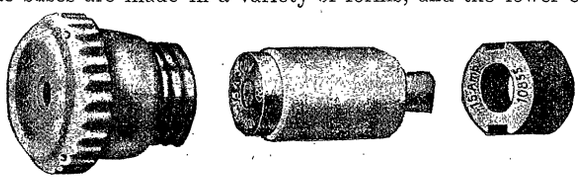


FIG. 2.—"B" TYPE CAP, CARTRIDGE, AND GUARD-RING.

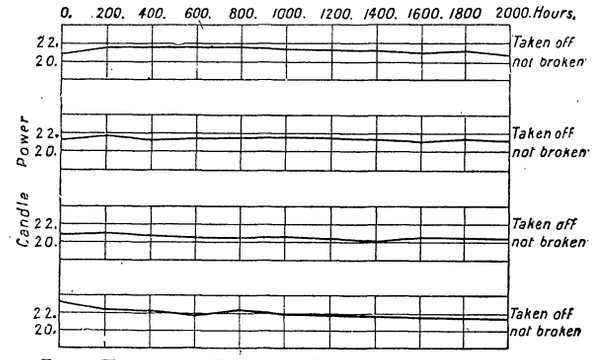
tact is fully protected by the soapstone gauge ring by which it is surrounded. The cartridges vary in colour according to the voltage. The actual fuse wires are of silver, in a chamber filled with sand, and the cartridges have been proved never to crack or explode on blowing, and the sand prevents a conducting film of silver being formed upon the inside surface. A fine constantan wire, in parallel with the main fuse wire, visible in the head of the cartridge, acts as an indicator whether the fuse has blown. The whole of the details seem remarkably well thought out, and a good example is presented of a system which offers some undoubted advantages as to safety.

THE LIFE OF METAL FILAMENT LAMPS

A GOOD deal of uncertainty has hitherto existed regarding the useful life of metal filament lamps, and many electrical engineers have regarded as extravagant the statements occasionally made to the effect that the life of a tungsten lamp was from 1,500 to 2,000 hours. In the first catalogue of metal filament lamps published some years ago by the Edison & Swan United Electric Light Co., Ltd., their life was stated to be about 1,000 hours. That this estimate was conservative has been known for some time, and in many instances these lamps have had a life some three or four times as long as the figure mentioned. So far back as 1909 it was announced that one of their metal lamps had burned for 5,880 hours.

The question has had further light thrown upon it by the series of independent tests on metal filament lamps recently carried out by the Westminster Electrical Testing Laboratory, of York Street, Westminster.

Four lamps made by each of fifteen makers were tested, and were not specially selected for the purpose, but were ordinary commercial lamps of 25 c.p. made for use on 200 volts. The curves given herewith of the four Ediswan lamps, which have been sent us by the Edison & Swan United Electric Light Co., Ltd., are of extreme interest, as it will be seen that not only were all these lamps still intact when taken off the test, but also that the candle-power of each



LIFE TESTS OF EDISWAN METAL FILAMENT LAMPS.

lamp is represented as practically a straight line, showing that the light given initially was maintained throughout the run.

The total watts taken by the lamps and the watts per candle-power also remained practically constant throughout the run.

CALCULATIONS OF MOTOR HORSE-POWER AND CURRENT

AN ingenious rotary cardboard device for making rapid estimates of the horse-power output or current input of either alternating-current or direct-current motors has been sent us by the Sandycroft Foundry Co., Ltd. (Sandycroft, near Chester), the manufacturers of the well-known Hunt "cascade" multiple-speed induction motors. The device is called the "Sandycroft Power Calculator," and consists of a carboard base cut in the form of an induction motor and provided with circular scales of volts and horse-power. A disc with circular scales of amperes, efficiency, and power factor is pivoted on this, and any calculation can be made by means of a single setting. The device is patented by Messrs. M. W. Ellis and T. M. Dutton. To find h.p., the amperes are set against the volts, and the h.p. is read against efficiency. In the case of A.-C. motors, it is read against a figure denoting efficiency × power-factor. To find the current, the efficiency or efficiency × power-factor is set against h.p., and the current is read opposite the volts.

CORRESPONDENCE

ELECTRICITY METERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Although the Paper read last week before the Institution of Electrical Engineers on the subject of electricity meters is perhaps one of the most important contributions on the subject that we have had for some years, it is a pity that the experience of the authors has apparently been limited to a few types of meters which are not altogether representative of the latest and most up-to-date practice.

With regard to commutator ampere-hour meters, we must reject the curve of accuracy given as not applying to the better-class makes of ampere-hour meters, in which we include our own, and which are not more than 5 per cent. slow on 1-20th load, and are accurate within 2½ per cent. from 1-10th full load. In connection with continuous-current commutator watt-hour meters, whilst the authors recognise the fact that the most satisfactory is the Thomson type of meter, they object to the small diameter commutator, presumably owing to insulation difficulties which have been their experience. The efficient insulation of the commutator on a meter is always a difficult matter, whatever the diameter may be, but in our types B. E. R., &c., the commutator dimension is reduced to 2½ millimetres, and practically perfect insulation is obtained by insulating the whole frame, to which the movable element is fixed, from the base, in addition to insulating the commutator itself. The advantages gained by the use of a small diameter commutator in regard to friction and wear can only be secured where the armature coils are few, three in the case of the meter mentioned.

It appears to be a common fallacy that three-coil armatures give a very fluctuating torque, but actual tests show that this is only true *cum grano salis*, at least in the case of Simplex

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meters. The constructional advantages of such armatures are obvious, and faults can be easily localised and remedied.

The easily removable armature is another feature which has been made use of for some considerable time in these types of meters. The authors of the Paper make mention of a removable spindle as being found in only one type of meter, but we should like to mention that we have supplied for some considerable time in all meters over 50 amperes a movable foot-step bearing ring; the bearing and pivot may be easily removed by hand without the use of any special tool, and may be as easily replaced, the armature locking automatically when the bearing is removed.

The objection raised by the authors to induction type a.c. meters on account of low torque and inaccuracy together with uncommon wave form, may apply to some classes of meters which have come under their notice, but in a well-designed a.c. meter, such as we claim for the Simplex type, 8–10 C.M.G. is obtained in single-phase meters (in polyphase meters considerably more), which, taking into consideration the absence of commutator friction and a light moving element, is certainly a distinct improvement on the old Thomson meter. The latter type might have developed 30 C.M.G., but this is discounted by the heavy weight of the moving element, the comparatively high speed, and, last but not least, commutator friction; these disadvantages contribute to make the meter inferior to a good induction meter.

With regard to variations in accuracy through wave form, the authors possibly lay undue stress upon this point, since the wave-forms instanced by them, which they admit were artificial and with difficulty obtained, cannot be said to represent actual service conditions. The testing of polyphase meters with single-phase current is now insisted upon by the Board of Trade, and all such meters as approved by them must be tested under these conditions. Our polyphase meters are built on this principle. Intersection between the two or three single-phase elements has been completely eliminated in the Simplex meters, and, of course, the breaking flux of the shunt circuits is fully considered when the meters are being calibrated.

Incidentally we should like to point out that we have had installed in our testing laboratory for some considerable time a set as mentioned by the authors on page 30B, and which they refer to as the "ideal set."

Yours faithfully,
SIMPLEX CONDUITS LIMITED.
Meter Department.

Garrison Lane, Birmingham.
March 28, 1911.

SOLDERED ALUMINIUM JOINTS

A NEW solder for aluminium has been brought to our notice by the Vacuum Engineering Co., Ltd. (24 South Moulton Street, W.), and, in view of the value to the electrical industry of an efficient solder for this metal, we decided to make some joints with its assistance. The Company assisted us in carrying out this intention, and we are also indebted to Messrs. Evershed & Vignoles, Ltd., for the loan of a "Ducter" for measuring the resistance of the joints. Our experience in using this beautiful instrument for a practical purpose fully confirms the high opinion which we had formed of it when it was first shown to us. A special flux is employed, which is in the form of a white powder, melting at a comparatively low temperature; it appears to clean the surface of the aluminium, at the same time forming a sufficient quantity of metal upon it to take the place of "tinning" in ordinary soldering, and even to join thin sheets of aluminium together without aid of the solder itself. The solder supplied takes readily to the surface cleaned by the flux, at a temperature slightly higher than the melting-point of the flux, and a joint in a stranded cable can be sweated up solid by pouring the solder through it exactly as in the case of a copper joint, although the solder does not "take" quite as smoothly as tin to copper.

Three simple twisted straight-through joints were first made with aluminium wire 0·087 in. diameter, some of them twisted less tightly than others. Before soldering, the resistance of a four-inch length of wire, including the joint, varied in the three cases from 40,000 to 130,000 microhms (·04 to ·13 ohm.). After soldering, the resistance was in each case 50 microhms (·00005 ohm.), which was also the resistance of a piece of wire of the same length without a joint, and the resistance was quite steady, showing that a thoroughly good electrical contact had been obtained.

In two cases the wires were simply immersed in the molten solder, and in the third case a soldering iron was used. The next test was to cover the ends of a short piece of 19/·087 aluminium cable (equivalent to 0·075 sq. in copper) with the flux, and to sweat them by dipping them into the solder. On sawing off the ends it was found that all the interstices between the individual wires had been filled, and the ends showed almost a solid section. The resistance of the cable was then measured, and it was found to be slightly less than the calculated value.

A tight "married" joint was next made in this cable, the inner core of seven wires being butted. The resistance of a 9-in. length of cable, including the joint before soldering, was 275 microhms, and after soldering was 85 microhms, while the resistance of a 9-in. length of the same cable, without a joint but with the ends soldered up solid, was 77 microhms.

Finally, a sleeve joint connecting two pieces of 37/·078 aluminium cable (corresponding to about 0·125 copper) was made and tested. A piece $16\frac{3}{4}$ in. long with the ends soldered solid measured 85 microhms, and a piece $9\frac{1}{2}$ in. long 40 microhms, the sum of the two being, therefore, 125 microhms. The two pieces were butted together and a piece of sheet aluminium $3\frac{1}{4}$ in. long wrapped round so that a $\frac{1}{4}$ in. gap was left along its length. The joint was then heated over a bunsen flame and flux and solder put in between the ends of the cable, which were drawn apart a little. When the solder had been molten a minute or so the ends were butted together and the joint allowed to cool. The resistance from end to end was then 122 microhms, which conclusively proves that a perfect electrical contact was obtained.

We are assured that no corrosion takes place with this solder. Two pieces of aluminium strip soldered together some three months ago have been in London tap-water since then, and the joint shows no signs of corrosion.

Tests made on joints with sheet and cast aluminium showed the mechanical strength to be highly satisfactory, the aluminium tearing or breaking at points other than where the joint was made.

PARLIAMENTARY INTELLIGENCE

MUNICIPAL WIRING.—The Luton Corporation Bill, which was passed by the Local Legislation Committee of the House of Commons last week, contains a clause giving the Corporation powers to undertake the wiring of premises and provide fittings, &c., on condition that this work is not carried out direct by the Corporation.

LONDON UNITED TRAMWAYS.—This Bill, which gives the Company twelve months' extension of time within which to construct a tramway between Kew Bridge and Richmond, was passed by the Unopposed Committee of the House of Commons on Thursday.

PROGRESS OF ELECTRICAL BILLS.—The London Electric Railway Bill and the Metropolitan District Railway Bill were read a third time in the House of Commons on Friday.

THE LANARKSHIRE TRAMWAYS.—This tramways Provisional Order, which has been under consideration in Scotland during the past week, has been withdrawn owing to the Commissioners proposing to insert a penalty clause should the proposed tramways not be completed within a specified period. The Order also contained powers for running trolley omnibuses.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

STREET LIGHTING.—An attractive booklet entitled "Street Lighting by Osrams," has been issued by the General Electric Co. (67 Queen Victoria Street), in which are collected together a quantity of data regarding the success that street lighting by Osram lamps has met with in Marylebone, Hampstead, Shoreditch, Wimbledon, Hammersmith, Glasgow, Nuneaton, Croydon, and numerous other localities, where they have been adopted extensively. A number of extracts from our own columns and those of our contemporaries are given and the object-lesson is rendered all the more forcible by the inclusion of an effective series of night photographs.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

SUPPLY ADVERTISING.—A copy has been sent us of a leaflet that is being issued in the Loughborough district by the Electricity Department, which puts the case for electricity in preference to gas in an attractive way, and gives particulars of a deferred payment system for wiring on the basis of 9½d. per point per quarter for three years.

CORONATION ILLUMINATIONS.—The Sun Electrical Co. (118–120 Charing Cross Road, W.C.) have now issued their complete Coronation illumination catalogue, which deals with a very extensive range of material for the purpose. Two different forms of "Suncolite" strip are included, and a quantity of decorative accessories for combining with these systems. A miniature strip is also listed which is easily made up into letters and devices. There are some very attractive designs, including illuminated transparencies and adaptations of the signs for which the firm is famous. A well-chosen selection of switches, fuses, plugs, connectors, &c., complete this useful publication.

DYNAMOS.—The new small continuous-current dynamo list

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of the Union Electric Co., Ltd. (Park Street, Southwark, S.E.), dealing with machines up to 30 kw., gives, in addition to the very well-arranged tables of sizes and outputs, a complete technical specification of the machines with numerous illustrations of the different forms they take with different degrees of enclosure, and of details of their parts.

WIRES AND CABLES.—After the excellent paper cable and other lists issued by Messrs. Aubert Grenier & Co. (68A Lincoln's Inn Fields, W.C.), we naturally expect a well-arranged catalogue in their new list of V.I.R. wires and cables just issued, and in this we are not disappointed. The tables are clearer to read than many, and the use of red for the prices is an advantage. Flexibles, bell wires, motor-car ignition cables, and aerial wires and cables are also dealt with.

ELECTRIC LIFTS.—A great deal of interesting information is contained in the sumptuous new catalogue relating to electric lifts, which has been produced by Messrs. R. Waygood & Co., Ltd. (Falmouth Road, S.E.), who, it may be remarked, claim to have been the first manufacturers of electric lifts in this country. Numerous forms of passenger lifts are illustrated, and these now run at speeds up to 400 ft. per minute. The mechanical details are also fully described and illustrated, with its worm driven drum or sheave, special electrical and mechanical safety appliances, and simple control gear. The last-mentioned can be of the car switch or push-button pattern, either fully or semi-automatic. Both alternating and continuous-current equipments are described, and among the large lift installations carried out by the company which are chosen for extended mention in the catalogue are those of the Royal Liver Building, Liverpool, and the new King Edward Post Office Buildings, the latter of which is an example of a three-phase equipment. Goods lifts are also dealt with, particularly those for motor-cars, and a few illustrations of public lifts, lifts for liners, of which Messrs. Waygood have supplied a large number, and the gantry lifts at Messrs. Harland & Wolff's shipyard conclude this interesting publication.

METAL FILAMENT LAMPS.—A most attractive postcard has been produced by the British Thomson-Houston Co. (Rugby) for advertising the Mazda Lamp bearing the legend "The Mazda lamp for beautiful light," and depicting one of these lamps being admired by a lady even more beautiful than the light of the lamp.

HOLOPHANE REFLECTORS.—Messrs. Siemens Brothers Dynamo Works, Ltd. (Incandescent Lamp and Fittings Department, Tyssen Street, Dalston), have issued a list dealing with 14 new patterns of Holophane Reflectors specially adapted for household use. Many of these are of particularly good appearance, and we hope to publish illustrations of them at an early date. Another new publication is a card illustrating a chain suspension and gallery for "stiletto" holophane reflectors forming a very convenient pendant. The firm are willing to overprint quantities of this card free of charge for any electrical contractor on receipt of inquiry.

In our notice last week in this column headed electrical thermometers, we regret that the interesting series of instruments mentioned were attributed to the Leskale Co. The correct name of the firm is The Leskole Company, Palace Works, Enfield.

LOCAL NOTES

Australia: *Melbourne: Tramways.*—It is stated that the Victorian Government propose to purchase the Melbourne City tramways, the lease of which still has six years to run.

Beckenham: *Increase in Lighting Charges.*—A recommendation of the Lighting Committee to increase the charge for lighting by ½d. per unit in order to counteract the effect of metal filament lamps has been adopted.

Croydon: *Electricity and Tramway Profits.*—It is stated that a sum of about £17,000, taken from the profits of the electricity and tramway undertakings, will be paid over in relief of rates.

Glasgow: *Tramway Assessment.*—The Assessment Committee of the Glasgow Corporation has dismissed the appeal of the Tramways Committee against the assessment of the tramways. The Tramways Committee protest against being assessed on the full valuation of the tramways instead of one-fourth. The decision of the Assessment Committee is to be appealed against.

Larne: *Electric Supply Co.*—The Council are to have a report prepared regarding the purchase of the Larne Electric Light Works, Ltd.

London: *Fulham: Period of Loans.*—The Comptroller of the London County Council has suggested that the Fulham Council should, instead of accumulating a reserve fund for renewals, arrange for the reduction of the periods for the repayment of outstanding loans from forty-two to twenty years, which latter is now the usual period allowed by the L.C.C. The Finance Committee of the Borough Council recommend that this course be not adopted.

Hammersmith: Municipal Wiring.—The Electricity Committee recommend that a scheme for the supply on hire of wiring and fittings required for external lighting be adopted, the work being carried out by contractors.

Stepney: Trolley v. *Conduit Tramways.*—The Works Committee once again recommend the Borough Council to refuse its consent to the adoption of the overhead system in Burdett Road and Globe Road.

Morecambe: *Lighting Committee Resigns.*—A scheme by the Electric Light Committee for granting reduction to certain classes of consumers was objected to by the Council last week, and a resolution was moved appointing the chairmen of all the Standing Committees of the Corporation to meet in order to come to a decision. The position arose on account of the attitude of the members of the Gas Committee. The Electric Light Committee thereupon withdrew from the Council, and subsequently asked to be relieved of their duties. This, however, was ruled out of order, and the matter was allowed to drop.

Newcastle: *Tramway Profits.*—It is proposed to transfer £6,000 out of last year's profits to relief of rates. It was originally proposed to transfer £10,000, but this was objected to.

Northumberland: *Tramways.*—An expert is to be consulted with regard to the proposed municipal tramway service between Blyth, Bedlington, Ashington, and Newbiggin. Local opinion seems to favour trolley omnibuses.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Beckenham.—The Local Government Board have sanctioned loans of £2,000 for mains, £3,000 for services, and £1,000 for meters.

Bury.—The Local Government Board have sanctioned a loan of £72,170 in connection with the new generating station, and also for additional mains.

Handsworth.—The Electricity Committee require switchboard extensions, cables, feeder pillars, and overhead-tramways equipment. Particulars from the Town Clerk, or Messrs. Kennedy & Jenkin, 17 Victoria Street, London.

Ireland.—Tenders are invited by April 10th for generating plant, and also for wiring, at the Cavan College and Bishop's House. Consulting Engineer, Mr. A. E. Porte, 43 Dawson Street, Dublin.

Kettering.—A Local Government Board inquiry was held last week concerning a loan of £13,100 for electrical extensions.

London: *Battersea.*—The Finance Committee of the L.C.C. have sanctioned a loan of £1,400 for electrical extensions.

Bermondsey.—The Electricity Committee require three boilers, a steam dynamo, and condenser. Particulars from the Borough Electrical Engineer, and tenders by April 19th.

Hackney.—The Finance Committee of the L.C.C. have sanctioned a loan of £20,599.

St. Pancras.—Tenders are invited by April 12th for a motor generator and balancer. Particulars from the Electrical Engineer.

Rugby.—Tenders are invited for laying 5,000 yards of cable. The Electricity Committee also requires 5,500 yards of 3-in. Sykes stoneware troughing, 1,500 yards of stoneware covers, and 30 tons of refined Trinidad bitumen. Particulars from the Electrical Engineer, and tenders by April 7th.

St. Helens.—The Electricity Committee invite tenders by April 20th for a 1,500-kw. turbo alternator with condensing plant and switchgear. (See an advertisement on another page.)

Swanage.—Mr. F. Swarbrick, of Leigh, has been asked for further details of an electric lighting scheme which he has put before the Council.

York.—Tenders are invited by April 11th for the replating of the storage battery, and the supply of a reversible booster and switchboard.

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WIRING

GREATER LONDON.

Rebuilding of Threadneedle Street Branch Post Office.

New branch Post Office at East Ham.

Proposed electric theatre at Eltham.

Twelve houses, Melrose Avenue, Croydon. Thirty-one houses, Kingscote Road.

Cinematograph theatre at 260–262 North End Road, Fulham.

Extensions to Nurses' Home at Infirmary, Archway Road, N. Architect, A. S. Snell, 22 Southampton Buildings, Chancery Lane, W.C.

PROVINCES.

Dover.—Theatre in Castle Place.

Edinburgh.—Charteris Memorial Church.—Alterations to Commercial Bank of Scotland, Northbridge. Architect, T. Forbes, 14 George Street.

Glasgow.—New theatre in Charles Street. Architects, George Alder & Sons.

Maidstone.—Additional wards at County Asylum.

Morley.—Pavilion at junction of High Street and South Queen Street. Architects, Howorth & Howorth, Bank Chambers, Cleckheaton.

Plymouth.—Barracks at Lambhay Green. Architect, T. R. Kitsell, Broad Street Chambers.

Southampton.—Cinematograph theatre in East Street.

Swindon.—Enlargement of head post office. H.M. Office of Works, London.

Wakefield.—Elementary School in Lawefield Lane. Architects, Messrs. Watson, Son & Ellison, Barstow Square.

MISCELLANEOUS

Blackpool.—Ten flame arc lamps are to be erected on the promenade.

London.—A quantity of meters, fuse switches, &c., are required for the Olympia Electrical Exhibition, 1911. (See an advertisement on another page.)

The Commissioners of H.M. Office of Works and Public Buildings invite tenders for three years' supply of electrical fittings and tubes. (See an advertisement on another page.)

St. Pancras.—Tenders are invited by April 12th for a supply of arc lamp carbons. Particulars from the Electricity Department, 57 Pratt Street, Camden Town, N.W.

Southend.—An inquiry was held last week by the Light Railway Commissioners into an application by the Council for considerable extensions of tramways.

TENDERS RECEIVED AND ACCEPTED

Beckenham.—The tender of Messrs. Lucy & Co. has been accepted for lead boxes, and that of the British Insulated & Helsby Cables, Ltd., for cut-outs.

Bombay.—The Oerlikon Co. has received an order for the equipment of a large cotton-spinning mill near Bombay, comprising three vertical-shaft three-phase generators of 900 h.p. each, together with the requisite switchgear, and 250 single-phase motors with automatic speed regulation for driving ring-spinning machines.

Croydon.—The tender of Messrs. Callender's Cable & Construction Co., Ltd., has been accepted for the supply of cables for the year to March 31st, 1912.

Grimsby.—The tender of Messrs. Crompton & Co. for a supply of electric motors for hiring out at £322 8s. has been accepted. The lowest tender was that of the Electrical Co., Ltd.; but as the difference in price was small, and a number of Crompton motors are at present working very satisfactorily in Grimsby, Mr. W. A. Vignoles, the Electrical Engineer, recommended the acceptance of Messrs. Crompton's tender.

Ipswich.—The following tenders have been received for a 1,000-kw. turbine driving two C.C. generators on the same shaft, with surface condenser, air and circulating pumps, &c.: Howden & Co., £4,541; alternative, Howden & Co., £4,800; Willans & Robinson, £4,756; alternative, £4,906; Brush Electrical Engineering Co., £4,950; Escher, Wyss & Co., £5,138; Richardsons, Westgarth & Co., £5,175; British Westinghouse Co., £5,195; alternative, £5,546; C. A. Parsons & Co., £5,320; alternative, £5,623; and A. E. G. Electric Co., £6,100. The tender of Messrs. Willans & Robinson at £4,756 is recommended for acceptance. This tender provides for Siemens dynamos.

The tender of Messrs. G. & J. Weit, Ltd., for a compound direct-acting steam feed pump, with a capacity of 6,000 gallons per hour, at £259 has also been accepted.

Leek.—The Lighting Committee recommend the acceptance of the tender of the Diesel Engine Co., Ltd., for a 220-kw. generating set (Crompton dynamo) at £3,570 10s.

London: *County Council.*—The tender of Messrs. George Wimpey & Co. at £26,409 10s. is recommended for acceptance for the road work on the Putney Bridge to High Street, Wandsworth, tramways.

Arrangements are being made with Messrs. Hadfield's Steel Foundry Co., Ltd., at £2,641 16s. and £1,387 respectively, for the special work required on the Battersea Park Road to King's Road, Chelsea, trams, and the reconstruction of the horse tramways in Highgate Road.

A contract has been entered into with the National Rail and Tramway Appliances Co., Ltd., for the supply of brake shoes to April, 1912.

Hammersmith.—The Works Committee recommend that 183 existing arc lamps be replaced by clusters of four or five 110-watt metal filament lamps. The annual charge by the Electricity Committee is to be £12 10s. for each column with five lamps, and £10 for each four-lamp column, instead of the existing charge of £20 per column for arc lamps. The cost of converting the lamps—namely, £752—is to be provided out of revenue. It is also recommended that all existing small arc lamps be converted into clusters of metal filament lamps as they wear out.

Wadebridge.—The lighting of the district has been divided between the Electricity and Gas Companies.

Watford.—The Council have accepted the tender of Messrs. Drake & Gorham, Ltd., for the alteration to street lanterns and the supply of metal filament lamps for three years.

APPOINTMENTS AND PERSONAL NOTES

A tablet has been unveiled at the Hackney Town Hall in memory of the Mr. H. W. Cox who died last year from the effects of his early work with X-rays.

The Hackney Electricity Committee recommend that the maximum salary of Mr. T. Dalby, Works Superintendent, be increased from £200 to £250 per annum. Mr. Dalby is at present in receipt of £200 per annum, and the new maximum will be reached by annual increments of £10. It is also recommended that the salary of Mr. E. Matthews, Testing Engineer, be increased from £130 to £160 by annual increments of £7 10s. It is further recommended that the salary of Mr. E. Wilkinson, Deputy Generating Engineer, be increased from £117 to £125 per annum.

Mr. W. G. Bond, who has been connected since 1899 with the British Electric Traction Co., has taken over the General Managership of the Traction and Power Undertaking operated by the Birmingham and Midland Tramways Joint Committee.

A switchboard attendant is required at Kilmarnock. (See an advertisement on another page.)

On the occasion of the appointment of Mr. W. Buchanan, late Senior Lecturer at Faraday House, to the Professorship of Electro-Technology in the Royal School of Mines, Transvaal University, his old pupils presented him with a pocket aneroid barometer. The presentation was made last Friday by Mr. F. de Lautour, foreman student.

The maximum salary of Mr. S. E. Britton, City Electrical Engineer at Chester, has been increased from £500 to £600 per annum.

Obituary.—We regret to announce the death last week in Chalmers Hospital, Edinburgh, of Mr. H. G. Young, Engineer and Manager of the Bo'ness Electricity Works. Mr. Young had been with the National Electric Construction Co. for about seven years, and was previously Assistant Manager of the Musselburgh tramways.

The Electrical Trades Benevolent Institution.—The annual general meeting of the above was held yesterday at the Hotel Cecil. The annual report records well-maintained activity during the past year, although there was a slight falling off in the receipts. Every case of relief, however, was satisfactorily dealt with. The festival dinner held early in the year added to the funds of the institution, and on the realisation of the surplus fund trust of the Olympia 1905 Electrical Exhibition, a further £382 will accrue to the funds. Mr. W. Davenport has retired from the secretaryship, and Mr. F. B. O. Hawes has been appointed in his place. The assets of the institution (including £180 cash at bank) now amount to £2,466. Grants were made during the year totalling £27 12s.



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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 15s. to £57 5s. per ton (last week, £57 to £57 10s.).

Liquidations.—A special meeting of the contributories of the Uxbridge and District Electric Supply Co., Ltd., was held on Thursday to consider a scheme for the arrangement of the Company's affairs. It provides for the payment of the first and second mortgage debenture-holders with interest, and, by means of an issue of £75,000 debenture stock guaranteed by Callender's Cable and Construction Co., Ltd., to satisfy the remaining creditors. A rearrangement of capital is also provided for in the scheme, which was unanimously accepted.

Mr. Justice Swinfen Eady on Tuesday made a compulsory winding-up order against the British Tungsten Lamp Co., Ltd., of Liverpool, on the application of two creditors.

The Automatic Trolley Head Co., Ltd., is to be wound up voluntarily. Mr. H. S. Foster, 82 Victoria Street, Westminster, S.W., is liquidator.

Dissolution of Partnership.—The partnership between A. H. Robinson, W. H. Horsfall, and E. B. Mulliner, trading as Robinson & Mulliner, Consulting Engineers, Liverpool, has been dissolved.

Bankruptcies.—The creditors of the North British Electric Power Syndicate, Ltd., are requested to send in particulars of their claims to Mr. Andrew Wood, 695 Salisbury House, London Wall, E.C., not later than April 15th.

United States Metallic Packing Co., Ltd.—This firm have now opened a branch office at 2 Collingwood Street, Newcastle-on-Tyne, in charge of Mr. H. B. Plummer.

Holophane Reflectors.—Holophane, Ltd. (12 Carteret Street, Queen Anne's Gate, S.W.), are now in a position to supply the trade with their new line of "Residence" holophane reflectors, which, while maintaining the optical efficiency of the holophane system, introduce new artistic features of design.

Pirelli & Co., Ltd.—A report has been published by a contemporary that Messrs. Pirelli & Co., of Milan, are about to build works in this country. We are in a position to state that this is incorrect, and that the firm in question have no immediate intention of establishing a cable factory here.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Isle of Wight Electric Light & Power Co.—After meeting debenture interest and preference dividend, there is a sum of £5,806 available as profit for 1910. The directors recommend that £3,500 be added to renewals fund, and £1,000 to reserve, carrying forward £686.

Madras Electric Tramways.—A dividend of 2 per cent. is declared upon the deferred ordinary shares for 1910, and 2½ per cent., in addition to 1 per cent. out of the surplus profits, on the preferred ordinary shares, making 5½ per cent. for the year.

Metropolitan Electric Tramways.—Dividend at the rate of 5 per cent. per annum on the ordinary shares for 1910.

Bell Telephone Co. of Canada.—An issue of $1,250,000 5 per cent. bonds has been offered during the week.

Durham Collieries Electric Power Co.—There was a loss of £9,300 for 1910. This unsatisfactory position has resulted in the directors calling in an independent electrical expert to consider the position, and look into affairs on the spot.

South London Electric Supply Corporation.—At the annual meeting last week, Mr. J. Atherton said that the present rate of progress of the undertaking was such that, if it were maintained, extensions of plant will have to be considered at the end of the present year.

British Aluminium Co.—The report for 1910 shows a profit of £125,063, but the profit in respect of the period prior to the date of the incorporation of the company is £34,606, leaving £90,457, which, after adding interest on deposits, &c., is increased to £91,865. The sum of £25,000 is transferred to depreciation, £21,000 to debenture interest, and, after meeting various other charges, the sum of £4,943 is carried to reserve. The report states that, although the output for last year was greater than in the previous year, the company's works were not operated to their full capacity, but the demand for aluminium was increasing satisfactorily.

Lancashire Electric Power Co.—Mr. H. F. Parshall stated, at the annual meeting on Thursday, that another generating set was being installed to meet the increasing demand, and arrangements have been completed for the issue of £150,000 prior lien bonds.

South Wales Electrical Power Distribution Co.—The report for 1910 states that steady progress has been made by the Treforest Company, the total units sold being 1,715,226 in excess of those sold in 1909, and the result of the year's working of this Company was to leave a small profit after meeting prior lien debenture interest, &c. The Treforest Company have found it necessary to order a second turbine set to meet the increasing demand. As the whole of the expenses in connection with the South Wales Company are now being borne by the Treforest Company, the directors present no revenue account.

Folkestone Electricity Supply Co.—After meeting debenture interest and preference dividends, there was a profit of £8,949 for 1910. A dividend at the rate of 6 per cent. per annum for the year has been paid on the ordinary shares, £5,000 carried to depreciation fund, and £349 carried forward.

Vickers, Sons & Maxim.—The annual meeting was held at Sheffield on Tuesday, Mr. Albert Vickers presiding. The proceedings were quite formal, the Chairman commenting upon the satisfactory nature of the year's working, and looking forward to a still further improvement in the current year. The recommendation to change the company's name to "Vickers" was carried unanimously.

The Electrical Trades' Benevolent Institution.—This year's Festival Dinner of the above will be held at the Hotel Cecil on Wednesday, April 26th. Lord Justice Fletcher Moulton has consented to preside.

The National Electrical Manufacturers' Association.—At a meeting of this Association on Tuesday, April 25th, at 8 p.m., a Paper will be read by Mr. L. Joseph on "Foreign as Compared with Home Industrial Finance." The meeting will probably take place at the Institution of Electrical Engineers.

Wireless Telegraph Notes.—The report of the Australian Wireless, Ltd., for 1910 states that a contract has been received from the Commonwealth Government for the erection of high-power wireless telegraph stations at Pennant Hills and Fremantle. The New Zealand Government have also accepted the Company's tender for two high-power stations and five ship stations.

The high-frequency generator designed by Dr. R. Goldschmidt for wireless work consists of a machine similar in construction to a simple single-phrase induction motor. The stator winding is supplied with continuous current, and the rotor, which has a short-circuited winding, is driven by a motor. The magnetic field of the stator induces an alternating current in the rotor, and the alternating field of the current induces currents of double the frequency in the stator winding, which is short-circuited by a condenser. A choking coil prevents any alternating current reaching the battery. This induction between the two elements is continued theoretically to an infinitely high frequency, and by suitable tuning only that current of a certain desired high frequency can be obtained in the external condenser circuit connected across the stator winding. A 12½-kw. machine giving a frequency of 30,000 cycles per second corresponding to a wave-length of 10,000 metres has been constructed by C. Lorenz A.-G. of Berlin, and has given every satisfaction.

According to the *Board of Trade Journal*, the Russian Council of Ministers have decided to erect a wireless telegraph station on the banks of the Cara Sea, Siberia.

Telegraph Traffic and Movements of Cable Ships.—The El Arich route between Eskichechir and Biledjik was down on 21st inst., and on the same date fire disabled the offices at Petropavlovsk.—The French Administration has followed suit in the reduction of rates *viâ* Brest-Dakar-Norouba to places in Brazil brought about by German competition.—The El Arich route was working again on the 22nd inst., which also saw the failure of the cable between Bathurst and Bissao.—On the 25th inst. the Lemnos-Salonica cable ceased working for a short while, and the Zante-Corfu cable was restored to working order. The cable between Candia and Sitia failed on the same day. On the 27th inst. the cable between Constantinople and Odessa became interrupted, so that the Eastern Company has a little repair work in hand now.—The recent stormy weather played havoc with land and telephone lines in Kent, etc., but disorders were soon put right.—Lines were down on the 27th between Inhassunge Vicente and Chinde Inhangombe in the district of Quelimane. On the same date telegraphic communication between Ceiba and Trujillo in Honduras was again in working order.—The c.s. *Minia* of the Anglo-American Telegraph Co. recently made an attempt to repair the old 1874 cable of the Company, but failed owing, it is believed, to ice.—The *Contre Amiral Caubet* repaired the St. Pierre-Cape Cod cable of the Compagnie Française des Cables Télégraphique, and returned to port. She went into dry dock owing to damage caused by ice.



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WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

Our monthly supplement on Electrical Engineering in Mines is included in this issue. It opens with an article discussing the limitations in the use of electricity in mines proposed in the Bill now before Parliament. A note is given on the inquiry into the Hulton Colliery explosion, and a discussion on the relative merits of electric power and compressed air is reported. An abstract of a communication dealing with the design of electric winding plants with balance ropes is also included, and among other articles are a description of the Winhey leakage detector and a new safety switch and plug. Some recent mining switchgear is also illustrated, and a report is given of a Home Office prosecution in Scotland. The more important electrical mining patents published during March are abstracted.

A letter from a well-known metal filament lamp firm criticises some particulars of tests of another make of lamp published last week. Another correspondent deals with aluminium solders. (Page 175.)

The subject of electricity meters is taken up by several correspondents. Messrs. Ferranti, Ltd., defend the mercury type, a station engineer gives his experiences, Mr. Paterson of the National Physical Laboratory discusses the testing of three-phase meters, and Mr. Schattner explains how the defects in the earlier commutator meter have been overcome. (Page 175.)

Major Pringle, in his report on the Hawes Junction accident, says that the fire originated without doubt in gas lighting equipment on the train, and expresses the opinion that, with every possible precaution, electric lighting will remain the safer method. (Page 176.)

The petition of the Lodge-Muirhead Wireless Syndicate for an extension of term of the Lodge patent covering the use of an inductance in the sending aerial to produce a prolonged series of tuned waves, and of a closed receiving circuit which can respond by resonance to a series of feeble impulses, is now before Mr. Justice Parker in the High Court. (Page 176.)

The first section of the Swedish State Railway System to be converted to electric traction is the 80-mile single-track line between the mining centre of Kiruna and Riksgränsen on the frontier of Norway. Power will be supplied from a water-power station, some 120 miles distant from the middle of the line, over a 50,000-volt single-phase transmission line. Current will be supplied at 15,000 volts, 15 cycles, to heavy locomotives, with commutator motors of the compensated series type. Besides a few passenger trains, eight heavy ore trains, each consisting of 40 ore trucks and two locomotives, and weighing 2,050 tons, will run daily in each direction. (Page 177.)

Prof. J. A. Fleming, during a course of Cantor Lectures at the Royal Society of Arts, dealt with the subject of electric furnaces, describing the different patterns, and the various manufactures in which they are employed, namely, the production of carborundum, aluminium, calcium carbide, artificial fertilisers, and the different special steels. A report of these lectures is given under "Electrometallurgy and Electrochemistry" together with some notes on several methods for the production of zinc in the electric furnace. (Page 178.)

At a meeting of the Farmers' Club on Monday, Mr. J. H. Priestley, lecturer in botany at the Bristol University, gave an interesting lecture on electricity in agriculture. He described the experiments with overhead wires on the Lodge-Newman system at Evesham, and then dealt with the application of Cooper-Hewitt lamps in greenhouses. At a distance of four feet from the lamps it is found that there is a distinct acceleration of growth, accompanied by one or two peculiar characteristics. (Page 179.)

The purchase price of the Cavehill & Whitewell tramways has been fixed at the high figure of £55,155, and the Belfast Corporation suggest an appeal.—The City of London Corporation has at last approved a route for the main to link up the two stations of the County of

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London Electric Supply Co.—It has been found necessary to anchor all the rails of the L.C.C. tramways laid down under the original scheme.—Difficulties are being met with by the promoters of the Brighton-Worthing tramways scheme through the absence of consents of road authorities. (Page 180.)

ADDITIONAL mains are required at Accrington and Stoke-on-Trent; new batteries at Barnstaple and York; new generating plant at Luton, Torquay, and Worcester; traction battery, reversible booster, and switchgear at Wrexham; a 350-kw. static transformer at Manchester, and a 1,500-kw. turbo-alternator at St. Helens. Hornsey Council require flame arc lamps; Manchester Corporation, tramway poles; and Australian Postmaster-General, 10,000 telephone protectors. A telephone system is to be installed in Korea. (Page 180.)

THE proposals of the Metropolitan Electric Supply Co. to purchase the Acton Council's electricity undertaking have been passed by a House of Commons Committee. The Central London Railway Bill, which will enable through trains to be run from Liverpool Street to Ealing, has also been passed. In passing the Bill of the Winchester Corporation for purchasing the local Electric Light & Power Co., a House of Lords Committee inserted the Northumberland clause. (Page 182.)

AMONG the specifications published by the Patent Office on Thursday last was one by C. J. Beaver for a cable with two layers of armouring, between which is a layer of fireproof material to prevent external arcing.—A method of regenerative control with series motors, in which the fields have an additional supply from a battery, is described by the Johnson-Lundell Electric Traction Co.—A patent for an electric advertising sign, in which transparent devices are exhibited successively, has been granted, in spite of opposition.—A patent relating to the Berry transformer expires next Thursday, after the full life of fourteen years. (Page 183.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, APRIL 6TH.

National Electrical Manufacturers' Association.

2.30 p.m. Council Meeting at Balfour House, Finsbury Pavement, E.C.

Institution of Electrical Engineers.

8 p.m. "Wireless Telegraphy Working in Relation to Interference and Perturbations," by J. E. Taylor.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science.

FRIDAY, APRIL 7TH.

Royal Institution.

9 p.m. Evening Discourse:—"A New Method of Chemical Analysis," by Prof. Sir J. J. Thomson, F.R.S.

SATURDAY, APRIL 8TH.

Birmingham and District Electric Club.

7 p.m. At Colonnade Hotel. Ladies' Night.

TUESDAY, APRIL 11TH.

Institution of Electrical Engineers: Glasgow Section.

8 p.m. At 207 Bath Street.

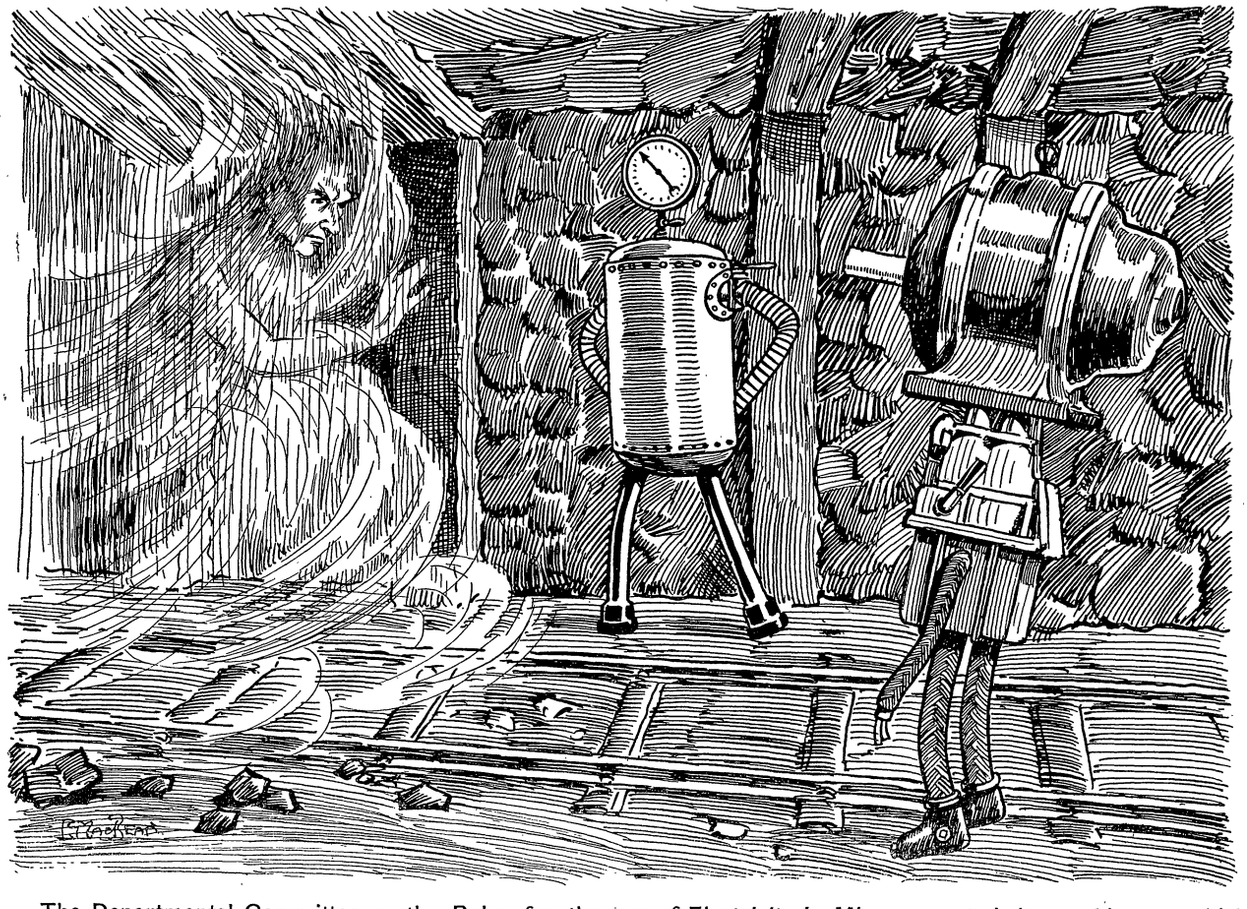
WEDNESDAY, APRIL 12TH.

Mining Institute of Scotland.

5.30 p.m. At 39 Elmbank Crescent, Glasgow. (1) "Some Considerations Affecting the Installation of Power at Collieries," by F. Anslow. (2) "Recent Progress in Mining Switchgear," by G. Stevenson. Also discussion on New Mines Bill.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At Victoria Embankment. "The Present Position of Electric Traction on Main Lines in Europe," by J. B. Sparks.



The Departmental Committee on the Rules for the use of Electricity in Mines reported that accidents could be avoided in all cases in which electricity is used if the best present-day practice is complied with. But, as it is difficult to ensure this, they suggested that electricity should be prohibited where there is daily or frequent occurrence of inflammable gas. The Government have brought in a Bill giving effect to this recommendation. In cases in which inflammable gas may occur in quantity, although not normally present, electricity is to be permitted, but special precautions are to be observed.

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

PROPOSED LIMITATIONS OF THE USE OF ELECTRICITY IN MINES

THE new Coal Mines Bill, which has passed its second reading in the House of Commons, contains one important clause (No. 60) relating to the use of electricity in mines. This reads as follows:—

(1) Electricity shall not be used in any part of a mine where, on account of the risk of explosion of gas or coal dust, the use of electricity would be dangerous to life, and if the owner of a mine, on being required by an inspector of the division not to use, or to desist from using electricity in the mine or any part thereof on such ground as aforesaid, refuses to do so, the question as to the application of this section to the mine or part thereof shall be settled in manner provided by this Act for settling disputes.

(2) The use of electricity in any mine shall be subject to general regulations under this Act.

It will be noted that this clause is identical with Rule 1 of the proposed new special rules prepared by the Special Committee, and reviewed in ELECTRICAL ENGINEERING IN MINES, March 2nd, 1911, p. xvii., and it is essential that the intentions of the Committee should not be misunderstood, for the meaning of the clause as it stands is not sufficiently definite, and the wording should certainly be modified when the next stage of the Bill is reached. In their report the Departmental Committee says:—

The Committee knows of no place below ground in which electricity is in use to-day where both kinds of accident would not be avoided if the best present-day practice as regards construction and maintenance were complied with . . . , but as it is difficult absolutely to insure continuous and universal compliance with the best present-day practice, the Committee is of opinion that there are parts of some mines from which electricity should be excluded altogether, and that in this respect, therefore, the existing rules require amendment. The daily or frequent occurrence of inflammable gas in any place in quantity detectable by the ordinary safety lamp in use at the mine, would make that place one to which prohibition should apply. On the other hand, in the opinion of the Committee, prohibition is not required where gas is seldom found, or where from experience in the neighbourhood, and from all the evidence available, it is likely to be of rare occurrence: provided good work and proper maintenance are insured so as to obviate as far as is practicable the risk of open sparking.

To meet this second class of conditions, the Committee have recommended the special precautions (referred to in our Mining Supplement last month) to be observed in "any part of a mine in which inflammable gas, although not normally present, may occur in quantity sufficient to be indicative of danger."

The clause of the Act as it stands might be read to imply prohibition of electricity whenever there is the minutest risk of explosion, but it is clear from what we have quoted above, that it is only intended to apply in the most gassy parts of mines, the precautions indicated by the Committee for the installation, maintenance, and working of the plant being sufficient for ordinary working where gas is occasionally present.

It is interesting, in this connection, to review some of the evidence given before the Departmental Committee.

Mr. D. M. Mowat, general manager of the Summerlee Iron Co., Coatbridge, said that an indication of firedamp did not necessarily mean that firedamp was present in sufficient quantity so as to be dangerous. Mr. J. Gill, manager of St. John's Colliery, Normanton, Yorkshire, representing the Colliery Managers' Association, said that in a fiery colliery he would allow open-type motors in the main intake roads where lamps were lighted, but not beyond these. On the other hand, if a pit were subject to sudden outbursts of gas he should consider very seriously as to putting electrical coal-cutters in at all. Mr. A. Hall, consulting engineer, giving evidence on behalf of the Colliery Managers' Association, said that at a coal face where gas did not appear every day but was of frequent occurrence, he would use an electric coal-cutter with an enclosed motor, as he knew of no case where such a motor had fired gas. Mr. W. Maurice, manager of the Hucknall Colliery, near Nottingham, made a general statement to the effect that the use of electrical plant was quite safe, even in gaseous mines, under certain precautions. He would only not use electricity in places where it was found necessary to withdraw men at frequent intervals owing to there being a visible cap on the safety lamp. Mr. W. H. Patchell, consulting engineer, giving evidence on behalf of the Institution of Electrical Engineers, said that he could not imagine that "the Home Office would go to the length of pandering to scaremongers to the extent of excluding electricity," but, speaking for himself, there were places where he would not introduce electrical plant. Mr. R. Rutherford, representing the Durham Coalowners' Association, thought that the conditions under which the use of electricity would be dangerous were those given in General Rule 8 of the Coal Mines Regulation Act as the conditions requiring the use of safety lamps. He would use electrical plant in so-called gassy mines, but not at the face if there were frequent outbursts of gas or if a cap were frequently seen on the lamps. He could not conceive of any form of electric coal-cutter which, including its switchgear and cable, could be considered as safe in such circumstances. Mr. W. C. Mountain, managing director of Ernest Scott & Mountain, Ltd., said that he would hesitate before introducing electricity at all into places where there was likely to be very frequently an explosive mixture; there were very few such places, however. Mr. T. Y. Greener, chief engineer of the collieries of Pease & Partners, Ltd., and appointed to give evidence on behalf of the Mining Association of Great Britain, said that he did not think there were any mines in which it would not be safe to instal electrical plant on the main roads and in most parts of the mine itself, except only it might be in the working places and in the returns. Electricity should not, he thought, be used in places liable to sudden outbursts of gas, nor in places in which the air current was so charged with gas as to be approaching an explosive mixture.

Ashington Pit Fatality.—At an inquiry held a few weeks ago into the cause of the death of G. Reaveley, an engine-man in charge of an electric haulage-engine in the Bothal Yard seam of the Ashington pit, it was elicited that the man received a shock from the cover of the switchbox. It appears that a screw in the switch blade had worked loose and came in contact with the cover, and that this did not blow the fuses as the wire which connected the cover with earth was missing. A verdict of accidental death was returned.

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THE PRETORIA PIT EXPLOSION

THE Home Office inquiry into the cause of the explosion at the Hulton Colliery on December 21st was concluded on March 9th, but Mr. Redmayne's report has not yet been published. It will be remembered that at the conclusion of the inquest the jury found that the explosion was due to an accidental ignition of gas and coal dust, but that the cause of ignition is unknown. As stated in ELECTRICAL ENGINEERING IN MINES, March 2nd, 1911, p. xxi, Mr. Tonge, general manager of the Hulton Collieries, expressed the opinion at the inquiry that the explosion was caused by a broken safety lamp at a fall. A lamp-room man also admitted that there had been a number of cases of damaged lamps in the mine during the six months preceding the date of the explosion. The electrical engineer to the Hulton Colliery, Mr. R. F. Bull, said that he was satisfied that the conveyer oil-switch which was suspected had sufficient oil in it to prevent sparking; and Mr. R. Nelson, H.M. Electrical Inspector of Mines, stated that there was no evidence of arcing at the contacts of the switch. He had no doubt that oil was spilt when the switch was moved out of the danger zone after the disaster, in order that he might inspect it. He had also observed no breach of the special rules now in force, and the electrical plant was well designed and installed. Dr. W. Thornton, of Armstrong College, Newcastle, gave evidence as to having examined the electrical plant, and found it in good condition. Experiments which he had made showed that an explosion in a switch-box left no signs on the inside of the box.

ELECTRICITY AND COMPRESSED AIR IN MINES

AT a meeting of the West of Scotland Branch of the Association of Mining Electrical Engineers on March 17th a Paper on the above subject by Mr. J. R. Benson, which had been read at a previous meeting, was discussed. The Paper was, on the whole, in favour of compressed air rather than electrical power, but the author wished it to be clearly understood that he was not by any means entirely against electricity in mines. He referred to comparative estimates from air and electrical coal cutters, which were in favour of the former as regards first cost of the machines and as regards the cost of the pipes and cables. He also claimed that the better efficiency of the electrical system was offset by higher cost of maintenance and supervision necessary for safety. On the other hand, he considered that for pumping he knew of nothing better for raising water from mines than the electrically driven turbine pump. For a direct drive and a uniform load it was an ideal power. He particularly emphasised the necessity for ample margin of power, especially for cutters in thin seams, and mentioned that where ten years ago a 10-h.p. motor was considered sufficient for a coal-cutter, 30- or 40-h.p. machines were now being used. He was very much against electric cables being introduced at all into fiery mines where safety lamps were in use, and in conclusion he referred to particular circumstances where compressed air had been used with success, and entered into some matter of detail as to its working. It was especially in thin seams that compressed air appeared to him to offer advantages over electric power.

The discussion was opened with the reading of a letter which was received from Mr. Spence, who thought that Mr. Benson claimed too much for compressed air when he said that it was as efficient as electricity. Compressed air to be efficient at all had got to work at full load, whereas electricity can be worked to half load with a high efficiency. He mentioned an example of the failure of compressed air as a stand-by. An electric pump was shut down for repairs, and a compressed air pump was put on in its place, but the boilers were unable to supply sufficient steam to keep up the pressure in the receivers, although they had easily supplied enough for the electric pump. When using air for drills it was usual to put down electric cables to compressors below for the air. At Rosyth Dock they had electric motors driving air compressors at points required.

Mr. THOMSON, on the other hand, spoke of estimates for both electrical and compressed air plant, where the lowest electrical estimate was £200 above any compressed air estimate. He also stated that in the case of the former more boilers were required. In a colliery he had visited, however, enough energy was lost in joints blowing in the compressed air pipe to keep another coal-cutter going.

Mr. MUIRHEAD also spoke in general terms in favour of compressed air, but admitted that electricity had not been enough in use in this country to compare it with compressed air, as regards cost of upkeep.

Mr. MCGUFFIE pointed out that radical changes had taken place in electrical cutters in the last eighteen months, while practically none had taken place in compressed air machines. Mr. Benson had tried to make out that electric power was all right for pumps and compressed air for everything else, but he himself would say that there was practically nothing in the pit which could not be driven efficiently and safely by electricity.

Mr. CASE said that where there was a power system at hand a small colliery should take a stand-by supply from it. They could use a small exhaust turbine for supplying current in place of a reciprocating set. Compressed air could not be compared to electricity for flexibility, especially where alterations had to be made. Mr. Benson had overrated the danger from shock; with up-to-date installations, armoured cables, safety boxes, and earthing there was no danger at all. In fiery mines an ideal system was to take electricity to a central station in-by, and instal squirrel-cage motors driving rotary compressors.

Mr. BENSON, in his reply, denied that he had said that compressed air was as efficient as electricity. He asserted that the cost per h.p. was practically the same, taking into consideration the cost of installing and maintaining each plant. One of the largest collieries in U.S.A. had adopted compressed air in place of a continuous-current plant. He did not himself advocate compressed air for everything in a colliery, but he did advocate it for coal-cutters, and especially for wet places. A compressed air plant, if well designed and well looked after, was as efficient as an electric plant.

ELECTRIC WINDING

AN original communication on this subject by Mr. G. Stjernberg has been accepted by the Institution of Electrical Engineers for publication in the Journal. The author points out how the steadiness of drive of the electric motor has enabled full advantage of the use of balance ropes to be taken without the dangerous swinging which the discontinuous impulses of the steam engine produce. He then proceeds to a detailed investigation of the effect of the balance rope on the design of the plant leading to results which may be summarised as follows :—

The size of a winding motor for a given arrangement of the mechanical part and a given useful load depends, in the case of a cylindrical drum with balance rope, upon the value of MS/QT^2 (where M = the equivalent mass, which, moving at rope speed, would produce the same effect as the moving parts of the gear, S = depth of shaft, Q = the static load, and T the total time allowed for the wind). This expression decides the torque, and the value of S/T decides the temperature rise. The form of the speed diagram influences the size of the motor when direct-coupled, or for a fixed ratio of gearing, not more than 5 per cent. for values of MS/QT^2 not exceeding 0·2, and not more than 10 per cent. for values of MS/QT^2 not exceeding 0·4. With geared motors, if the maximum motor-speed is given, the value of the average speed has a very great influence upon the size of the motor, which is then larger the higher the speed. The temperature rise of a winding motor under actual working conditions can be ascertained by running the motor at average speed with a load corresponding to the R.M.S. torque. The electrical efficiency can be ascertained by running the motor at average speed developing a torque equal to the R.M.S. torque. With resistance control, this test gives the sum of motor losses and the resistance losses. The motor losses during time T are equal to the motor losses taken over the diagram. The resistance losses stand in the same proportion to the mechanical output as during actual winding if no braking occurs. Resistance control can, with the limitations given in the Paper, not be considered for values of B, where $B = MS/QT^2$, larger than about 0·25. As a rule, in consideration of the peak load, the limiting value is smaller still. The most suitable values are B = 0·1 to 0·2. Ward-Leonard control with cylindrical drum can be used for values of B up to about 0·35. With Koepe discs, however, the maximum value of B is about 0·25.

In the case of a cylindrical drum without balance rope, the effect of leaving out the balance rope is to increase the R.M.S. value of the torque diagram by about one-half the torque produced by the full length of rope. For values of B smaller than 0·2 the increase is somewhat less, and somewhat more for B = 0·2. If we desire to work without braking, the value of B for which resistance control is suitable is reduced in proportion to $(1 - W/Q)$, that is, it can only come into question for values of B smaller than about 0·15. Ward-Leonard control can be used within the same limits as before, but the motors are then much larger, and the efficiency considerably less. When testing the winding motor as above the diagram efficiency has to be separately dealt with. Different winding systems and best results cannot be correctly compared without taking into consideration the value of MS/QT^2 and the value of M/Q so far as it is inherent to the system. If no balance rope is used, the value R/Q must also be considered (where R = the ratio of the R.M.S. torque during the wind to the static torque).

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THE WINHEY LEAKAGE DETECTOR

IN a Paper read on March 14th before the Manchester Geological and Mining Society Mr. E. E. Baker gave a description of an instrument known as the Winhey leakage detector, the object of which is to isolate a section of a mine installation automatically directly the leakage current rises to a predetermined value. The instrument contains a relay worked by a local battery, which controls the tripping circuit of the main oil feeder switches and the detector relay, the coil of which is connected on one side to a copper earth wire run to the bottom of the pit shaft. Tappings are taken off at each pit-eye and connected to the armouring of the three-core cables which run from the pit-eye main distribution boxes, along the intake haulage roads to the motors, transformers, &c.

The author states that in testing one of these instruments on a 550-volt A.C. system the circuit could be opened automatically with an amount of leakage sufficient to cause a shock only appreciable in the nerves of the wrist and ankles. The objection might be raised that with an instrument of such sensitivity there would be inconvenience through constant interruption of supply from slight leakages, but in a twelve months' trial of the apparatus at the Rose Bridge and Douglas

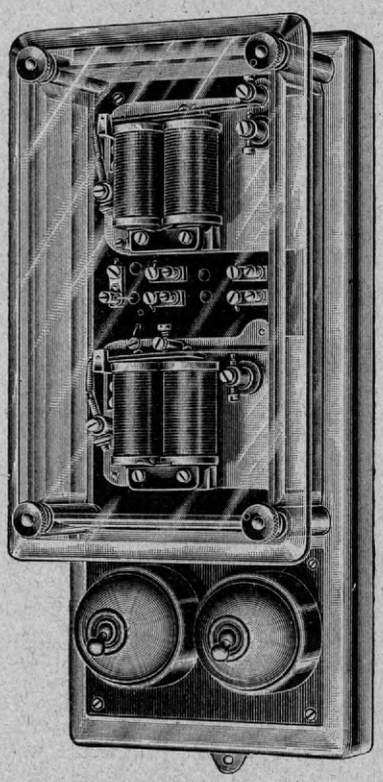


FIG. 1.—WINHEY LEAKAGE DETECTOR.

Bank Colliery the detector only came into action twice, and both cases were real breakdowns, one due to a leaky steam pipe having damaged a cable, and the other to an induction motor having gone to earth. During the experiments in connection with the design of the apparatus it was found to act with sufficient rapidity to prevent a rat, who earthed one phase of a 550-volt three-phase system, being killed.

In the installation in question the instrument was adjusted so as to allow a certain limit of leakage, and then sealed up. If a leakage beyond this limit should occur, the circuit-breakers in the shaft cables are instantly opened, and at the same time a bell is rung in the power-house, which attracts the attention of the man in charge. The circuit-breakers are of the loose-handle type, and these are then immediately put in. If the leakage has gone off, they stop in; if it is still on, they come out. His instructions are to try them once after operating, and, if the fault is still on, to send for the electrical engineer. The faulty circuit is discovered by trying one circuit at a time, and if it is considered safe to do so, the magnitude of the leakage can be seen by cutting out the detector and reading the leakage current on the leakage indicator. If it is a serious fault, the installation is still protected by the overload trips. If, however, it is small and within the allowable limit, it may be considered advisable to finish the shift with the leakage on, in which case a record is kept of its magnitude and duration.

A SAFETY SWITCH AND PLUG

THE Foster Engineering Co., Ltd. (Morden Road, Wimbledon), have introduced an automatic switch and plug for use in dangerous situations in coal mines, in powder magazines, coal bunkers of ships, or wherever there is risk of explosion. The apparatus is so arranged that it is im-

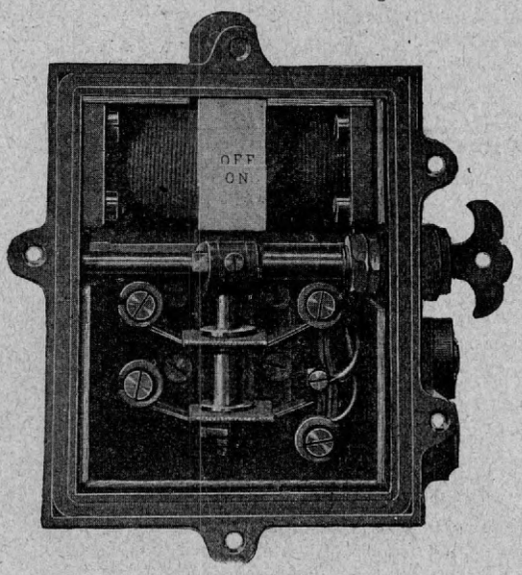


FIG. 1.—FOSTER SAFETY SWITCH.

possible to withdraw the plug from the socket unless the circuit has previously been made dead by the switch situated outside the danger zone; nor can the switch be left in the "on" position unless the plug is first inserted. Both switch and plug are water and gas tight, and of substantial construction. The principle of their operation is very simple. The switch contains an electro-magnet so arranged that it holds in the "on" position the double-pole switch when current is passing through it, but should no current be flowing

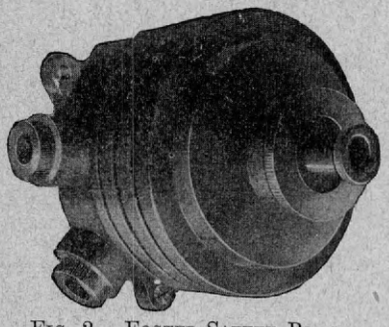


FIG. 2.—FOSTER SAFETY PLUG.

the magnet ceases to be energised, and the circuit is broken. The socket also contains an electro-magnet, so arranged that when current is passing through it a small bolt is lifted, which locks the movable plug so that it cannot be withdrawn while the current is on. The magnets in both switch and plug are in series with the rest of the circuit.

The switch, with the cover removed to show the working parts, is shown in fig. 1, and the plug which screws completely over the socket is seen in fig. 2. We understand that several of these switches and plugs are in use on battleships in the Navy.

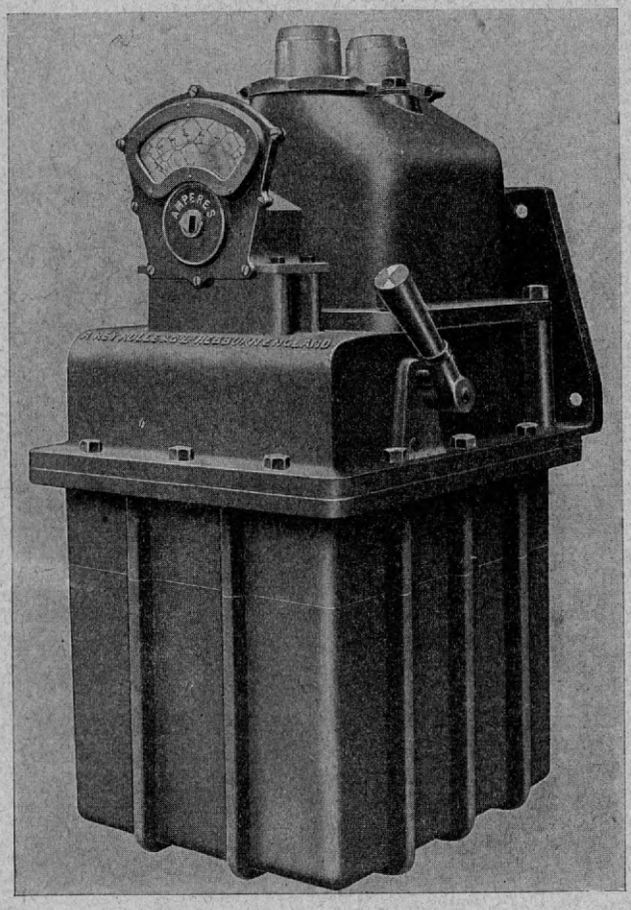
Rescue Work.—The report of the Departmental Committee appointed by the Home Office last October to consider rescue work in mines, contains draft rules, including one to the effect that two electric hand lamps ready for immediate use and capable of giving light for at least four hours must be provided at every mine. It is also recommended that twenty such lamps should be kept in every central rescue station.

The Institution of Mining Electrical Engineers.—It has been resolved that "the Report of the Departmental Committee appointed to consider the working of the existing Special Rules for the use of Electricity in mines, may be read at the Branch Meetings with a view to instructing Members as to the meaning of the Report, the proposed New Rules, and the Memorandum, but no reports of the discussion or criticisms which may be made on the Rules shall be published in either the Official Organ or any other paper."

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COLLIERY SWITCHGEAR

IN the early days of mining switchgear design the aim was to construct gas-tight apparatus of strength sufficient to withstand internal explosions, but it was soon found that it was impossible to construct switchgear either sufficiently gas-tight to avoid all possibility of an accumulation of gas inside the cases, or to ensure that they could withstand internal explosion without risk of bursting. Messrs. Reyrolle & Co., Ltd. (Hebburn-on-Tyne), have long realised these points, and their principal aim is to construct apparatus in which an



REYROLLE OIL SWITCH FOR UNDERGROUND USE.

accumulation of gas can be exploded without danger. One of the methods by which this is ensured is the provision of extra wide flanges to all the joints without tight packing, so that, as in the safety lamp, the flame is cooled before it can protrude. The firm have brought out a number of designs on these lines, and a complete three-phase oil switch equipment provided with ammeter worked by a current transformer of this kind is illustrated here. The principle has also been applied to circuit breakers, fuse boxes, motor starters, &c.

Powell Duffryn Co.'s New Pit.—Mr. J. Shaw, chairman of the Powell Duffryn Co., has stated that the new colliery at Pengam would be the first to be worked solely and entirely by electric power. The sinking and equipment of the pit, and the winding of the coal, would be done by electric power produced from waste gases and waste products.

Colliery Guide and Directory.—A new edition (1911) of "Reid's Colliery Guide" for the counties of Northumberland, Durham, and Yorkshire, has been issued by Andrew Reid & Co., of Newcastle-upon-Tyne. This comprises a list in alphabetical order of colliery owners, with the names of the collieries, agents, managers, and engineers, for the above districts. An alphabetical list of collieries is provided also with reference numbers, so that the owners, managers, &c., can be found readily from the first list. The addresses of agents, managers, and engineers are given, and also a list of Associations and Institutions in the district. Useful maps of the coalfields, on which all the collieries are clearly marked, are included. The Explosives Act of 1875 and the Orders of 1906 and 1910 are given in full, as are also the Coal Mines Regulation Acts of 1887, 1896, 1903, and 1908. The Special Rules for the use of electricity in mines are included, but not the new draft rules. Mining statistics, the Workmen's Compensation Act, 1906, and other miscellaneous information are given.

HOME OFFICE PROSECUTION

AT Hamilton, Scotland, on March 29th, Sheriff Hay Shennan gave judgment in two cases of alleged contravention of the Coal Mines Regulation Act and the Special Rules relating to the use of electricity. The case arose out of complaints made by H.M. Inspector of Mines with regard to the electrical apparatus in Millburn Pit. The defendants were Mr. R. M'Kay, resident manager of Cornsilloch Colliery, Dalserf, belonging to Messrs. Archibald Russell, Ltd., and Mr. J. Salmond, general manager to the firm. The charges against Mr. M'Kay were as follows: (1) Failure to maintain communication between two shafts (this was withdrawn as irrelevant); (2) having allowed a haulage motor to have a wood cover on both its commutator and its switch, with consequent danger of fire; (3) failure to earth the frame of the motor efficiently; (4) failure to protect the terminals and starting switch with an insulating cover or an earthed metal cover; (5) having allowed a joint in a lighting wire to be merely twisted and taped and not soldered; and (6) having had cables in a haulage road suspended on iron nails and not hung with straps. The charge against Mr. Salmond was that he had failed to have a competent person in charge of the electrical plant.

Mr. J. Masterman, H.M. Inspector of Mines, in giving evidence, said that there was no earth wire attached to the distribution box in the motor house, while the earthing of the motor frame was bad in respect that a seven-strand signal wire passed loosely through a hole in the iron frame, and was held in position by a piece of wood jammed into the hole. Mr. R. Nelson, H.M. Electrical Inspector of Mines, said that the wooden cover over the commutator was not more than three inches distant from live metal. The earthing connection provided was quite useless, and the starting switch had an exposed terminal. He had found that a joint in a lighting wire near the motor house had been made by twisting the wires together and covering the bare wire with waterproof taping. Mr. W. Walker, Chief Inspector Mines in Scotland, confirmed these statements, and mentioned that the electrician in charge, Mr. J. Young, had said that if he had erred, he had done so in ignorance. Evidence was given in defence by Mr. Young to the effect that the switch was well fenced off, and that the wood cover had been on the commutator for some years. The Sheriff convicted on charges (2), (3), and (6) relating to the commutator and switch, earthing, and the suspension of cables respectively, but rejected the other charges against Mr. M'Kay. He did not consider the offences very serious, and dismissed the defendant with an admonition.

In the case against Mr. Salmond, evidence was given by Mr. Nelson as to defective work in the pit, which he put down to the incompetency of Mr. Young; but Mr. Salmond stated that the resident manager's reports as to Young's work were good, and Mr. A. Anderson, managing director of Anderson, Boyes & Co., also spoke very highly of Mr. Young who was, he considered, quite competent to have charge of electrical plant, and particularly resourceful. The Sheriff held that the evidence showed that Mr. Salmond was entitled to regard Young as a competent person, and consequently found the defendant not guilty.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during March.

March 2nd.—Monthly supplement on ELECTRICAL ENGINEERING IN MINES, opening with an article giving the main features of the report of the Home Office Committee on Electricity in Mines and the proposed new special rules. Reports are given of the adjourned discussion on Messrs. Dixon & Baxter's Paper before the Institution of Mechanical Engineers, describing the electrical coal hoists at Clydebank, and of a discussion by a branch of the Association of Mining Electrical Engineers on three-phase haulage motors. The verdict of the jury, to the effect that the cause of the Hulton Colliery explosion was not electrical, is announced. Other short articles contain a summary of Electrical Mining Patents for February, and descriptions of a transformer for mining bells and some oil-immersed motor starters.

March 9th.—Illustrated description of a new design of turbo-alternator. Results of steam consumption tests of a 6,000-kw. turbo-alternator. Discussion on high-tension transmission lines. Report of a Paper and discussion on circuit breaking.

March 16th.—Literary supplement, with reviews and list of recommended books in all branches of electrical engineering. A Paper on cable laying and jointing. Descriptions of two new types of water-tube boiler.

March 23rd.—Special article and report of a discussion on main cables. Description of a new instrument for measuri[ng] very low resistances.

March 30th.—Tests of some soldered aluminium joints.

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ELECTRICAL MINING PATENTS OF MARCH

Among the Patent Specifications of interest to electrical mining engineers published during the past month was one by H. F. Joel, of Forest Gate (No. 3,185 of 1910) for an electric safety lamp in which the lamp is attached to the hinged lid of the battery case. Taper pointed contact pins on the lid engage with spring clip contacts attached to the battery terminals when the lid is closed, and thus complete the lamp circuit. One of the contact pins is mounted on the end of a rod, which is threaded where it passes through the top of the lamp case, and thus makes a gas-tight joint. By rotating this rod, the circuit can be broken when the lid is closed.

Specification No. 7,388 of 1910, by E. A. Hailwood, of Morley, describes an apparatus for testing miners' lamps and for observing the percentage of a gas mixture by the height of the "cap" on the flame. The apparatus encloses the lamps, and is provided with means for regulating and indicating the composition of the gas mixture, and electric ignition arrangements.

A novel design of electric coal-cutter is described in Specification No. 10,358 of 1910, by J. C. Hirst, of Reynoldsville, U.S.A. This comprises a wheeled truck on which is mounted a motor-driven shaft provided with a bulbous head studded with a series of tangentially arranged cutters. The cutters engage with the coal successively as the shaft is swung laterally in an arc of a circle with the truck as a pivot.

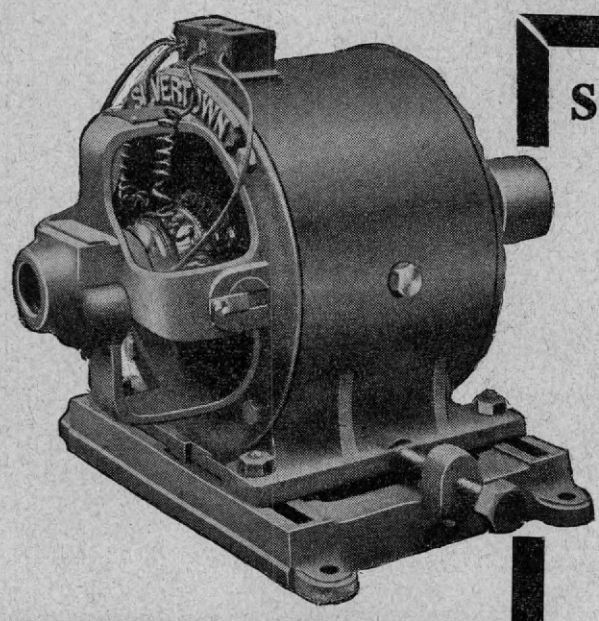
Specification No. 11,792 of 1910, by C. J. Beaver and others, of Manchester, and describing a cable protected against external arcing in the event of a fault developing inside, is abstracted in the Patent Record on another page of this issue.

A safety lamp with an improved electrical igniting device is described in Specification No. 13,892 of 1910 by F. Kay, of Grimethorpe, and E. Kay, of Normanton, Yorkshire. Instead of one wire close to the wick two wires are employed and are provided with adjustable sparking buttons. When the lamp is placed on the relighting table, the sparking buttons are brought close to the wick, and as soon as ignition is effected are kept down by springs below the level of the flame, thus preventing oxidation and burning of the buttons.

Specification No. 18,135 of 1910, by L. Kovatch, of Sidney, Indiana, U.S.A., describes a movable support for an electrically driven coal punching machine enabling the machine to be tilted or swung in a lateral plane to work on the walls situated at the sides of the support.

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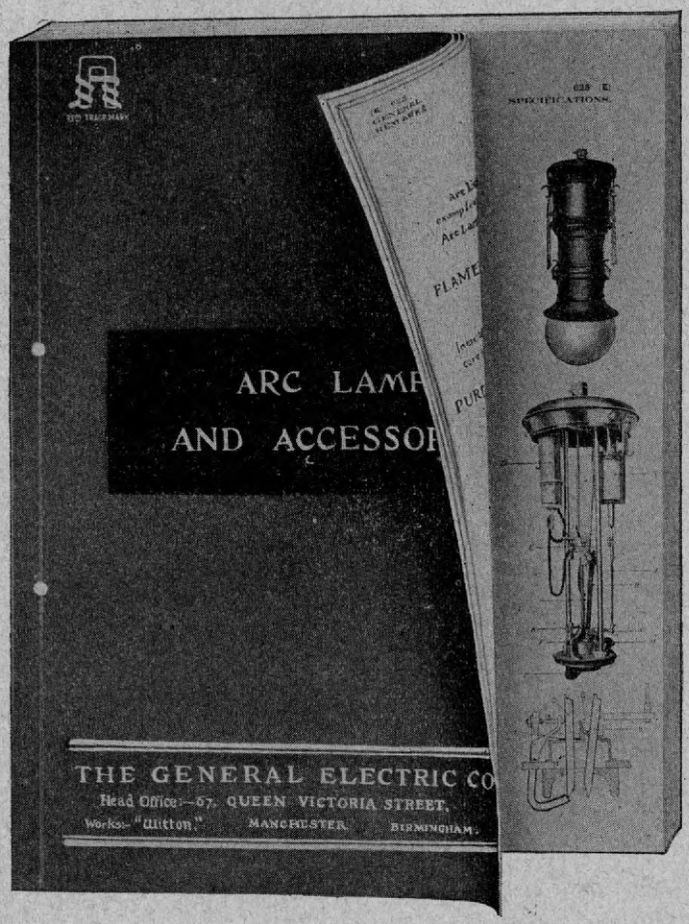
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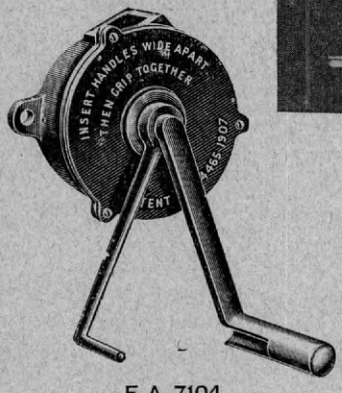
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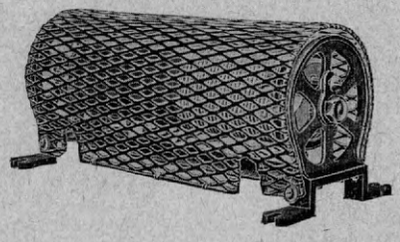


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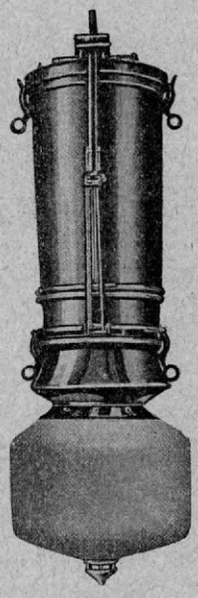
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When handle is removed it is impossible to interfere with suspension of lamp.



E A 6800/12.
RESISTANCES.
Small oblong type with cover.
Weight 7 lbs.
Overall dimensions, $4\frac{3}{4}$" by $13\frac{1}{2}$" by $5\frac{1}{2}$".



LATEST TYPE
'ANGOLD' MAGAZINE FLAME LAMP
(PATENT.)
For continuous current.
70 hours burning.

THE GENERAL ELECTRIC CO., LTD.,

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CORRESPONDENCE

THE LIFE OF METAL FILAMENT LAMPS.

To the Editor of Electrical Engineering.

Sir,—With reference to the article on page 167 of your issue of March 30th on metal filament lamps, we note that you commence by saying "a good deal of uncertainty has existed regarding the useful life of metal filament lamps"; it would be interesting to us to hear your opinion as to what is the useful life of metal filament lamps. The Westminster Electrical Testing Laboratory, to whom you refer in the article mentioned, consider the economical life of a lamp to be at an end when the efficiency reaches 1·5 watts per candle-power, and on this basis the lamps to which you refer have no economical life whatever, the efficiency of the four lamps varying from 1·55 to 1·64 watts per candle-power. After all, the only question for the consumer is to consider which lamp will give the required light at the least cost. Now, taking current at 5d. per unit, we find that the cost of the Cryselco lamp per 1,000 candle-power hours is 7·75d. With regard to the other 14 makes, the cost varies up to 12·3d., no make showing such a low cost as the Cryselco lamp. This difference does not sound much as it stands, but if we take a dwelling-house requiring 50 lamps giving, say, 25 c.p. each, and take the lighting hours at 1,000 per year, the total cost of lighting using Cryselco lamps would amount to £40 7s. 3d. a year, whereas, using any of the other makes of lamps tested, the total cost would exceed this amount, being in the case of the lowest £43 15s. up to £64 a year for the highest. We therefore consider that we are entitled to claim that this independent test conclusively proved that the most economical and satisfactory lamp to the consumer is the Cryselco.

We are, yours faithfully,

Cryselco, Ltd., Bedford. H. T. Deacon.
March 31st, 1911. (Managing Director.)

P.S.—As some of the four lamps of some makes failed in less than 1,000 hours (not Cryselco), the proportionate cost of replacing is included in the above figures, i.e., if a lamp failed at 700 hours, three-tenths of the cost of a new lamp is charged.

SOLDERED ALUMINIUM JOINTS.

To the Editor of Electrical Engineering.

Sir,—In last week's issue of Electrical Engineering I notice there is a paragraph on soldering aluminium joints, and reference to a company called the Vacuum Engineering Co., who have introduced what they claim to be something quite new.

It has been possible for some time now to solder aluminium in a highly satisfactory manner by using the patent solder made by Standard Alloys, Ltd., of Carpenters Road, Stratford, E. This solder has been used by several of the leading cable manufacturers in this country, and wherever tried, so far as one can ascertain, has given entire satisfaction. It is very simple to use, and a workman after once being shown can easily apply it. It has been found after exhaustive tests that the soldered portion of the joint is stronger than any other part, and that it is not attacked by acids, nor does disintegration take place after it has been in use, as is the case with all other forms of solder when used with aluminium.

It appears to me that if this solder were only better known it should command a ready sale, so that if any of your readers are in difficulty with regard to soldering aluminium, or the jointing of aluminium cables, let them communicate with the Standard Alloys, Ltd., who, I think, will soon remove their troubles.

Yours faithfully,

7 Victoria Street, S.W. Horace Boot.
April 3rd, 1911.

ELECTRICITY METERS.

To the Editor of Electrical Engineering.

Sir,—Your correspondents, Messrs. Simplex Conduits, Ltd., claim that commutator meters are not so bad as painted by the authors of the recent important I.E.E. Paper. No doubt the better class commutator meters can show better results than those shown by the curves in the paper. At least, this is possible when the meters are new and clean. However, the curves are remarkably similar to those which we have recently published in the electrical press. Our curves are the results of a test made by the engineers of a Continental capital, who have in use thousands of commutator meters and thousands of Ferranti mercury meters. The test is one of the most practical which we have yet seen, and was applied to meters which had been in service for a period of two years without any examination or repair, and ten meters of each class were tested *in situ*. The curves of four different makes of commutator ampere hour meters showed errors as follows, viz. :—

Nos.	1.	2.	3.	4.
		Per cent.	Per cent.	Per cent.
Half load	OK	− 3	− 3	− 3
Fifth ,, ...	− 4·8	− 5·9	− 6·3	− 6·5
Tenth ,, ...	− 9·8	− 33·1/3	− 16	− 19

The curve of the Ferranti mercury motor meter shows the meters within 1 per cent. from full to 1/20th load.

Accuracy on low loads is really far more important than first cost of the meters, in view of the extensive adoption of low-current lamps.

Your correspondents' letter is in curious contrast with their advertisement in the same issue, since they announce in an advertisement, "Ready Shortly. New Mercury Ampere Hour Motor Meter for Continuous Current."

Yours faithfully,

Hollinwood, Ferranti, Limited.
April 3rd, 1911. R. H. Schofield.

To the Editor of Electrical Engineering.

Sir,—Messrs. Ratcliff & Moore's Paper on integrating meters will be greatly appreciated by many who are unable to make more than a superficial study of the instruments upon the accuracy of which so much depends.

Meters of large size are usually selected with care and kept under fairly close observation, but many of the instruments being sold at the present time for registering energy used for lighting, are not sufficiently well made in detail, and when placed on consumers' premises do not keep up a sufficiently high average of accuracy; the chief cause of this is possibly to be found in the quite unnecessarily large number of meter makers, and the ruinous competition at present existing between them with regard to the smaller-sized meters.

In some instances the prices quoted appear to be tentative only and subject to reduction by as much as 15 per cent., not so much in regard to the size of the purchase in view, but rather depending upon the keenness of the buyer and the immediate state of the seller's order book—these conditions are not good for the meters or those whose revenue depends to a great extent upon their accuracy.

The difference between test-room results and average accuracy over long periods when subjected to dust, moisture, temperature changes, and vibration, depends almost as much upon mechanical details of construction as upon correct design of the essential parts—these details, the fitness of which is only proved by time, are apt to suffer considerably in the attempt to cheapen production.

The most serious trouble with meters used for lighting circuits arises, not from inaccuracy, but from failure, after a short time, to register at small loads, a defect which arises almost entirely from the works of the meter being insufficiently protected against external influences. On alternating systems where the use of low voltages reduces the minimum load which can be put upon the meter, this fault may cause serious trouble, failure to register under 40 watts permitting 2–16 c.p. lamps to be used free; on small premises, where light may be used in only one room for many hours during the year, this leakage may represent a large percentage of the annual bill—an amount, in fact, which would have paid the difference in cost of a superior type of meter.

April 3rd, 1911. J. W. B.

At the close of the discussion on Messrs. Ratcliff and Moore's Paper on meters before the Institution of Electrical Engineers on March 23rd, several gentlemen who had hoped to speak were prevented from doing so by the lateness of the hour, and were invited to send in written contributions.

Mr. C. C. Paterson (National Physical Laboratory) has sent us a copy of his communication, in which he endorses the author's view that indicating wattmeters used for testing A.C. meters often read low on lagging currents owing to metal parts near the windings. He says that this is particularly the case with heavy currents. It had been suggested that the standard wattmeter might be tested against an induction meter. This was not so absurd as it sounded, for he knew of more than one type of precision wattmeter whose change of accuracy between unity and 0·5 power factor exceeded that usually met with in induction watt-hour meters. It was important on account of interaction of the circuits to test three-phase meters on actual three-phase circuits, and not on single-phase circuits only. It was also essential to know which element was to be connected to the leading and which to the lagging phase of the system. At the National Physical Laboratory they certified the errors of the meter for both methods of connection, but the whole difficulty would be overcome if meter makers would distinctly mark which element was to be connected to each phase. If these precautions were taken, he considered that the three-phase watt-hour meter was as reliable and accurate as any other form of integrating meter.

We have also received a communication on the subject from Mr. E. B. Schattner, particularly directed to contraverting statements in the discussion regarding the inaccuracy at low loads after a period of service of commutator ampere-hour meters, and the liability of the insulation of the commutator segments to break down. The commutator meter was introduced, he says,

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originally on the Continent to supply the demand for a simple ampere-hour meter not so liable to derangement as most of the then existing watt-hour meters. The mercury meter was at that time not known on the Continent, and was also very imperfect as manufactured in England.

Generally speaking, the climate on the Continent is of a dry nature, and porous insulating materials, such as fibre and press-pahn, were giving satisfactory results. Also the majority of important supply systems on the Continent were at 100 volts. It was therefore essential that a meter should not have a higher drop in volts than 0·6 to 1 volt. These instruments were then imported into this country, and on the strength of favourable Continental experience, it was not found difficult to effect immediate sales. We know now, however, that the insulating materials above mentioned are of no use in this country. We also know, that whilst a commutator that will not appreciably change its surface resistance in a dry atmosphere, will do so to a considerable extent in a moist and sulphurous atmosphere, and so it happened that these Continental meters developed serious faults.

The above considerations were taken into account when the Company, with which Mr. Schattner is identified, designed the E.A.C. high torque meter about three years ago, a meter now largely used. By the exclusive employment of pure mica for insulation purposes (except under the commutator) insulation troubles were avoided, although a large number of seaside towns have them in continuous use. The commutator segments are built up on a solid ebonite sleeve, and no single case of break-down has been heard of. The prevailing voltages in this country lie between 200–250 volts; a higher and more suitable drop in volts could be employed, diminishing the influence of contact resistance.

The Company have been able to construct an armature having as high a resistance as 7·5 ohms, without sacrificing torque, and the maximum error which can occur in the E.A.C. meter owing to change of resistance on the commutator surface is not likely to exceed 2½ per cent., that under the same conditions a very much larger error will occur in meters having a correspondingly smaller drop in volts.

GAS AND ELECTRIC TRAIN LIGHTING

MAJOR PRINGLE'S Board of Trade Report on the collision, last December, near Hawes Junction on the Midland Railway, has now been published, and contains some interesting remarks on the relative safety of gas and electric train lighting. It cannot be denied, he says, that compressed oil gas stored in the cylinders under the first two coaches was the origin of the fire. Nor can it be denied that there is greater liability to fire, in a railway accident of this description, when gas is used as the illuminant, than with electric light. For it is a simple matter to prevent danger from short circuiting of electric wires by the proper provision and arrangement of fuses. He points out that the elimination of gas as a source of lighting would not preclude all danger from fire, as the risk from the contents of the fire-box of the locomotive and the cooking stoves in the restaurant cars would still remain. In fairness to gas, he remarks that this is the first fatal train fire in this country directly attributed to gas train lighting (although, as is well known, several such accidents have occurred in America and on the Continent), and says that it is only reasonable therefore first to consider, before entirely condemning it, whether it is possible to safeguard the use of gas as an illuminant, by the adoption of any improvement in appliances, which may minimise the risk of fire. Several suggestions for lessening the risk with gas are discussed, but finally Major Pringle writes :—

But even with every such possible precaution, it will remain true that electric lighting will still be the safer method. On grounds of safety, therefore, I still hold that electricity is the more desirable means of illumination for passenger trains, and as such should be adopted wherever possible. In the case of long distance and express trains, it is more particularly to be recommended. In the meantime, for of necessity a long period must elapse, during which gas will still be very largely used as an illuminant, a good deal can be done in the directions above suggested to reduce the liability to fire from its use.

THE LODGE WIRELESS PATENT

ON Tuesday the petition of the Lodge-Muirhead Wireless and General Telegraphy Syndicate, Ltd., for an extension of the term of Patent No. 11,575 of 1897, granted to Sir Oliver Lodge, came before Mr. Justice Parker in the Chancery Division of the High Court. The ground upon which an extension of term may be granted is that the patentee has been inadequately remunerated for his invention, and the period of extension may be seven years, or, in exceptional cases, fourteen years. No objections have been lodged to the extension except by the Crown, who allege that the invention was not of sufficient merit to deserve extension, and that no attempt was made during the fourteen years of ordinary life to protect the rights of the patent.

Mr. A. J. Walter, K.C., and Mr. J. Hunter Gray are appearing for the Lodge-Muirhead Syndicate, and the Solicitor-General (Sir John Simon, K.C.) and Mr. Sargant for the Crown. Expert evidence is being given by Sir Oliver Lodge and Dr. S. P. Thompson for the petitioners.

In opening the case, Mr. Walter sketched in detail the history of wireless telegraphy previous to the date of the patent in question, and then read the specification, which describes a syntonised system of wireless telegraphy, in which the radiator sends out a prolonged series of waves of a definite frequency, and the receiving apparatus resonates in response, very feeble impulse being gradually strengthened until they produce an effect on the coherer. Various arrangements of transmitting and receiving apparatus are described, the essential features being the introduction of an inductance coil in the aerial circuit to prolong the oscillations, and to make it a radiator of definite wave frequency, the use of variable inductances for tuning, and the closing of the oscillatory receiving circuit, so that oscillations can be gradually built up from small beginnings, the coherer being in a derived or shunt circuit. The specification also describes the use of a transformer in the receiving circuit, the coherer being placed in the secondary.

The first of the eleven claims covers the insertion of an inductance coil in the sending aerial; the second covers the same thing for the receiving circuit; the third covers the bridging of the spark-gap in the aerial to make it a receiving aerial; the fourth and fifth, variable inductances; the sixth, means of exciting the oscillating circuit; and the ninth, the use of a transformer in the receiving circuit. Mr. Walter agreed, on the suggestion of the Crown, that claims 7, 8, 10, and 11 were of no importance.

Mr. Walter asserted that, previous to this patent, tuning was absolutely impossible with any system of wireless telegraphy, as all then employed a coherer directly in the receiving aerial. As the coherer was necessarily a break in the continuity of the electrical circuit, it was impossible that minute oscillations could be induced in the aerial by feeble waves and built up by resonance. By using a closed aerial circuit with the coherer either shunted off the inductance coil or arranged in the secondary of a transformer, as described by Lodge, this building-up effect was made possible, and tuning could be effected.

Mr. Justice Parker here mentioned that if this were so, all the systems of wireless telegraphy utilising the principle of resonance infringed the Lodge patent, and that if he granted an extension, the Lodge-Muirhead Syndicate could come upon them for heavy royalties, and thus cripple their business. He was obliged to consider the effect of his decision upon the general public. Mr. Walter, however, urged that his lordship had only to consider what had taken place during the 14 years' life of the patent, and should not take into account what might happen as the result of a grant of extension. The syndicate would be willing to grant licences on reasonable terms, which might, if desired, be settled by the Board of Trade.

Turning to the alleged neglect to protect the rights of the patent, Mr. Walter explained that little progress was made in the working of the patent during the first few years on account of the difficulty of securing a reliable coherer. In 1901 a private company was formed with a capital of £50,000, most of which was found by Messrs. Muirhead. Thousands of pounds were expended on experiments, and experimental stations were constructed. In 1902 the well-known Lodge-Muirhead coherer was invented, and this proved commercially successful. It was so perfect that messages could be recorded from it in ink by means of a siphon recorder as used in cable telegraphy. Continued experiments were then made in conjunction with the War Office and Admiralty, and in 1903 the India Office purchased an installation for the Andaman Islands. The receipts of royalties, &c., from the India Office, U.S. Army, Trinidad, and Zanzibar Governments, &c., amounted, during the 14 years of the patent, to nearly £6,000 less than the amount expended on experiments, &c., namely, £33,167. This latter sum did not include anything for the personal time of either Sir Oliver Lodge or Dr. Muirhead. In 1904 they considered that the Admiralty, who were using a system of their own, were infringing the patent, and approached them in the matter, but the Admiralty refused to put up anyone whom they could sue. Recently, however, they had come to terms, the Admiralty agreeing to pay a certain sum. They had been refused a licence by the Post Office for a coast station in 1905, and had not been able, therefore, to engage in the very remunerative business of communicating with ships at sea. Further, they had entered into an action against the Marconi Co., but this was settled between the parties, the Marconi Co. refusing to raise the question of their 1896 patent, which it was the wish of the Lodge-Muirhead Syndicate to do.

Sir Oliver Lodge was then called in evidence, and stated that he did not turn his attention seriously to the application of Hertzian waves to telegraphy until 1896, after Mr. Marconi's early work had been brought before the public. He then explained clearly the reason and importance of the different features of the patent in question.

The case is still proceeding.

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ELECTRIC TRACTION ON THE SWEDISH STATE RAILWAYS

The 80-mile Kiruna—Riksgransen Section.

WORK has already been commenced on the conversion to electric traction of an 80-mile section of a full-gauge line of the Swedish State Railways in the extreme north of Sweden, and the equipment is to be complete in the year 1914. The section in question is between Kiruna, where there are extensive deposits of iron ore, and Riksgränsen, on the border between Sweden and Norway. The continuation of the line in Norwegian territory connects Riksgränsen with Narvik, a seaport from which the ore is shipped to the smelting centres. Although the traffic consists mainly of ore trucks, there is a certain amount of passenger and general goods traffic, and special locomotives for passenger trains will be provided. A feature of the line is that it is wholly within the Arctic circle and heavy falls of snow have to be dealt with in the winter months.

There is no coal in the north of Sweden, and only a very small amount in the south, and consequently all the coal for the railways has to be imported, and is high in price. There is an abundant supply of water power, however, and should the present electrification prove successful, the whole system of railways will no doubt eventually be converted to electric working. It will be remembered that as a result of the experiments carried out near Stockholm between 1905 and 1907, the State authorities decided to employ the single-phase system. In the present case, a trolley-line pressure of 15,000 volts and a frequency of 15 cycles per sec. will be employed, as is favoured in Germany and Switzerland. In May of this year the Swedish Parliament granted for the present work a sum of approximately £1,200,000 (of which £270,000 will be forthcoming this year), and the contract for the whole of the electrical work was given to the Allmänna Svenska Elektriska Aktiebolaget, of Westeras, Sweden, and the Siemens-Schuckertwerke-Ges., of Berlin, who have guaranteed that the running costs shall not exceed certain limits.

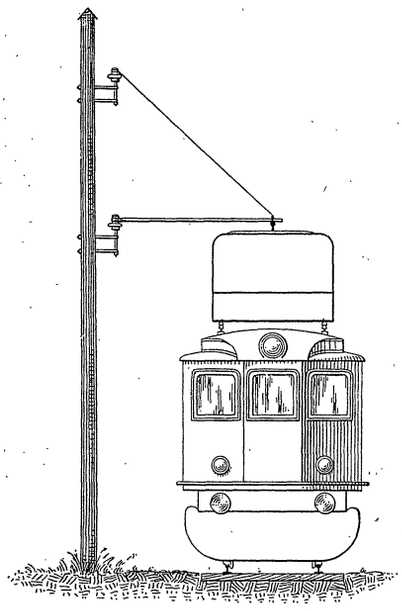


Fig. 1.—Trolley-wire Suspension.

The line is single track, and the traffic is increasing rapidly, but the introduction of electric traction will render unnecessary any immediate duplication of the track. At present the trains consist of not more than 28 loaded trucks, weighing 35 tons each, and a general goods wagon, hauled by a locomotive of the heaviest type employed in Sweden. With electric traction, each train will consist of 40 loaded trucks, a goods wagon, and two electric locomotives, one in front and one behind, and will weigh 2,050 tons. Eight such trains will run daily in each direction. A maximum speed of from 30 to 38 miles per hour will be attained, whereas with the present steam trains the maximum speed reached is only 25 miles per hour. The speed on the heaviest gradient, viz., 1 per cent., will be increased from 7·5 to 19 miles per hour. Apart from the increase in the capacity of the line, electric working will effect a yearly saving to the Government of over £23,600 in the running costs, as compared with steam traction, assuming the guaranteed costs of the contracting firms, and a yearly transport of 3,850,000 tons of ore, which is the figure estimated for the year 1918, on the basis of the increase during the last few years.

Power will be supplied from a water-power station to be erected at Porjus, some 74 miles south of Kiruna, on the river Luleälf. The falls there will provide far more power than will be required for the railways in the vicinity, but it is expected that a large amount of energy will be utilised for industrial purposes, including electric smelting of iron and zinc. The lake of Porjus will be dammed up just above the falls, which will provide an effective head varying between 158 and 188 ft., according to the season. The power station itself will be constructed underground in the solid rock. Five turbine units of 12,500 h.p. each will be installed, with three single-phase alternators generating at 5,000 volts, 15 cycles, and two three-phase alternators generating at 25 cycles. The latter will be for the industrial power supply. Access to the station will be gained by two lifts. The switchgear and transformers will be housed in a separate building above ground. For the purpose of constructing this station and to assist in the industrial development of the neighbourhod, a special railway is being built connecting Porjus to Gellivare, a town on the main line, 60 miles south of Kiruna. From the power station current will be transmitted over a steel pole line at a pressure of 80,000 volts to four transformer sub-stations at various points along the line.

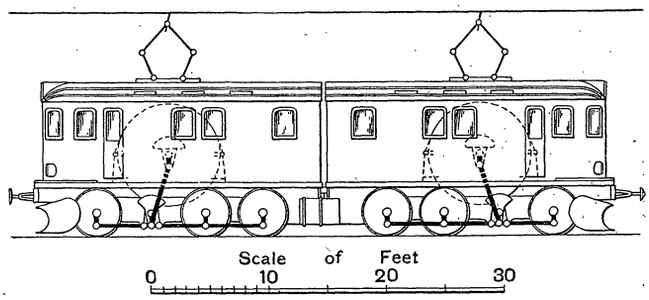


Fig. 2.—Goods Train Locomotive.

The trolley line, which will supply current to the locomotives at 15,000 volts, will have the very simple suspension illustrated in Fig. 1. The trolley wire itself is attached directly without the interposition of insulators, at intervals of 33 yards, to an iron tube supported at one end on an insulator fixed to a wooden pole and held at the other by a steel wire attached to another insulator at the top of the pole. This simple construction was tested during the trials near Stockholm in 1906, and proved satisfactory. The attachment of the wire to the tube is such that a certain amount of longitudinal movement of the wire is possible under the influence of changes in temperature, the sag being taken up automatically by suspended weights at the end of each section. Vertical movement under the upward pressure of the collector bow is also possible at the points of suspension.

A diagram illustrating the general design for the goods locomotives is given in Fig. 2. It consists of two self-contained units, each with three coupled axles driven through a coupling rod and an intermediate shaft by a large commutator motor of the compensated series type. Each half of the locomotive has its own transformer, switchgear, and collector. Fig. 3 shows the design for the passenger train locomotives. This has a single motor driving two coupled axles through a coupling rod and an intermediate shaft, while a four-wheel bogie is provided at each end to give smoother running. The total weight of this type will be about 70 tons. A speed of over 60 miles per hour will be attained by the passenger trains.

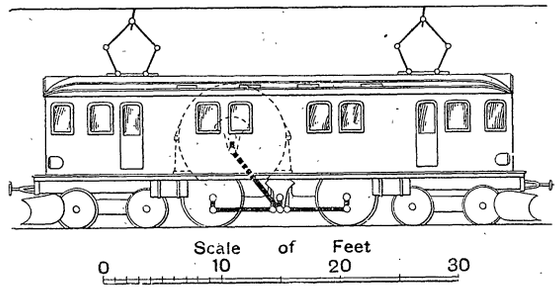


Fig. 3.—Passenger Train Locomotive.

Most of the above information is taken from an article by J. Oefverholm, an official of the Swedish State Railways, in a recent issue of *Elektrische Kraftbetriebe u. Bahnen.*

The Old Ferrantians Dinner.—The date of this dinner, which is to be held at the Trocadero Restaurant, has been fixed for Saturday, April 29th. Tickets can be obtained from the Hon. Sec., Mr. W. E. Warrilow, "Selwyn," Mildred Avenue, Watford.

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ELECTROMETALLURGY AND ELECTRO-CHEMISTRY

ONE of the most difficult problems which the electro-metallurgist has been called upon to face is that of the production of zinc from its ores in the electric furnace. The electrometallurgy of zinc is one of the least satisfactory of metallurgical operations. This is readily understood when it is mentioned that the reduction of zinc oxide by means of carbon to the metal requires a temperature of at least 100° C. above the boiling point of the metal. Furthermore, the metallic vapour when formed is extremely readily oxidised, and when a portion is oxidised it is not easy to get the metal to condense as a liquid, the tendency being for a blue powder containing oxide to be produced. In the circumstances it is therefore not surprising that many attempts have recently been made to produce zinc from its ores by electro-thermic methods. Gustave Gin recommends his induction furnace for the production of pure zinc directly from its ores. Iron and carbon are employed as reducing agents, and a yield of 65 per cent. is obtained. The iron required for reducing purposes is first melted in the furnace, then the calculated mixture of ore, coke, and flux added, after which the furnace is sealed up, except for the flues leading to the condensing chamber. The condensing chambers are kept at a temperature of about 500°, which aids in obtaining the metal in the form of a liquid.

According to Ingalls, a zinc process could only pay if the cost per h.p. did not exceed 50s. per annum. Côte and Pierron take advantage of the greater affinity of sulphur for iron than for zinc, and reduce zinc blende with iron. This also causes reduction of the lead sulphide in the blende, which takes place at a lower temperature than the reduction of the zinc sulphide. The lead is tapped off and then the temperature raised when the zinc blende is reduced. The chief point, however, is in the method employed for the condensation of the zinc vapour. The condensing chamber consists of a firebrick shaft filled with broken carbon, and is provided at the bottom with a door through which the molten zinc is tapped. The carbon in the shaft is kept at a temperature above the melting point of zinc, and the partially oxidised vapour is reduced, so also is any carbon monoxide which would otherwise react on the zinc vapour.

Woolsey McA. Johnson has also devised a furnace in which smaller quantities of carbon than are employed in the ordinary methods for reduction can be employed. Only so much carbon as is necessary for reduction is employed, whereas in ordinary practice a considerable excess is required; consequently an easily fusible slag which may be tapped off is obtained. The lead, copper, and iron in the ore are reduced and collect below the slag, and are tapped off. Fresh portions of charge are added either continuously or at intervals, thus a continuous operation is secured. The mineral components of the mixture, and which form the slag, are proportioned so as to give a slag melting at 1,100° to 1,175° C., the slag being superheated to 1,250° to 1,300° C., is consequently readily tapped.

The gases which are produced are oxidising in character, and would thus prevent efficient condensation, therefore they are passed along with the zinc vapours through a shaft packed with carbon which is artificially heated. This is done by passing an electric current through the column of coke, through which the vapours pass, which heats it to a temperature of 1,020° C. to 1,150° C., thus ensuring perfect reduction.

Another method is that of Hiram W. Hixon. In this process a shaft furnace with a carbon bottom plate which acts as one electrode is employed, the other carbon electrode is placed near the top of the shaft. The charge acts as a resister, and consists of a mixture of zinc ore and carbon, which is packed in between the electrodes and extends above the top electrode. In order that the zinc vapours may not get out into the air, the shaft is provided with a double hopper; an upper door may be opened for feeding in a new charge, a lower door being kept shut. The upper door is then closed, and when the charge has been pre-heated to a sufficiently high temperature, the lower door is opened and the charge allowed to enter the furnace. The zinc vapours are drawn off near the bottom of the shaft, and pass into the condenser. At the top of the tap hole a number of arcs are provided, to prevent the tap hole being choked with "blue powder" (a mixture of zinc metal and zinc oxide in the form of a powder). An exhaust pipe is also provided at the top of the furnace to pump out the carbon dioxide and moisture.

It is obvious from these notes that the question of the treatment of zinc ores electrically is receiving serious attention, and probably the time is not far distant when the 50-lb. zinc retorts will be relegated to the scrap heap, and zinc reduction, like other metallurgical operations, will be worked in large units.

The second and third of the series of Cantor lectures on electric heating, by Prof. J. A. Fleming, at the Royal Society of Arts, were delivered on March 13th and 20th, and were devoted to electric furnaces. (The first lecture on March 6th dealt with the laws of heating and pyrometry only.) After describing the different arc and combined resistance and arc furnaces for the production of steel from pig and scrap iron, Prof. Fleming discussed the electric smelting of ore, pointing out that of the coke used in an ordinary blast furnace, only a small quantity was used for heating, and that for electric smelting to be as economical in this country the power would have to be available at a cost of not more than 1-20d. per unit. He then described the Keller smelting furnace, which had been used with success and economy in Sweden when fuel was dear and electric energy cheap. A drawback to arc furnaces for steel production was that carbon was taken up by the charge from the electrodes. The induction furnace, first constructed by Mr. S. Z. de Ferranti, got over this trouble. The Röchling-Rodenhauser furnace combined the induction with the resistance furnace in order to raise the power factor. Among the other furnaces described by the lecturer were the Electro-Bessemer furnace, a combination of an arc furnace and a Bessemer converter, and the Moissan arc furnace for laboratory purposes. Finally, Prof. Fleming showed that the most economical section for the electrodes of arc furnaces was that for which the heat lost by radiation from the outer end was equal to half the resistance loss in the electrode. A larger section would cause more heat to be conducted away, a smaller section more heat to be lost in resistance.

Prof. Fleming then dealt with the important manufactures in which the electric furnace is employed. Carborundum, a carbide of silicon, was, he said, produced by fusing a mixture of sand and coke in the Acheson resistance furnace, and large quantities were manufactured at Niagara. Artificial graphite for lubricants, "lead" pencils, &c., was also produced in a resistance furnace. Aluminium was manufactured from an oxide of the metal, alumina, by first melting a mixture of cryolite and fluor-spar in which alumina could be dissolved. At the British Aluminium Co.'s works at Kinlochleven, a large number of melting pots were employed, each absorbing about 60 h.p. About half of this was required to keep the mixture molten and half to electrolyse the dissolved alumina. The dissolving mixture was not affected. Alumina was added continuously, and the metallic aluminium deposited on the cathode sank to the bottom of the pot and was drawn off at intervals. By heating a mixture of lime and coke in a resistance furnace, calcium carbide was produced. It was thought at one time that there would be a large demand for this substance for illuminating purposes, but this was not realised. The large works which had been erected, however, were utilised to manufacture artificial fertilisers, which were produced by combining nitrogen with the calcium carbide, thus forming cyanamide. Another product of the electric furnace was quartz glass, which was proving invaluable in chemical and other work. Turning to the applications of the electric furnace in iron and steel manufacture, Prof. Fleming pointed out that by obviating the necessity for blowing air through the steel as in the Bessemer converter, the danger of occluded gases was practically eliminated. The presence of sulphur, phosphorus, and troublesome oxides which originated from the coke used for heating was also practically prevented, and the addition of exactly the correct quantities of such metals as vanadium, nickel, chromium, or tungsten to produce special steels was facilitated.

Testing Transformer Iron.—An original communication on the above subject, by Mr. L. W. Wild, has been published in the last number of the *Journal* of the Institution of Electrical Engineers. The Paper contains an investigation of the "Washington" system employed by the American National Bureau of Standards, in which a number of strips, each 10 in. by 2 in., are built up into a square, with interleaved joints, with special bent corner pieces. Coils are slipped over two opposite sides of the square, and an alternating-current wattmeter is used in conjunction with an electrostatic wattmeter to determine the losses in the iron. A large number of tests with certain alloys are given in the Paper, and the magnitude of various causes of error in investigation. The final conclusion is that the method is not very suitable for the particular alloys tested, and that if it should be decided that the interleaved method with rounded corners is the most accurate, it is hardly necessary to trouble about cutting the corners round. If the amount of waste material at the corners is deducted from the gross weight, the results obtained will not differ by more than 1 per cent. from the results that would have been obtained had the corners been rounded. It appears, however, to the author that the interleaved method is still the best method of testing transformer iron available. It is generally agreed that if accurate results are to be obtained the strips must be annealed after being cut, and this can only properly be done by the manufacturer. There is no special virtue in using wide strips. Strips, say, 10×1 would be in many ways preferable to strips 2 in. wide. Corner effects would be reduced by one-half, and, with the same area of iron, the length per turn in the magnetising coil would be reduced, thus reducing the CR drop and improving the form factor.

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ELECTRICITY IN AGRICULTURE

At a meeting of the Farmers' Club, in London, on Monday, Mr. J. H. Priestley gave a lecture on "Electricity as a Factor in Crop Production." Mr. E. Packard, Chairman of Club, presided. The bulk of the lecture was a recapitulation of the experiments which have been carried out by Mr. J. E. Newman, in conjunction with Sir Oliver Lodge and Mr. Lionel Lodge, and with the co-operation of Mr. Raymond Bomford, of Evesham, supplemented by experiments by Mr. Priestley himself. In these, a network of wires is erected over the land under cultivation, and is kept charged with positive electricity at high potential. We gave a review of this work in Electrical Engineering for July 21st, 1910, p. 475, the actual figures and facts given there being repeated by Mr. Priestley on Monday.

Mr. Priestley also dealt with the application of electric light in greenhouses for stimulating plant growth, and mentioned experiments with the Cooper-Hewitt mercury vapour lamp, and also with a quartz mercury vapour lamp. The result of the experiments so far seem to indicate that plants exposed to the lamps have grown more rapidly, and, if anything, were more sturdy than plants not exposed in this manner; there were no signs of the lanky, unnatural extension of the plant usually associated with forcing. With the Cooper-Hewitt lamp the method of treatment has been, subsequent to the usual exposure to daylight, to put the plants under the rays for about two hours, at a distance of about four feet from the lamp. At this distance it has been found that the dangerous effects of the ultra-violet rays coming from the lamp are lost. Similar effects were found in the experiment with the quartz mercury vapour lamp, namely, that at close range growth was retarded or entirely inhibited, but at greater distances, or behind a glass screen, a marked acceleration and invigoration was noticeable, if the light was used as complementary to ordinary daylight. One extraordinary result obtained was that in the case of mustard seedlings exposed to the lamp at close range, the plants are of an absolutely glabrous type, instead of, as usual, very hairy. The plants close to the lamp do not possess, either on stem or leaves, a single hair. Further away from the lamp, hairs develop only upon the side away from the light, whilst shaded behind glass the plants are approximately as hairy as usual. These experiments are being continued.

Mr. Robertson Scott, who opened the discussion, drew attention to the meagre grant of £50 made by the Board of Agriculture for the purpose of these experiments. He further suggested that the Agricultural Colleges of Wye and Rothampstead should be assisted in carrying on experiments of this character owing to the difficulty of the ordinary farmer setting aside land for the purpose. He asked if it were not possible to experiment with hops and sugar beet.

Mr. J. E. Newman called attention to the necessity for thoroughly testing the overhead wires, in order to see that a proper discharge was taking place. It had happened that, although the wires themselves were fully charged, yet the crops were receiving no benefit owing to an excessive discharge taking place down the wet poles, and he was inclined to think that this had happened in certain cases where no benefit had been derived from the electrical method. He had had five different crops of wheat in three different fields, and in each year there had been an increase in the yield; so distinct was the improvement in the electrified crop, that a line of demarcation in the field could be plainly seen. Probably it would be eventually found that the best results would be obtained by using very high pressures for short periods during the day, as distinct from the present method, which, for economical reasons, was to use a small amount of current all day.

Dr. Voelcker expressed his doubts as to electricity being applicable to agriculture in the broad sense.

Mr. Charles Bathurst, M.P., suggested that a resolution should be passed by the Club, urging further action on the part of the Board of Agriculture. He asked to what extent electrical methods could be used for replacing sunlight, and what was the effect upon the quality as well as the quantity of the crop. Further, did the electrical treatment have the effect of stimulating noxious bacteria in the soil? At Rothampstead, during the past few years, some interesting experiments had been carried out in sterilising soils, and perhaps the electrical method could be worked in conjunction.

Mr. Alfred Amos said that hop-growers would be ready to adopt the electrical method if any benefit could be shown.

The Chairman pointed out that the Board of Agriculture was quite willing to make grants if they had the money, but at present they had not the funds.

Mr. Priestley, in replying to the discussion, said that in Germany experiments were being tried by treating the plants with an electrified spray in order to get over the difficulty that electrified crops produced less in dry weather. The difficulty in applying the method to hops was that there was a danger of there being electrified poles and not electrified crops. If the hop poles could be abolished, something could be done. He had tried experiments, with satisfactory results, upon sugar beet, but nothing could be done here unless sugar beet was introduced as an industry. The cost of installing the plant was from £10 to £5 an acre, according to the scale. He asked the Club not to blame the Board of Agriculture, as he had not asked for an additional grant to the £50 allotted him for experiments in this connection. The electrical method he did not think could replace sunlight entirely, and as to the effect upon the quality, he could only say that millers paid more for wheat produced under electrification, and he concluded that the quality must have been better. As to bacteria, he could not answer. So far he had experimented with the desirable bacteria, and had found that electrical treatment stimulated them. He hoped to get on to the noxious bacteria later.

At the close of the discussion, the Chairman was asked to write to the Board of Agriculture suggesting that the general opinion of the members was in favour of a larger grant being made.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

FACTORY ACCESSORIES, &c.—A new list from the British Central Electrical Co. (84 Hatton Garden, E.C.), which they describe as their Home Office list, contains particulars of a range of accessories that they are supplying to meet the regulations and recommendations of the Home Office under the Factory Acts. The cover bears the inscription "Guard against Accidents by using our 'Handshield' Accessories," and the apparatus dealt with includes a number of patterns of shielded wall plugs, distribution boards with shielded fuses, insulated lampholders, special designs of shockproof hand-lamps, all-china switches, and a variety of other articles. A leaflet relating to small electric fans and sewing machine motors from the same firm is also to hand.

AMMETERS AND VOLTMETERS.—Messrs. Crompton & Co., Ltd. (Salisbury House, London, W., and Chelmsford), in a new catalogue just issued describe a pedestal form of instrument in cast-iron case, specially intended for mounting direct on ironclad controlling pillars or angle iron frameworks. The base of the instrument is in the form of a hollow neck, through which the leads can be brought, and terminates in a flange, which can be bolted down. Ammeters and voltmeters of both the moving-coil and moving-iron patterns are made up in this way.

MOTORS, CONTROLLERS, AND LAMPS.—A folding leaflet from the Electrical & Ordnance Accessories Co., Ltd., calls attention to a number of their manufactures, including motors, controllers, and arc and metal filament lamps.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

BOILER HOUSE SPECIALITIES.—We have received through the Engineers' Standardised Publications Association a series of leaflets from Messrs. Kater & Ankersmit (Centre Avenue, Acton Vale, W.). These describe an automatic air recorder for boiler furnaces, a series of oil separators suitable for exhaust steam, an oil pump, an oil filter, and a patent steam dryer and purifier.

CIRCUIT BREAKERS.—A new list is to hand from Messrs. Morris & Lister, Ltd. (Carlton Works, Lockhurst Lane, Coventry), embracing all the patterns of their now well-known time element circuit breaker, which is dependent upon thermal effects for its action. The different variations include plain overload with fixed or free handle, with or without no-voltage, minimum or reverse current attachments, and magnetic blow-out, all either open, protected, or totally enclosed.

CORONATION ILLUMINATIONS.—A special list of material for illuminations is to hand from G. Braulik (8 Lambeth Hill, E.C.). It includes the "Eclipse" and "Pixielite" forms of strip, a strip for small lamps with porcelain lamp-holders, a great number of illuminated devices, lamps at special prices, and a number of accessories.

ELECTRICAL DRIVING OF ROLLING MILLS.—A most attractively produced and well-illustrated pamphlet entitled "Electrically Operated Reversing Rolling Mills," is being issued by the Electric Construction Co., Ltd. (Dashwood House, 9, New Broad Street, E.C., and Wolverhampton). After a short introduction, the advantages of electrical driving are put forward, and the function and principle of power storage of the flywheel motor-generator are explained. A fully illustrated description is then given of the electrically driven reversing mills at the works of Messrs. Alfred Hickman, Ltd., in which continuous current rolling mill motors up to 6,000 h.p. capacity are in use.

New Motor Coaches on the Metropolitan Railway.—This railway has introduced two motor coaches of a new design with sufficiently powerful equipments to be used as locomotives, and sufficient accommodation to enable them to be also useful as individual units, for working a shuttle service between Baker Street and West Hampstead. According to the *Railway Gazette*, the cars have two first-class and two second-class compartments, luggage compartment, and drivers' cabins at both ends, and are 52 ft. long with two bogies each of 7 ft. wheel base. The total weight is 45 tons. One was equipped by the British Thomson-Houston Co., and the other by the British Westinghouse Co. Each car has four 150 h.p. motors, two on each bogie.

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LOCAL NOTES

Aston: *Charge for Tramway Energy.*—The Birmingham and Midland Tramways Joint Committee have asked the Council to reduce the price of energy for the trams to 1d. per unit, but the Electricity Committee recommend the Council not to agree to this.

Belfast: *Cavehill and Whitewell Tramways.*—The arbitration proceedings for the purchase by the Corporation of the Cavehill and Whitewell trams have now been concluded.

The award has caused no little surprise in Dublin, for it has been fixed at no less a sum than £56,155, and the Corporation are to pay all the expenses of the arbitration. It will probably be remembered that a few years ago the Belfast Corporation promoted a Bill for purchasing the lines in question at £60,000, but it was rejected on second reading in the House of Commons on the ground that the price was excessive. It is computed that the terms of Mr. Lynden Macassey's award will involve the Corporation in a far larger sum, and the question of contesting the validity of the award has been suggested.

Brierley Hill: *Lighting Order Revoked.*—The Board of Trade have revoked the Brierley Hill electric lighting order granted in 1900.

Brighton: *Tramways to Worthing.*—In consequence of the promoters of the Brighton to Worthing Tramway scheme not having received the consent of several road authorities, the Standing Orders Committee of the House of Commons has refused to allow the Bill to go forward except as regards the portion of the proposed tramways between Lancing and Worthing. No announcement has yet been made as to whether the promotors will proceed with this smaller scheme.

Budleigh Salterton: *Electric Lighting.*—Mr. A. P. Trotter held an inquiry last week on behalf of the Board of Trade with regard to the objections which have been raised by a number of residents against the site of the proposed generating station. A gas-producer plant is to be used, and the objections seem to be based upon fears of unsightliness and noise. Mr. Trotter heard the views of the residents, and will report to the Board of Trade.

Guildford: *Lighting of Workhouse.*—A Consulting Engineer is to be appointed to advise with regard to the electric lighting of the workhouse.

Leeds: *Goods on Tramcars.*—The Tramways and Electricity Committee have passed a resolution expressing the opinion that the general carrying of parcels on tramcars is undesirable. The General Manager has prepared a report upon the subject, and the above is the Committee's conclusion.

London: *L.C.C. Tramways.*—A new tramway between Woolwich and Greenwich was inspected last week by Colonel Yorke on behalf of the Board of Trade, and has since been opened to the public.

When the first portion of the Council's tramways were reconstructed for electric traction on the conduit system no measures were taken to anchor the track rails, but in the case of the lines dealt with later extended yokes were used for this purpose. Many of the rails of the tramways first laid have begun to work loose, and it became necessary to anchor them by fastening short lengths of inverted rail to the track rails and embedding them in a concrete foundation. This work is now being extended to all trackwork laid without anchoring.

City of London: Linking up Electricity Works.—After considerable dispute as to the route to be followed, the City Corporation have at last agreed with the County of London Electric Supply Co. for the laying of a trunk main over London Bridge for the purpose of connecting up the Company's two stations in the North and South of London. It has been agreed that the work shall not be commenced until after the Coronation, and will then be carried on day and night.

Marylebone.—In reporting upon the need for additional battery capacity (see Tenders Received and Accepted), Mr. A. H. Seabrook, the Council's Electrical Engineer, states that the increased load this winter (1910–11) over the previous winter was 500 kw., and that he anticipates the additional load next winter will be at least 600 kw. over 1910–11.

Macclesfield: *Electricity Supply.*—A Board of Trade inquiry was held in Macclesfield last week to consider applications by the Electricity Company of Macclesfield, Ltd., and the Railless Electric Traction Co., Ltd., for an electric lighting provisional order for the district. The latter Company propose to supply electricity in conjunction with a service of trolley omnibuses, whilst the former are only proposing to supply electricity for lighting and power purposes. The trolley omnibus scheme is the subject of a Bill before Parliament, and consequently the Board of Trade can give no consideration to this. Therefore the Board will decide merely upon the merits of the two lighting schemes.

Newcastle; *Tramway Chairman Resigns.*—The Corporation having decided to transfer £12,000 from tramway profits to relief of rates in opposition to the general view of the Tramways Committee, the Chairman of the Committee has resigned as a protest.

Oldham: *Generating Costs.*—Considerable criticism has been made recently of the cost of producing electricity at the Corporation generating station, and Mr. S. W. Newington, the Borough Electrical Engineer, has prepared a report in which he deals with the matter in detail. Whilst the total cost of producing electrical energy at Oldham is within the average of a large number of similar size towns, yet it is admitted that the coal cost per unit is excessive. At the same time, the conditions under which the generating station at Oldham works must be taken into consideration, for there are no mechanical stokers; the coal has to be unloaded by hand, and the generating plant consists of reciprocating engine sets. The Electricity Committee have already decided to instal a turbo-generator, and have had under consideration for a long time the question of installing mechanical stokers and coal-handling plant.

Pontefract: *Transfer of Provisional Order.*—A Bill is to be promoted in Parliament to transfer the Council's Electric Lighting Order to the West Riding Tramways Co., Ltd. The transfer is subject to the Company paying £400, the estimated cost of the promotion of the Bill, and £140 already incurred in obtaining the provisional order. The Corporation will have the option of purchasing after twenty-seven years, no allowance being made for goodwill or monopoly value.

Worksop: *Overhead Wires.*—Application is to be made by the Council to the Board of Trade for sanction to erect overhead wires in certain parts of the town.

York: *Electricity Accounts.*—The accounts of the electricity department to March 31st show a net profit of £1,569 after meeting capital charges. It has been decided to place this surplus to the Renewal Fund.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Accrington.—Additional mains are to be laid at a cost of £1,830.

Barnstaple.—A recommendation of the Lighting Committee to replace the battery in the generating station at an estimated cost of £1,440, the loan for which is to be repaid in ten years, has been passed by the Corporation.

Derby.—It is proposed to instal three-phase generating plant at an estimated cost of £6,650. The plant will consist of two 500-kw. rotary converters, duplicate three-phase mains to supply Messrs. Rolls Royce's Works, transformers, and switchgear.

Haslingden.—A Local Government Board inquiry will shortly be held concerning a loan of £8,750 for electric lighting.

Luton.—The Electrical Engineer has made a preliminary report with regard to the provision of additional generating plant and mains. The estimated expenditure will be about £12,000.

Manchester.—A 350 kw. static transformer is required by the Electricity Committee. Particulars from the Secretary, Electricity Department, Town Hall, and tenders to Chairman of Committee by April 11th.

St. Helens.—A 1,500 kw. turbo-alternator, with condensing plant and switchgear, is required by the Electricity Committee. Particulars from the Borough Electrical Engineer, and tenders to Chairman of Committee by April 20th.

South Africa.—The scheme of electric supply in Potchefstroom has not been approved by the Government, and a new scheme at an estimated cost of £13,000 is being prepared.

Stoke-on-Trent.—Additional feeders are to be laid in Burslem at a cost of £700.

Torquay.—The Borough Electrical Engineer recommends extensions to the generating plant at an estimated cost of £5,000. The new plant will include a turbo generating set.

Turkey.—According to the *Board of Trade Journal*, the Turkish Ministry of Public Works at Constantinople is in-

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viting tenders for a concession for electric lighting and tramways in Jerusalem. A copy of the specification may be seen by British contractors at 73 Basinghall Street, E.C.

Worcester.—The Electricity Committee recommend the installation of additional generating plant at a cost of £7,100.

Wrexham.—A loan of £800 is to be taken up for the provision of a traction battery with switchboard and reversible booster.

York.—The Electricity Committee propose to instal a new battery, booster, regulator, and other machinery at an estimated cost of £1,400.

WIRING

London.—New theatre, Broad Street, Holborn.

PROVINCES.

Aberdeen.—Flax stores in Maberley Street for Messrs. Richards, Ltd.

Barnsley.—Boys' School at Churchfield. Architects, R. & W. Dixon, 5 Eastgate.

Birmingham.—Council School at Small Heath.

Bristol.—Additions to Cadbury Heath Council School. Architect, R. S. Phillips, Shire Hall, Gloucester.

Carnarvon.—Hospital in connection with the workhouse.

Coventry.—Additions to the Coventry and Warwickshire Hospital.

Leeds.—Extension to General Infirmary.

Oxford.—New County Hall.

Scarborough.—New Drill Hall and Headquarters, Royal Field Artillery (Territorials).

St. Albans.—Vicarage at St. Paul's Church. Architects, Messrs. Cutts, 14 Southampton Street, London.

MISCELLANEOUS

Australia.—The Deputy Postmaster-General at Melbourne invites tenders by May 16th for 10,000 telephone protectors.

Blackpool.—Application is to be made for a loan of £2,000 for the equipment of additional trams with top-deck covers.

Hornsey.—Tenders are invited by April 24th for the supply and erection of flame arc lamps. Particulars from the Borough Electrical Engineer.

Japan.—The Japanese Government have decided to instal a telephone system in Korea.

London.—Tenders are invited by H.M. Office of Works for a supply of wood blocks for conduit boxes for a period of three years. (See an advertisement on another page.)

Manchester.—Tenders are invited by April 18th for steel tramway poles and span wire brackets. Particulars from Tramway Manager.

New Zealand.—The *Board of Trade Journal* states that a New Zealand municipality proposes to raise a loan of £24,000 for the construction of additional tramways. Further particulars may be obtained at 73 Basinghall Street, London, E.C.

Spain.—The *Board of Trade Journal* states that extensive harbour improvements, which include the installation of sixteen electric cranes, are to be carried out at Barcelona, Valencia, Algeciras, Seville, Santander, Bilbao, Canary Islands (La Luz and Teneriffe), Melilla, and Ceuta.

TENDERS RECEIVED AND ACCEPTED

Chesham.—The local Electric Lighting Co. is to be asked to continue the public lighting for two years.

Ilford.—A contract for electricity meters has been given to the Electrical Apparatus Co., Ltd.

London: *L.C.C.*—The Highways Committee have received tenders for the supply of four electric watering-cars and four electrical equipments for same, but, after consideration, report that it will not be in the best interests of the Council to accept any of the tenders submitted.

Marylebone.—The tender of the Tudor Accumulator Co., Ltd., for the provision of additional cells to the Manchester Square and Rathbone Place Sub-station batteries at £2,643, plus £156 per annum for maintenance for a period of twenty years, is recommended for acceptance.

York.—The tender of the British Thomson-Houston Co., Ltd., has been accepted for a 1,000-kw. turbo alternator, with converters and switchgear at £7,451, and that of Messrs. Babcock & Wilcox, Ltd., for a water-tube boiler, automatic stoker, and pipework at £2,080. The tender for electricity meters up to 5 amperes capacity has been given to the Electrical Apparatus Co., Ltd.

OSRAM·LAMPS

APPOINTMENTS AND PERSONAL NOTES

Mr. J. W. Meares, Electrical Adviser to the Government of India, will arrive in England on leave in a few days' time. Letters addressed c/o Messrs. H. S. King & Co., 65 Cornhill, London, E.C., will be forwarded.

Mr. A. S. Giles, formerly Electrical Engineer to the Blackburn Corporation, and latterly in charge of the Cape Town Tramways, has been appointed to the General Managership of the Lisbon Tramways.

The Accrington Council have appointed Mr. Ernest Hall shift engineer at the Electricity Works at £104 a year.

Mr. J. L. Winter, who has acted for three years as Chief Assistant Engineer to the Musselburgh and District Electric Light and Traction Co., has been appointed Manager of the Bo'ness Electricity Works.

Arrangements are being made to give a farewell dinner on May 6th to Mr. Evan Parry (late Chief Assistant to Mr. H. F. Parshall, M.Inst.C.E.), prior to his departure to New Zealand to take up his new appointment of Electrical Engineer to the New Zealand Government. Those who would like to be present are requested to apply to Mr. E. Moss (801 Salisbury House, London Wall, E.C.).

Mr. H. F. Parshall has been appointed Chairman of the Central London Railway in place of Sir Henry Oakley, who has just resigned that position.

Mr. F. T. Chapman has been appointed to succeed Professor Buchanan as Lecturer in electro-technics at Faraday House. He formerly held an appointment at the Leeds Technical School, and for the last ten years has been designer to Messrs. Greenwood & Batley, of Leeds.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 15s. to £57 per ton (last week, £56 15s. to £57 5s.).

Electric & Ordnance Accessories Co.—The Hurst Electric Manufacturing Co., Clokey's Buildings, King Street, Belfast, have been appointed representatives in Ireland for the Electric & Ordnance Accessories Co., Ltd.

Plant for Sale.—The Bristol Electricity Committee have for sale a quantity of plant, including engines, alternators, motors, 100 arc lamps, electric launch, &c. (See an advertisement on another page.)

Liquidations.—Before Mr. Justice Swinfen Eady on Tuesday an application by Messrs. Siemens Bros. Dynamo Works, Ltd., for the compulsory winding-up of Arc Lamps, Ltd., was allowed to stand over for a week. It is considered probable that a scheme for the payment of creditors will be arranged.

Messrs. F. A. Glover & Co., Ltd., Vine Street, Clerkenwell, are to be wound up voluntarily. The liquidators are W. Peet, 27 Queen Victoria Street, E.C., and G. E. Corfield, Balfour House, Finsbury Pavement, E.C. A meeting of creditors will be held on April 13th at 4 p.m. at 27 Queen Victoria Street, E.C.

The British Radio-Telegraph and Telephone Co., Ltd., is to be wound up voluntarily. Mr. G. P. Grenfell, 5 London Wall Buildings, E.C., is liquidator. A meeting of creditors will be held at the offices of Messrs. Hudson, Matthews & Co., 32 Queen Victoria Street, E.C., on April 13th at 2.30 p.m.

Westinghouse Turbines.—The British Westinghouse Co., Ltd., report great activity in their steam-turbine department. The output of these machines during 1910 aggregated 100,000 h.p., or more than double that in 1909. During the first three months of this year the Company received orders for twenty-two impulse turbines aggregating 40,000 h.p., equivalent to an increase of nearly 60 per cent. on the figure for the corresponding period of last year.

Change of Address.—The Dowsing Radiant Heat Co., Ltd., has removed from 24 Budge Row, Cannon Street, E.C., and opened showrooms and offices at 105 Great Portland Street, W., where larger and more commodious premises are available.

Adams Agents.—The Adams Manufacturing Co., Ltd., advise us that their agreement with their Scottish Agent having terminated, they have, for the convenience of their customers throughout Scotland (except Midlothian), opened an office at 50 Wellington Street, Glasgow, where their Resident Engineer, Mr. A. L. Birch, is prepared to supply all information. For Midlothian the Company's Agents are Messrs. Mitchell, Graham & Son, 46 Buccleuch Street, Edinburgh.

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PARLIAMENTARY INTELLIGENCE

ACTON ELECTRICITY UNDERTAKING.—The Bill of the Metropolitan Electric Supply Co., enabling it to purchase the electricity undertaking of the Acton Urban District Council, was passed by a Committee of the House of Commons, presided over by Sir Henry Kimber, last week. The company proposes to take over the undertaking, to pay the capital charges on the outstanding loans, and also to make a payment of £5,000 to the Council as purchase money. The Bill, although unopposed, was sent to a Select Committee for consideration in the usual way, and leave was given to the Acton Council of Public Welfare to appear before the Committee. The point made on behalf of this body was that the agreement to sell the undertaking to the company was passed by a very small majority on the Council, and that when the poll of the ratepayers was taken, only a few days were allowed for the result to be obtained. Further, it was argued that the company should pay, say, £20,000 or £30,000 for the goodwill of the undertaking. The Committee, however, decided to pass the preamble of the Bill without alterations.

CENTRAL LONDON RAILWAY BILL.—A Committee of the House of Commons passed the Central London Railway Company's Bill last week. The Bill proposes to extend the company's line from the Wood Lane terminus to join the authorised Ealing and Shepherd's Bush Railway of the Great Western Railway Co., thus allowing a through service from Liverpool Street (when that extension is complete) to Ealing. The Great Western Railway Co. have an old agreement with the Metropolitan Railway Co., which, it was claimed before the Committee by the latter, would be prejudiced by the proposals in the present Bill, and the Committee ordered words to be inserted in the Bill with the object of safeguarding the terms of this agreement.

WINCHESTER ELECTRICITY UNDERTAKING.—The Bill of the Winchester Corporation authorising the purchase of the undertaking of the Winchester Electric Lighting Power Co., was passed last week by a Committee of the House of Commons. The parties have agreed to the purchase price being fixed at £91,000, plus the repayment of capital expenditure, and the Committee allowed forty years for repaying the loan to provide the purchase price and twenty years for any new capital that may be borrowed in the future. This case involved an interesting point with regard to the company's wiring and fitting business, which had been developed to a considerable extent. The Corporation originally intended to resist having to purchase this, but eventually an agreement was come to on the point. The Winchester Gas Co. opposed the terms of the sale, and the Committee inserted the Northumberland Clause, under which the Council must, at the beginning of each year, fix the charges for supply at such a figure that there will be no loss upon the year's working.

SIDMOUTH GAS & ELECTRIC BILL.—The Bill of the Sidmouth Gas & Electricity Co., which confers electric lighting powers upon the existing gas company, was passed by a Committee of the House of Lords last week.

"The Generators."—At 7.30 p.m. to-morrow, the 66 generators will start on a five hours' run at full load, the trial being for endurance and consumption. The site selected is the Caledonian Salon of the Holborn Restaurant.

Obituary.—We regret to announce the sudden death at Bournemouth, on the 28th ult., of Mr. J. Hardie McLean, Manager and Engineer of the Midland Electric Corporation for Power Distribution, at the age of forty-four. After serving his apprenticeship with Mr. Greenhill at Belfast he became associated with Mr. Ferranti's staff at the Grosvenor Gallery and Deptford stations, where he went through the hardest of pioneering work of the early days of electrical supply. From Deptford he went to Oxford, where he put down the "Oxford" system, and managed the Company with success, afterwards becoming a partner in the old-established Oxford firm of W. Lucy & Co. Later he became General Manager and Engineer to the Midland Co., and it was a great satisfaction to him that the year just closed saw the financial success of this Company firmly established.

The Batti-Wallahs.—This society, erstwhile the P. & O. Batti-Wallahs (for the sake of the uninitiated we should explain that Batti-Wallah means "the Light-Man"), held its annual general meeting at the Golden Cross Hotel, Charing Cross, on Wednesday, the 29th March. There was a fair attendance of members. The secretary reported that 44 new members had been enrolled during the year, and that the total membership was now 164. The report and balance sheet were passed, and the usual formal business transacted. The following were elected as officers and committee for the year:—President, W. Slade Olver; vice-presidents, C. Newton Russell, W. A. Jones, and F. J. Collis; hon. secretary and treasurer, J. F. Avila; assistant hon. secretary, Mr. R. J. Elmshurst; entertainment hon. secretary, Mr. A. W. Robinson; members of committee, Messrs. M. R. Gardner, C. C. R. Wray, W. Dobson, J. S. Huddleston, F. J. Humphrey, and R. Ball. The last fortnightly gathering of the society for the season will take place on Wednesday, 12th April, at the Bedford Head Hotel, in Tottenham Court Road, W.C. A smoking concert was arranged for Friday, 21st April, but it has been proposed to postpone this for a week until the 28th April.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

O. C. Hawkes.—There was a net profit of £6,216 for 1910, of which £5,103 is available for dividends. After meeting the 5 per cent. preference dividend, the sum of £853 is carried forward.

Gateshead & District Tramways Co.—The profit for 1910 amounts to £22,149, and after placing £4,500 to reserve and meeting reduction of mortgage and preference dividends, a dividend at the rate of 6 per cent. per annum is declared upon the ordinary shares, carrying forward £848.

Clyde Valley Electrical Power Co.—At the annual meeting last week it was stated that the continued expansion of the company's business had rendered it necessary to order an additional 5,000 k.w. turbo-generator for the Motherwell power station. This brings the total capacity of the company's two-power stations to 22,600 k.w.

Newcastle Electric Supply Co.—At the annual meeting last week Dr. J. T. Merz stated that although the profit for 1910 was £5,000 more than for the previous year, the profit per horse-power had fallen from 16s. to 14s. 6d.

Metropolitan Electric Tramways.—The report for 1910 shows a net profit of £57,345, and after meeting preference dividend and placing £8,000 to reserve, a dividend of 5½ per cent. for the year is declared upon the ordinary shares. The sum carried forward is £2,822. The total length of the Company's tramways and light railways is now 55½ miles. The renewals account now stands at £83,358. The number of passengers carried last year was 76,460,980 compared with 62,357,947 in the previous year, the average receipts per car mile being 10·78d. against 11·13d.

North Metropolitan Electric Power Supply Co.—A dividend of 6 per cent., with a bonus of 3s. per share, making 15s. per share, has been declared upon the ordinary shares for 1910. The sum of £2,000 has been placed to reserve for redemption of debentures and £21,639 to depreciation. The sum carried forward is £1,065.

Hastings and District Tramways Co.—A general meeting will be held shortly to consider a proposal for the reduction of this company's capital.

Central London Railway Co.—An issue of £385,000 4½ per cent. Preference stock is being made in connection with the extension of the Company's line to Liverpool Street.

Durham Electrical Power Distributing Co.—In spite of an increased number of consumers, the profits for 1910 were less by £2,295 than in 1909, with the result that only 3¾ per cent. has been paid upon the 5 per cent. Preference shares. The Company experienced a bad time in 1910 owing to the unsettlement in the coal trade. For the first twelve weeks of 1911, however, there has been some improvement, although at present there are no signs of a considerable increase in trade.

Anglo-Argentine Tramways.—A final dividend, making 7¾ per cent. for the year, is declared upon ordinary shares for 1910, carrying forward £13,045.

British Westinghouse Engineers' Club.—The fifth annual dinner of this club was held on Friday evening, March 31st, 1911, in the Banqueting Hall of the Midland Hotel, Manchester, when a company of over 170 members of the staff assembled. Mr. J. S. Peck was in the chair, and an excellent musical programme was provided. Mr. W. W. Blunt, the general sales manager, proposed the toast of the Company, and mentioned that the Company's sales for this year were much in excess of those in the corresponding period of last year. Mr. C. A. Park, the recently appointed managing director, responded. Mr. D. N. Dunlop, speaking on behalf of his colleagues of the sales organisation, expressed appreciation of the appointment of their general sales manager, Mr. W. W. Blunt, as a director of the Company, which was suitably acknowledged in a short speech by Mr. Blunt. The toast of the Works Organisation was proposed by Mr. O. H. Baldwin, and Mr. Ph. A. Lange, managing director of the works, in responding, mentioned that while the works had an extremely heavy load to carry in consequence of the large increase in orders, he was fully confident that they would be able to meet all demands made upon them. The toast of the Engineers' Club and the Foremen's Association was proposed in a humorous speech by Mr. A. McKinstry, responses being made by Mr. J. S. Peck for the engineers and Mr. R. W. Rowe for the foremen.



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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published March 30th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

9,933/10. **Insulating Compound.** R. G. SHARP. A filling for cable troughs consists of pitch and an equal quantity by weight of finely ground whinstone or granite. The two substances are well mixed together when the pitch is in a molten condition.

11,792/10. **Non-arcing Cable.** C. J. BEAVER, G. L. PREECE, and E. A. CLAREMONT. A cable suitable for mines where external arcing is dangerous has two layers of steel wire armouring or lead sheathing between which is a layer of fireproof material such as asbestos or treated fibrous material. One figure.

13,406/10. **Motor Starter.** ADAMS MANUFACTURING CO., LTD. (*Cutler Hammer Mfg. Co., U.S.A.*). This is a combined starter and shunt regulator with an adjustable automatic device for arresting and holding the arm in the position corresponding to any desired speed. Three figures.

14,743/10. **Resistance Wire.** BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*). An alloy which can be rolled and drawn and is suitable for resistance wire or heating elements consists of 20 parts by weight of iron, 62 parts nickel, 12½ parts chromium, 5 parts manganese, and between 0·1 and 0·4 per cent. of carbon. This alloy oxidises only very slowly at a red heat.

15,424/10. **Metal Filament Lamps.** F. HARRISON. The stem is constructed in two parts, and the distance between the two sets of radial supporting arms can be varied by sliding the parts relatively to each other. Four figures.

21,339/10. **Regenerative Control.** JOHNSON-LUNDELL ELECTRIC TRACTION CO. (*R. Lundell*). Two series motors on a common load are controlled by series-parallel connection, and a battery and resistance are connected across each series field to give an independent control of the fields. Six figures.

Opposition to Grant of Patents

28,210/09. **Advertising Sign.** A. W. LEONARD. This patent has been allowed in spite of opposition. It covers an electrically driven and illuminated advertising device in which transparent advertisements are exhibited successively through apertures in a box.

29,938/09. **Coal Conveyor.** J. NISBET and J. KIRKPATRICK. This patent has been granted in spite of opposition. It covers a coal-face conveyor comprising a number of bogies, which are tilted to discharge the coal when on a bridge at the roadhead.

Amendments

23,077/04. **Electric Welding.** L. S. LACHMAN. Pontelec Welding Patents, Ltd., desire to amend this specification, which covers a process of electric spot welding for sheet metal articles. The proposed amendments consist of the insertion of a reference to Ferranti's patent No. 11,921/03 and other disclaiming notes. (See also ELECTRICAL ENGINEERING, Dec. 22nd, 1910, and March 30th, 1911.)

13,276/04. **Protective Devices for Transformers.** BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*). The amendments to this specification referred to in ELECTRICAL ENGINEERING, Vol. VI., p. 812, have been allowed, and certain further alterations have been made. The patent covers tripping coils which operate on a change of the normal ratio of current in-put to out-put.

29,895/09. **Submarine Signalling.** S. M. DAVISON desires to amend this specification in order to define more clearly the features of invention. The patent describes a system of signalling by sound waves under water by means of an electrically operated bell and a telephonic receiver.

8,219/10. **Train-lighting Dynamo.** H. LEITNER. A disclaiming reference to patent No. 16,447 of 1909 has been inserted in this specification, which covers the use of broad brushes in reversible variable-speed dynamos in order to produce a strong cross-magnetising field from the armature.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: BLECKLY [Multiple carbon lamp] 6,536/10; BURKITT 8,380/10; VINCENT [Vapour lamps] 13,405/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: BRITISH THOMSON-HOUSTON CO. [Distribution systems] 13,124/10; ANDERSON, RUSSELL and GRAY [Distribution systems] 15,618/10.

Dynamos, Motors, and Transformers: HALL [Motor-car lighting] 6,312/10; VON ZWEIGBERGK [Machines] 6,624/10; LORING [Homopolar machines] 6,634/10; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Control and protection of motors] 13,123/10, and [Machines] 13,410/10; SIEMENS BROS. DYNAMO WORKS (*Siemens Schuckertwerke Ges.*) [Cooling of machines] 20,491/10; MACDONALD [Motors] 29,593/10; MAXWELL [Squirrel-cage motors] 4,871/11.

Electric Ignition: HART (*Bawden*) [Ignition of fuses] 15,098/10; GILLIES and MCPHEE [Blasting fuses] 17,789/10.

Electrometallurgy and Electrochemistry: STORA KOPPARBERGS BERGSLAGS AKTIEBOLAG [Electric furnaces] 6,768/10; WILDERMANN [Electrolytic cells] 26,568/10.

Incandescent Lamps: BLOXAM (*Siemens & Halske A.-G.*) [Manufacture of tungsten filaments] 19,932/08; GRAINGER [Lamps and filaments] 18,799/09; HARRISON, 10,874/10; SKAUPY [Metal filament lamps] 15,621/10; SCHROTER [Metal filament lamps] 23,121/10.

Instruments and Meters: HARTMANN & BRAUN A.-G. [High-frequency resonance measuring instruments] 14,925/10.

Switchgear, Fuses, and Fittings: WATERHOUSE [Pendant fittings] 6,595/10; HIGHFIELD [Ceiling roses, wall-plugs, &c.] 7,929/10; CHADWICK and CLARKE [Detachable handle for controllers] 11,569/10; LAITTE and SAFETY LIGHT, LTD. [Switch] 12,347/10; GOOD [Sign flasher] 13,293/10; KALLMANN [Motor starters] 14,186/10; FAIRWEATHER (*Hart Manufacturing Co.*) [Switches] 18,344/10.

Telephony and Telegraphy: FAIRWEATHER (*Stein*) [Sub-station telephone] 22,410/10.

Traction: STEVENS [Signalling apparatus] 6,006/10; PECKHAM and ANDREWS [Railway and tramway tracks] 6,732/10; MOORE [Switches operated by passing trains] 15,564/10; SIEMENS BROS. DYNAMO WORKS (*Siemens Schuckertwerke Ges.*) [Control apparatus for traction supply at two voltages] 17,995/10.

Miscellaneous: DONISTHORPE [Synchronising apparatus] 3,512/10; DE FERRANTI [Packings for turbo-blading] 7,089/10; DE HOLDEN-STONE [Electric generation and superheating of steam] 8,005/10; BRAGGE [Dust distributor for mines] 12,360/10; ENGEL [Contact device] 15,150/10; JOH and WOLF [Utilising heat of sun] 26,782/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: JUSTON and BÜNZLI [Magneto generator] 28,177/10.

Electrochemistry, &c.: OTTO [Liquid sterilising apparatus] 4,127/11; HELFENSTEIN [Electric smelting furnace with refining hearths] 5,140/11; ESTELLE [Anodes for use with alkaline salt solutions] 5,734/11.

Traction: TH. GOLDSCHMIDT [Rail welding] 26,085/10; GARDNER [Cleaning track] 1,597/11; HILL [Automatic train control system] 5,378/11.

Miscellaneous: CLAUDE [Vacuum tube lighting] 5,589/11; RITTER and UHLMANN [Lamp-shades] 6,081/11.

The following amended Specifications can now be obtained.

A. M. TAYLOR [Storage battery plant] 24,643/08; H. A. MAVOR and MAVOR & COULSON, LTD. [Electrical marine propulsion] 27,478/09.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

9,457 of April 13th, 1897. **Transformers.** A. F. BERRY. This patent relates to the well-known Berry transformer and covers the formation of each radial rectangular section of straight strips of thin sheet iron with alternate strips overlapping at the ends so as to form interleaved joints. The expiration of the fundamental patent, No. 2,801 of 1897 was referred to in ELECTRICAL ENGINEERING.

9,464 of April 13th, 1897. **Rubber Compositions.** E. HORNUNG and S. HANSEL. Compositions containing india-rubber or gutta-percha are prevented from hardening on exposure to air or heat by adding a mixture of insoluble gelatine or glue with vulcanised oil, and afterwards vulcanising.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: M. VON RECKLINGHAUSEN [Automatic tilting of mercury vapour lamps] 25,749/05.

Electric Ignition: G. GIORGI [Electromagnetic control and ignition of gas jets] 27,297/04.

Electrometallurgy, &c.: S. O. COWPER-COLES [Electrolytic manufacture of copper wire and strip] 26,724/98.

Incandescent Lamps: G. MICHAUD and E. DELASSON [Filaments of magnesia, alumina, &c.] 27,707/04.

Instruments, &c.: C. RAMSPECK [Prepayment meter mechanism] 26,264/98.

Switchgear, &c.: O. O. KRUH [Mercury vapour arc rectifiers] 27,011/04; M. J. E. TILNEY [Automatic voltage regulator] 27,168/04; J. H. ROSS [Lamp-shade carrier] 26,202/05; M. B. FIELD and FERRANTI, LTD. [Prevention of chattering of A.C. electromagnets] 26,281/05.

Telephony, &c.: E. RAYMOND-BARKER [High-speed telegraphy] 25,866/05.

Miscellaneous: A. J. BOULT (*H. Joly*) [Electrical synchronising of phonographs and cinematographs] 26,522/05.

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British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.
Western Electric Co., Ltd., North Woolwich, E.

TESTING LABORATORIES.
Electrical Standardizing & Testing Institution (Faraday House), 62–70, Southampton Row, W.C.

VENTILATION AND FANS.
Wilson-Wolf Engineering Co., Ltd., Bradford.

VULCANISED FIBRE.
Mosses & Mitchell, 122–124, Golden Lane, E.C.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

THE Paper by Mr. J. E. Taylor, of the General Post Office, read before the Institution of Electrical Engineers on Thursday last, is a very complete account of the various interferences and disturbances met with in wireless telegraph working, and contains many valuable suggestions for avoiding these. In the discussion of the Paper, Commander Loring, of the Post Office, gave the results of a number of investigations into the matter, and Sir Oliver Lodge and Mr. W. Duddell discussed the use of unearthed aerials and the effects of different types of wave trains. (Page 187.)

THE chief features of the electrical installation of the Royal Automobile Club are the thoroughness of the wiring work, the artistic quality of the fittings, and the agreeable and efficient nature of the illumination. We illustrate some of the fittings, which were specially designed. All the cables were pushed into the screwed steel conduit and not drawn. Two independent supplies are provided, and the wiring is in duplicate, each room having lights off both supplies. A highly ingenious fire-alarm system is provided, and all the corridor and staircase lights are switched on when an alarm of fire is given. The power equipment includes lifts, ventilating fans, pumps for the swimming bath, and a sewage raising plant, and comprises 34 motors in all. (Page 189.)

MR. JUSTICE JOYCE gave judgment last week in the action by the London Electric Supply Corporation against the Westminster Electric Supply Corporation. He held that the Westminster company had, to all intents and purposes, purchased the Westminster undertaking of the London Electric Supply Corporation, and that no breach of the agreement between the two parties has taken place. (Page 190.)

OUR monthly article on new electrical supplies and accessories includes illustrations of a number of new designs of holophane shades and some fittings for use with them. We also describe the latest form of the "Twinob" switch, some new motor starters and motor panels, and a recently introduced pattern of electric iron. (Page 191.)

MR. C. C. F. MONCKTON contributes an article commenting on Mr. Taylor's Paper, and describes a method of reducing interference in use at Trinidad, and at the same time improving the signals by connecting two receiving transformers of unequal coupling in parallel. (Page 193.)

MR. JUSTICE PARKER has reserved his decision as to the extension of the Lodge wireless patent until after the Easter vacation. He has expressed a wish to assist the Lodge-Muirhead Co., but says he will not grant the extension if the company are going to press their rights under the patent too far. (Page 193.)

A NEW form of fault localising set for making the Murray loop test, requiring no correction for the connections to the slide wire, has been introduced by R. W. Paul. (Page 194.)

A LETTER from Simplex Conduits, Ltd., calls attention to the high efficiency of heaters of the immersion type. The discussion on meters is also continued in our correspondence columns by a representative of a firm making commutator meters. Mr. J. T. Irwin has also sent us an interesting communication dealing with the influence of harmonics of high frequency in the current wave upon the accuracy of alternating current meters. (Page 195.)

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Among the specifications published by the Patent Office on Thursday last was one by Siemens & Halske for a process of manufacturing drawn tungsten filaments by first making a ductile alloy of tungsten with nickel. A method of cooling armatures by circulating water through the core is covered by Siemens Bros. Dynamo Works, and H. Maxwell describes end connections for squirrel-cage rotors, doubled back upon themselves to give resistance with minimum self-induction. A patent by B. J. Hall for an arc-lamp photo-printing apparatus, and another by A. Kapteyn for the emergency operation of pneumatic brakes, expire during the current week, after the full life of fourteen years. (Page 196.)

In a Paper read recently before the Dublin Local Section of the Institution of Electrical Engineers, Mr. S. L. R. Price advocated the use of electric heaters of large surface similar in construction to hot-water pipes. (Page 197.)

In a lecture at the Royal Society of Arts, on domestic electric heating and cooking apparatus, Dr. J. A. Fleming compared their efficiency with that of gas. The cost of cooking was probably equal with electricity at 1d. per unit and gas at 2s. 9d. For heating small rooms there was probably a saving with electricity at ¾d. per unit. (Page 198.)

The Scarborough tramways have resumed running, and the Corporation have withdrawn their application to the Board of Trade to deal with the company.—A new 1,000 k.w. Westinghouse turbo-alternator has been put into operation at St. Helens.—The A.C. supply from the Leeds tramway power station is to be converted to 50 periods, uniform with the supply from the lighting station.—Mr. Albert Gay, the Islington Borough Electrical Engineer, has been asked to advise the Barnstaple Corporation.—A net profit of £8,680 was made upon the Southend electric supply department last year, and £5,100 upon the tramways. (Page 198.)

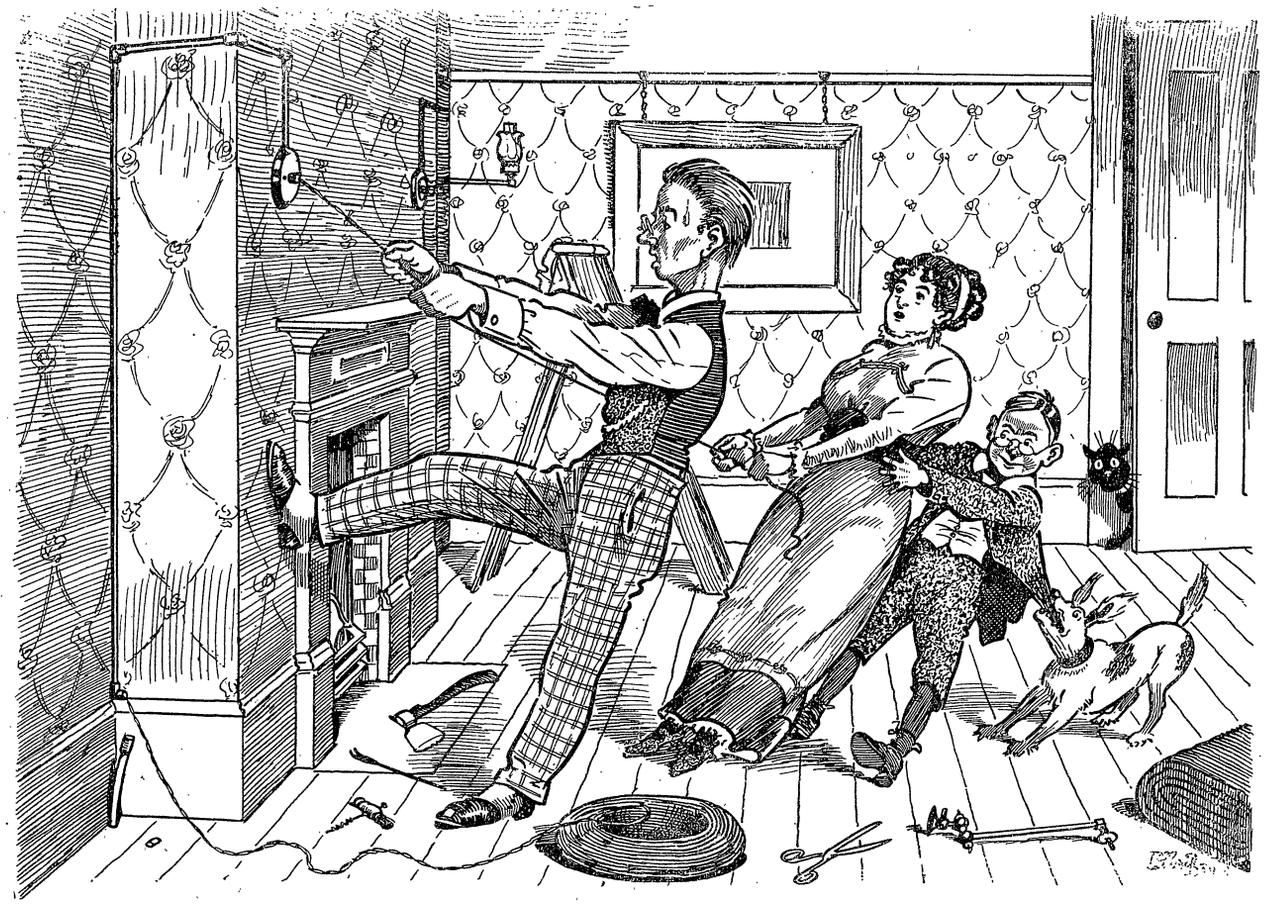
A 3,000 k.w. turbo-alternator is to be installed at Bradford, and rotary converters, cables and switchgear at Derby; car traversers are required by the L.C.C.; electric cables, fittings, &c., by the Dudley Corporation; extensions are contemplated at Blackburn, Epsom, Newcastle-under-Lyme, and South Shields.—Electric lighting schemes are under consideration at Barmouth, Oulton Broad, and Woodbridge. (Page 199.)

The capital of the Hastings and District Tramways Co. is to be reduced from £500,000 to £372,942 10s. —The expansion of traffic upon the Metropolitan Electric Tramways, Ltd., last year was so great that cars had to be hired. (Page 200.)

The Telephone Purchase.—As we have already announced, the Postmaster-General and the National Telephone Co. have disagreed as to the suitability of certain of the company's plant for the purposes of the forthcoming transfer, and the matter has to go before the Railway and Canal Commissioners for arbitration. The Postmaster-General was recently given leave to put certain interrogatories or questions to the company regarding the matter, which the latter resent on the ground that at the present stage of the proceedings it placed an undue burden upon them in relation to matters of detail. An appeal by the company to the Railway and Canal Commissioners on this point last week was successful.

Electricity in Agriculture.—According to the *Standard of Empire*, the Hon. Adam Beck has been sent to Europe by the Canadian Government to study the application of electricity to farming operations.

In the House of Commons last week Mr. Charles Bathurst asked the Parliamentary Secretary to the Board of Agriculture whether, in view of the value of the experiments of Professor Priestley of Bristol University (see Electrical Engineering, April 6th, p. 179), as to the effect of the discharge of positive electricity on the acceleration of plant growth, the Board could increase their present grant of £50. In reply Sir E. Strachey stated that a general scheme for the promotion of agriculture research was now under consideration, and that funds would, no doubt, be available for the purpose referred to.



Mr. Flecks, who is wiring his house for Electric Lighting, sees no object in erecting new pipes to take the wires, as he can utilise the existing gas pipes.

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INTERFERENCES IN WIRELESS TELEGRAPHY

ON Thursday last a Paper was read at the Institution of Electrical Engineers by Mr. J. E. Taylor, of the General Post Office, entitled "Wireless Telegraph Working in Relation to Interferences and Perturbations." After emphasising the importance, especially in the case of coast stations, of freedom from disturbances, and referring to the almost universal employment of telephonic receivers, the author divides the different disturbances as follows: Extraneous noises, local induction influences, waves from other stations, atmospheric electrical perturbations, and perturbances of wave-propagation efficiency of the dielectric medium. The first trouble is avoidable by careful selection of the site of the station, &c., and the second can be eliminated by ensuring that there is no sparking at the various contacts in the adjacent telegraphic circuits, no electrostatic or electromagnetic induction from these circuits, nor battery leakage. Telegraph or telephone circuits should be led into the station by underground cable, so that the exposed line is at least 30 or 40 yards distant; twin wiring should be employed, and the wireless and land line earths should be some distance apart.

The whole question of tuning and selectivity is involved in the third trouble, which may be sub-divided as follows: Electrostatic interference; pre-charged aerial interference; interference by heavily coupled transmitters; interference by lightly coupled transmitters; interference between continuous wave and spark systems; interference by accidental waves; and damping in transmitters and receivers in relation to interference. The first item is due to electrostatic induction across from aerial to aerial in the cases of stations close together. This produces forced oscillations, which are extremely difficult to annul. The trouble is more pronounced from aerials which are charged up to a high potential prior to the discharge across the spark-gap—*i.e.*, from pre-charged aerials, such as the Lodge-Muirhead, as compared with coupled transmitters as employed by Marconi. The interference by pre-charged aerials on distant stations is most difficult to tune out, and is doubtless due to the character of the wave-train emitted. Heavily coupled transmitters give rise to interference both in respect of impurity of wave-train due to forcing at the transmitter, and also in respect of double-wave emission. The former trouble is particularly pronounced in the case of continuous-wave and even quenched-spark transmitters, unless they are so connected as to reduce the damping in the aerial system to a sufficiently small amount. A high degree of selectiveness is assured with lightly coupled transmitters, and the accompanying reduction in range can be largely compensated by sharply tuning the receiver. For ship and shore communication, however, a very light coupling is impracticable by reason of the reduction of range and the difficulty of getting into touch with sharp tuning. A moderate bluntness of tuning is therefore essential for such work, but there is no reason why coast and ship stations should not have "stand-by" and "tune" adjustments for both receivers and transmitters, the former being used for calling and look-out purposes only. There is reason to suspect that with continuous wave or so-called "undamped" systems there is not the high degree of immunity from interference which might be expected. This is due, probably, to the "forcing" action of such transmitters, as any one oscillation must be appreciably damped affecting the purity of the wave-form. Interference produced by emission of accidental waves occurs if insulated sections of the aerial stay wires are allowed to spark to ground or to one another as a result of the electrostatic induction set up. When it occurs, the conductors emit waves of a period determined by their own electrical constants.

Turning to the question of damping in relation to interference, Mr. Taylor refers to the deformation of waves due to increased "driving" of energy into the oscillator to maintain the oscillations, and mentions that a moderately damped receiver is not nearly so sensitive as a very slightly damped one. He then describes in detail the operation of the Marconi "multiple-tuner," which comprises three coupled tuned circuits, enabling the use of variable coupling, while providing an intermediate circuit of very small damping. Without its use, since both the detector and aerial circuits possess considerable damping coefficients, it would not be feasible to reduce the coupling considerably and still preserve signals of readable strength. Another method of reducing interference is by the use of divided circuits, in which the impulses in one branch are annulled by those in the other, except to the extent necessary for the interpretation of the signals. In S. G. Brown's "bridge" connection the aerial is connected through capacities to both ends of an inductance, across which is connected the detector. The inductance is earthed at some point in the middle, and by altering this point the detector is affected by the branch best tuned to the received impulses. The author considers, however, that the adoption of non-earthed directive aerials promises more satisfactory elimination of disturbances than is obtained with the above devices. For short distances between fixed stations, simple unearthed balanced directive aerials in the form of vertical triangles, as used by Bellini & Tosi, give good results. Post Office tests have shown that very powerful long-wave stations may be freely operated at comparatively short distances away without producing the least disturbance on such a system, quite irrespective of directional properties. Musical-note transmission reduces interference, but this method has not yet been tried in the Post Office.

The author then deals with atmospheric electrical perturbations which are heard in the telephone receiver as a series of scraping, scratching, and explosive noises. They are more prevalent during the summer than the winter, and are particularly troublesome during thundery weather. Records taken in December, 1910, at the Post Office stations showed that though the disturbances were not precisely of the same character at each place, there is no very marked variation, the periods of maximum and minimum disturbances coinciding. With regard to reducing such interference, tuning does not appear to offer a complete solution, as the disturbing influences have no specific wave-length of their own, but seem to be the result of sudden changes in the electrical state of the atmosphere, which set the aerial oscillating at its own frequency. Heavy damping of such oscillations, such as by the use of a long, light aerial for receiving only, is a possible solution to the problem.

Finally, the author gives a few notes upon "freak" communications due to changes in the transmitting efficiency of the atmosphere. These are more pronounced at night, but do not synchronise with the periods of atmospheric disturbances. They hardly affect the working of coast stations with ranges up to 200 miles.

DISCUSSION IN LONDON.

Commander F. G. Loring (Inspector of Wireless Telegraphs, G.P.O.) said that if ships were equipped according to the standard required by their licence, there should be no interference between the 600-metre wave and the 300-metre wave at a range of three miles or more. Further, it should be easily possible to use a wave-length of about 150 metres, and under favourable conditions another of about 450 metres, and these should be obtained with any set of good standard apparatus. In practice, advantage was not generally taken of these facilities, because the apparatus was not always properly installed, and because, generally speaking, the operators were not sufficiently competent. Measurements were taken last week of the wave-lengths of thirteen ships installed with apparatus for 300-metre (984 ft.) and 600-metre (1,968 ft.) wave-lengths, and figures were obtained of 2,020 ft., 1,500 ft., 1,968 ft., 2,220 ft., 1,670 ft., 1,200 ft., 1,000 ft., 1,817 ft., 1,830 ft., and 1,520 ft. It seemed that with such variations no amount of tuning would prevent interference. During recent years, however, there had been a great improvement in ship installations, and the apparatus worked within 5 or 6 per cent. of the 300 or 600 metre wave-lengths, for which they were designed. A musical-note transmission would help operators very considerably, both as regards interference and speed of working. Such a note should preferably be of an aggressive timbre like a brass instrument as opposed to the soft tone of a flute. The multiple tuner was used a great deal at shore stations, but the percentage of ship operators who used it was very small. He had collected notes on atmospherics for several years, reports being sent in every month. The worst months were October, June, and July, and the best January, February, and March; the worst hours were between sunset and sunrise, and the freest period was between sunrise and noon. Other things being equal, short wave-lengths under 2,000 feet were very much less affected by atmospherics than long ones. In the case of two stations, one using a 4,000-feet wave-length, and the other about 2,000 feet, the disturbance from atmospherics on the short one was two hours per day, whilst on the long one it was twenty hours. At Crookhaven it was frequently necessary to suspend communication with ships altogether until the signals improved. All three Irish stations experienced particularly strong atmospheric disturbances with north-west winds. The best "freak" recorded at Hunstanton were signals from a ship 300 miles south-west of Cape Blanco in South Africa, or a total distance of 2,800 miles. Another curious point in connection with "freak" ranges was that North Foreland, Bolt Head, and Crookhaven never intercommunicated, or only extremely rarely, and yet all of them frequently intercommunicated with ships in the Mediterranean at night. These signals were found as strong as those of ships only twenty or thirty miles away. There were three stations on the Morocco coast which seriously interfered with traffic in the Channel at

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night, and similar interferences were experienced from the American Fleet when it was in the Mediterranean. He was glad to say, however, that it was a rare thing to receive any report of interference with commercial work by the British Navy.

Sir Oliver Lodge said that the operators seemed to be extraordinarily good, to judge from the manner in which they picked out the thing they wanted to attend to in the midst of a perfect babel of other communications. What would happen in war time, when everybody was trying to disturb everybody else, he really did not know. He asked Commander Loring whether there would be any objection to a lower capacity aerial on a ship. He supposed it was the universal custom for the lower aerial of ship installations to be the earth, or rather the sea. With land installations, when using the earth as the lower capacity, it had been found that the tuning was spoilt. After a long series of experiments Dr. Muirhead had designed an aerial in the form of a Maltese cross suspended horizontally, the aerial wire being connected to the centre. He was surprised that this gave such good results, and it appeared that the reason was as follows: The surges rushed up the aerial wire, divided, and all reached the points of maximum potential at the same time, then surged back and travelled down the aerial wire also together, instead of going down in a procession as they did when the aerial was not symmetrical and the different paths of unequal length. The resistance of the earth was the trouble, and whether this was overcome in the case of the sea, where there was salt water, he did not know, but from the Paper it did not appear that everything was right. The lower-capacity aerial had got over the trouble on land, and he thought that it would on sea, unless there were practical objections from the nautical point of view. As regards tuning out, the Admiralty, who, he believed, had a system of their own, were unable to tune out an adjacent Lodge-Muirhead station, whereas the latter station was easily able to tune out the Admiralty station. As regards Mr. Taylor's remarks as to "precharged" aerials, he did not deny that his system did perturb other installations, but the electrostatic effect could only do so if the collector were untuned. With his system he had given tuning one of the severest tests—namely, to have two stations in a field, one speaking to a distance and the other receiving and tuning out all interference from the speaking station. Further, by means of the Maltese cross arrangement he could split the aerial into two, and receive two different sets of signals at the same time.

Mr. W. Duddell thought they were all working on wrong lines in trying to reduce the power required to a minimum. He suggested that ten times the power at present used should be employed. He had always had a great doubt as to the theoretical advantage of the multiple circuit in the Marconi multiple tuner, and suggested that the advantage gained was due to the very loose coupling only. With regard to atmospherics, he asked whether these propagated themselves with the speed of light, and whether it is possible to determine the difference of time between the arrival of atmospheric disturbances at two different points, say, 1,000 miles apart. Such experiments might give an indication of the direction from which the disturbances came. Upon the point that long waves were affected more than short ones, did this apply to stations with short aerials adjusted for long waves as well as stations with large aerials, because the latter, owing to their size, were very liable to pick up atmospheric disturbances? On the question of precharged aerials affecting the ordinary coupled receiving stations, he agreed with Sir Oliver Lodge that the electrostatic action could not really be an explanation, because the effect was observed over a mile or two. He thought perhaps the effect was due to the shape of the wave train. Thus, the wave train from the Lodge precharged aerial consisted of a series of oscillations beginning with a wave of large amplitude and gradually diminishing, while the wave train from a coupled aerial started with a wave of small amplitude which gradually increased by resonance to a maximum, and then diminished again. The maximum in the latter case was not so great as the amplitude in the first wave from the Lodge aerial, which was sufficiently large to set the receiving circuit of a coupled aerial in oscillation by shock excitation, especially as receivers were usually tightly coupled in order to get sufficient energy. On the other hand, it appeared that a receiver coupled to a Lodge aerial was not excited in this way by the waves from a coupled transmitting aerial.

Sir Oliver Lodge thought Mr. Duddell had probably given the right explanation. The power used by the Lodge-Muirhead system for signalling between Burmah and the Andaman Islands, a distance of 300 miles, was less than ½ h.p. He hardly agreed with Mr. Duddell as to the need for greater power: he preferred to see accurate tuning and small power. He had heard no complaints of interference from the Burmah-Andaman installation.

Dr. Erskine Murray disagreed with Mr. Duddell's idea of the shape of the wave-train from a coupled transmitter. The aerial was charged up to maximum potential before the spark occurred by transformer action at the low frequency of the charging circuit, and there was a sudden fall in potential when the oscillations commenced giving an impulse of large amplitude before the resonance train took place. With regard to selectivity with continuous-wave systems, if everybody worked with the pure sine waves of the simple Duddell arc, then extremely good results in tuning could be obtained, but the trouble was to get enough energy with such waves. It was necessary to force the arc in some way by a transverse magnetic field, and certain proportions in the capacity and inductance in the oscillating circuit. If they could get a sine wave they would get something, not, perhaps, a great deal better than a good spark system, but certainly better than the ordinary average continuous-wave system. He believed it was a fact that directive aerials suffered less from atmospherics, probably because one class of atmospherics comes from all directions, and, therefore, the directive aerial picked up less than a non-directive aerial. There was not the slightest doubt that a large number were shock disturbances due to sudden discharges at a distance, such as thunderstorms in North Africa and elsewhere.

Mr. A. S. M. Sörensen pointed out that Mr. Taylor had advocated, for minimising interferences, the use of loosely coupled, slightly damped receivers, and that for continuous-wave systems, such as the Poulsen system, a receiver of this kind was not only desirable, but necessary. Among the points in favour of the Poulsen transmitter were the comparative smallness of amplitude and the continuity of the waves and the sharpness of tune. With regard to the use of the term "undamped," it was true that a single oscillation from a Poulsen transmitter could not be presented by a pure sine-curve, but whereas the discharge of a spark oscillator caused a train of oscillations with a constantly decreasing amplitude, the arc oscillator gave a train of continuous and uniform oscillations. As damping generally referred to the proportion between the amplitudes of consecutive oscillations, the term "undamped" did not seem altogether out of place, as applied to the Poulsen system. As the signalling was effected by a small variation in wave-length, only very sharply tuned receivers could intercept the signals.

The author said a few words in reply, reserving his full reply for the *Journal*.

DISCUSSION AT NEWCASTLE.

Prof. H. Stroud believed that with the musical spark messages could be received even when atmospherics were fairly large.

Mr. A. S. M. Sörensen said that he had never heard of his station (the Poulsen Station at Cullercoats) causing the slightest inconvenience to any other station.

Mr. H. Morris-Airey said that it was possible to ascertain at Armstrong College that the Cullercoats Station was sending, only by tuning very carefully to their particular wave-length, in spite of the fact that they were only 8¾ miles away. In conjunction with Dr. Eccles he made a special study of atmospherics last summer by means of stations at Newcastle and London. The disturbances were carefully timed at each station, and the character noted. The results were similar at each station, and he concluded that the disturbances were not local, but were due to discharges taking place at a great distance from both stations—probably in the upper parts of the earth's atmosphere. He thought that it would eventually be proved that there was some connection between these disturbances and sun-spots. The disturbances detected depended upon the wave-length to which the receiving circuit was tuned.

Mr. J. B. Johnson described how the Cullercoats Station affected the working of the telephone line run into it. It was eventually found necessary to run a lead-covered twin cable right up to the station instrument from a point outside the influence of the aerial.

Mr. J. M. Robb said that telephones were liable to disturbances due to precharged aerials in the shape of telegraph wires, and considerable care was necessary in order to shut these out. He asked if unexplained failures of telephone lightning arresters might not be due to wireless telegraphy stations in the vicinity.

Mr. A. Patterson mentioned some early experiences with the system of wireless telegraphy in which parallel wires are used. This was thrown out of action, sometimes for weeks, by atmospherics, and it was found that a current of 2 to 3 milliamperes was generated in the receiving wire, the direction depending upon whether the tide was ebbing or flowing.

Mr. C. Vernier thought that the Poulsen system had many advantages over the spark system, especially as it was less likely to interfere with other stations. He suggested that atmospherics might be due to lightning storms in the tropics.

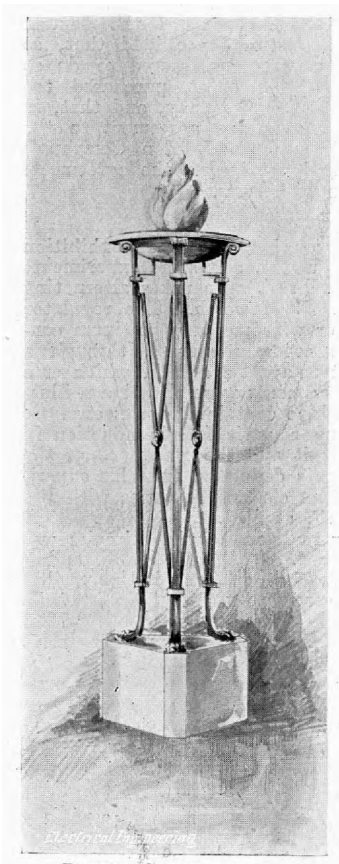
Mr. J. E. Taylor (in reply) said that in reference to the question which had been raised regarding the musical spark, he preferred a good scratchy note as being easier to detect. The fact that different disturbances were detected on differently tuned receivers simply showed that the disturbances had sometimes a wave-length of their own. He did not think that local weather conditions had anything to do with disturbances. Telephone lightning arresters, to be affected at all, would have to be in the field of the aerial. There was undoubtedly some connection between atmospherics and magnetic storms. The Poulsen system was useful for certain purposes, but not for isolated stations, on account of the amount of power required. There could hardly be a connection between tropical storms and atmospherics, as the latter have a diurnal variation, while there is no reason to believe that the former have.

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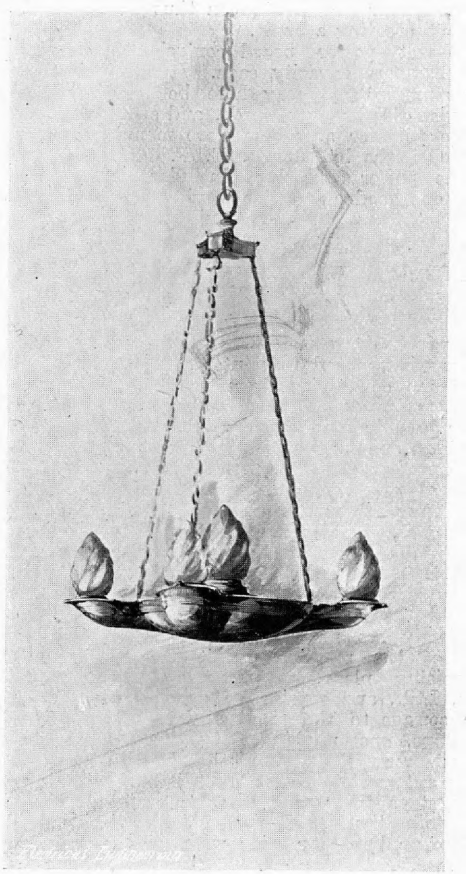
THE ELECTRICAL INSTALLATION AT THE ROYAL AUTOMOBILE CLUB

THE new building for the Royal Automobile Club, occupying a portion of the site of the old War Office in Pall Mall, which, after having been about two years under construction, was opened on March 23rd, is one of the largest and most luxuriously fitted club-houses in the world. We will not attempt here to give a general description of the many unique features of the building itself, as these have been fully dealt with in our non-technical contemporaries. The electrical installation, however, is worthy of detailed attention. It was carried out by Messrs. Higgins & Griffiths (21, Orchard Street, Portman Square, W.) to the specifications of the consulting electrical engineer, Mr. E. Wingfield Bowles; and the chief feature of the lighting installation, apart from its magnitude, is the way in which no effort has been spared to obtain the best effects both artistically and from the point of view of illumination. The power equipment has several features of importance, while the fire-alarm installation is of particular interest.

In order to reduce to a minimum the possibility of a total extinction of the lamps, the lighting circuits are supplied from two separate services from the St. James' and Pall Mall Electric Light Co.'s system. One service is from the street mains, and the other is taken direct from a sub-station supplied straight from the Grove Road, St. John's Wood, generating station of the Central Electric Supply Co., from whom the St. James' Co. obtain a portion of their energy. The supply in each case is D.C. three-wire, with 220 volts across the outers. The concentric services are brought to dividing boxes in intake rooms below the switchboard rooms, and the cables are then run up through main fuses to two main boards, one for each supply. The lighting points in every room of the building are as nearly as possible equally divided between the two supplies, so that should one fail, the whole of the building will still be lighted. In small bedrooms, for example, the pendant is off one supply and the plug fitting off the other, while in the larger rooms alternate fittings are wired off the second supply. The two boards are thus duplicates of each other, except that one controls, in addition, the power circuits, and the other the pilot lighting of the corridors, &c., in connection with the fire alarm installation. The main lighting boards each comprise between 20 and 30 sub-circuits of about 100-ampere capacity, each balanced across the two sides of the system; each circuit has double-pole switches and cartridge fuses of the porcelain holder pattern mounted on marble panels. The main cables are paper-insulated, lead-covered, and the sub-mains are paper-insulated, lead-covered, and armoured, with the sealing boxes bolted to the steel framework of the board. This latter is earthed to the fire water main by means of a 19/14 cable in a special conduit, so that efficient earthing of the armouring of the cables is ensured. The wiring from the sub-boards is carried out in heavy-gauge E.S.C. welded screwed steel conduit, and the steel cases of the sub-boards to which the conduit is connected are all earthed by 7/16 cable to the nearest water-pipe, also in a special conduit. The distribution boards are lined with Uralite, and have glazed wood fronts. They are divided into two portions, one above the other, containing the tubular fuses and the tumbler switches respectively. While the attendants have keys for the switch portions, only the electrician has the key of the fuse portions. Front connections are employed in all cases. Great care has been taken to keep the conduits of the different supplies entirely separate; the two runs are placed quite apart under the floor, and no switch or fitting on one circuit is within six feet of any switch or fitting on the other circuit. To facilitate installation and repairs, the two sets of circuits are wired with different coloured wires. The switches throughout the building are of the flush type, with the exception of those on the service and fifth floors. Lundberg plugs are used throughout, and where heating circuits are provided a device is employed to prevent the heating plug being inserted in the lighting circuit or *vice versa*. A complete bell installation is provided on each floor, and the electrical contractors also provided the conduits for the telephone system, which includes a private branch exchange with twenty incoming lines, and a very large number of extension instruments, installed by the National Telephone Co.



Bronze Standard for Swimming Bath.



Bronze Pendant for Swimming Bath.

An important feature of the wiring work is that the cables were not drawn in, but were pushed through, inspection boxes being provided at all bends to facilitate this. The tubes were provided at all ends with hexagonal screwed brass bushes, nicely rounded off. On the main boards, in addition to the Supply Co.'s meters (Ferranti type) are twenty sub-meters (Chamberlain & Hookham type), which are used to measure separately the power taken by the different departments, such as the restaurant, for which it is desired to get out separate accounts.

The arrangements for controlling the pilot lighting in connection with the fire-alarm system is exceedingly ingenious. All the points in the corridors, staircases, passages, and entrance hall are controlled by two-way tumbler switches, and the 50-ampere switches controlling these circuits on the main board (ten in all) are triple-pole switches, the mains on one pole being split. One side of the switch supplies the lamps through the ordinary sub-distribution boards and local switches (when in the "on" position) in the usual way, while the other supplies

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the lamps through special sub-distribution boards and the off-position contacts of the two-way local switches. On this side the supply is normally broken by a single-pole switch held open by a catch. Should a fire-alarm push be operated in any part of the building, and the fire-alarm circuit closed, an electromagnet pulls up the catch and allows the switch to close, thus lighting up all the lamps in the corridors, &c., should the local switches be in the "off" position. It may be mentioned that the fire push-buttons are held open by the glass covering them. On breaking the glass, the button springs out and makes contact. This rings bells and actuates indicators in six places —namely, the rooms of the secretary, engineer, porter, manager, the manager's private room, and the boiler-room. No general alarm is sounded, and a fire can thus be localised and dealt with without creating a panic.

The 220-volt power board controls 15 circuits of from 100- to 150-ampere capacity each. It is fitted with an Elliott recording ammeter. It may here be mentioned that all the switchboards, distributing boards, and switches with the exception of the tumbler switches, were manufactured for Messrs. Higgins & Griffiths by Messrs. E. F. Moy & Co., of Camden Town. The power equipment includes eight Otis lifts (two passenger, one goods, and five service lifts), ventilating plant, pumps, air-compressors, and auxiliary plant in the boiler-room, &c. In all there are 34 motors installed. The ventilating plant by R. Crittall & Co. consists of two 14-h.p. motors driving centrifugal fans, which draw air in from outside through filters and deliver it through ducts into the various rooms, and one 24-h.p. and two 15-h.p. motors driving fans on the roof, which draw the air out through other ducts. The incoming air is warmed in winter and cooled in summer, and so far as one can judge from the short time the club has been open, the ventilation and temperature control is very superior to that in most large buildings.

Two 15-h.p. motors (by Electromotors, Ltd.) drive two Gwynnes centrifugal pumps, which are employed to circulate the water of the swimming-bath. This is continually drawn through filters and pumped up to the top of the building, where it is aerated before being returned to the bath. Another pump (13 h.p.) is installed in connection with the fire arrangements. This is controlled by an automatic starter, which is actuated by a relay controlled by the main fire hydrant supply. Thus should the pressure in this water main fall, the pump is immediately set in operation. As the basement is below the level of the main sewer, it was necessary to provide sewage raising plant. This was installed by Hughes & Lancaster, Ltd., and consists of compressed-air ejectors, which raise the sewage to the required level. There are two compressor pumps, one working intermittently to maintain the required air-pressure, and the other held in reserve. Each has an Adams automatic starter controlled by an air-relay, which starts and stops the motor so as to maintain the air-pressure within certain limits. Berry Skinner ironclad double-pole switches are used in connection with all the motors.

Perhaps the most striking features of the whole installation are to be found in the lighting arrangements. A large variety of elaborate and costly fittings were especially designed to harmonise with the different styles of decoration employed in the various rooms. Thus in the ladies' reception-room and restaurant, which were decorated by a French firm, large special Louis XV. candle electroliers and wall brackets are employed. Special glass fittings are used in the large smoking-room, and harmonise well with the Georgian style of decoration. The accompanying illustrations show the two designs employed for the standards and pendants in the swimming-bath, which has imposing architectural features carried out in the Pompeian style, with columns decorated in coloured mosaic. The fittings illustrated are of solid bronze, and are exact replicas of fittings which were found in Pompeii, and which date back about 2,000 years. A feature of these fittings is that Messrs. Higgins & Griffiths have succeeded by a special process in reproducing very faithfully the green colouring of the old bronze. The swimming-bath is also provided with concealed lighting by rows of lamps in the cornice, and the effect produced is to bathe the whole place with a powerful but diffused glow, while the unpleasant contrast between the bright ceiling and the unlighted walls so often seen in examples of indirect lighting is avoided by the presence of the ordinary fittings as well. It is important to notice, however, that these are so constructed that the lamps are shielded from the eyes of those in the water. The lighting of the large hall, known as the Great Gallery, is also worthy of especial mention. This has three massive 30-light candle lamp Louis XIV. pendants, and eight 4-light candle lamp brackets. There are besides these 450 20-watt lamps in the cornice, which illuminate a fine painted ceiling. They also provide a very soft general lighting, any monotony of which is removed by the candle fittings. It is impossible to particularise the styles of fitting employed all over so large a building; the needs of each situation have been studied independently. The billiard-table lighting is a special feature, and most handsome cut-glass bowls are used in the committee-room, libraries, &c., as well as in the first floor corridors and galleries in combination with massive wall brackets, and extensive use is made of holophane spheres in the upper corridors, offices, and other situations. All the lamps in the building, with the exception of some of the candle-lamps, are Ediswan metal filament. The lighting of the squash racket courts also deserves mention. In each are suspended three "Tantalite" battens similar to those employed for stage lighting, each containing twenty-four 20-watt metal filament lamps.

In conclusion, we should like to express our indebtedness to Mr. J. W. Orde, Secretary of the Royal Automobile Club, for giving us permission to inspect the installation; to Messrs. Higgins & Griffiths, the sole contractors for the electrical installation, for preparing drawings of the swimming-bath fittings especially for us; and to Mr. H. T. Hocking, their representative, who has been in charge of the installation work from the beginning, and who kindly conducted our representative over the building.

DISPUTE BETWEEN LONDON ELECTRIC SUPPLY COMPANIES

MR. JUSTICE JOYCE gave judgment on Saturday in the action by the London Electric Supply Corporation against the Westminster Supply Corporation for alleged breach of an agreement between the two companies, under which the Westminster Co. have taken over the management of the London Company's Westminster area. The agreement in question has been made under the London Electric Supply Act of 1908. The terms of the agreement include the payment to the London Company of certain annual sums to meet standing charges, and upkeep of the works of the London Company in respect of the Westminster area, and a sum of 0·85d. per unit for all energy supplied to the consumers of the London Company in that area. There are also one or two other small charges to be made by the Westminster Company. The complaint against the Westminster Company was that they were endeavouring to induce the consumers of the London Company in the Westminster area to transfer to the Westminster mains, instead of acting as managers to the undertaking and doing their best to develop it as a portion of the business of the London Company. In his judgment Mr. Justice Joyce held that, so far as the Westminster Company were empowered to do so under the Act of 1908, they had, in effect, purchased the Westminster undertaking of the London Company, and that, in the absence of any specific clauses in the agreement to the effect that they were not to induce the London Company's consumers to change over, they had not broken the agreement. He therefore dismissed the action with costs.

Physical Society.—At a meeting on March 24th an exhibition was given of a sensitive thermo-regulator, and some experiments on the measurement of electrolytic resistance using alternating currents were shown by Dr. H. F. Haworth. The regulator consisted of a toluene thermometer with mercury platinum contacts in a capillary tube; these contacts operate, through a Siemens telegraph relay, an electromagnetic switch, which cuts in or out the heating circuit. Experiments were also shown illustrating the ease with which a bridge containing an electrolytic cell could be balanced by placing a variable self-induction in series with the cell and adjusting it and the resistance of the bridge simultaneously. The author's deduction from his experiments was that the resistance of an electrolyte varies with the frequency of the alternating E.M.F. applied.

A Paper on the oscillatory currents in coupled circuits was read at the same meeting by Prof. G. W. O. Howe, and a demonstration was given by means of a double projection oscillograph of the currents in coupled oscillatory circuits. Each circuit consisted of a condenser, an air-core choking oil, and a strip of the oscillograph. The condenser in the primary circuit was charged and discharged by means of a commutator on the spindle of the oscillograph motor, and every change in the currents in the two circuits due to a variation in the damping of either circuit or in the coupling between the two circuits could be followed. A third oscillatory circuit represented a wavemeter, and could be used to plot resonance curves, from which the damping could be calculated. By altering the connections the conditions of the quenched spark-sending apparatus was represented. Some radio-telegraphic apparatus in use at the City and Guilds College was also exhibited by Prof. G. W. O. Howe. The receiving apparatus was shown connected up to the aerial, which is 260 feet high, and a transformer specially designed for experimental work at long wave-lengths was shown. By means of a Brown telephone relay and special trumpets fitted to the telephone receiver, the time signals and messages sent out from Norddeich and from the Eiffel Tower can be plainly heard anywhere in the lecture theatre.

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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Fittings and Accessories.

An attractive list has recently been issued by the British Thomson-Houston Co., Ltd., entitled "Mazda-Holophane Glassware," which illustrates a number of applications of these well-known scientifically constructed shades and reflectors. It is important, to get the best effect out of the combination, that the source of light and the glassware should be in correct relative positions, and the Company have arranged that the position of the filaments in all Mazda lamps conforms with this requirement when a suitable gallery is used. They have themselves brought out a special gallery



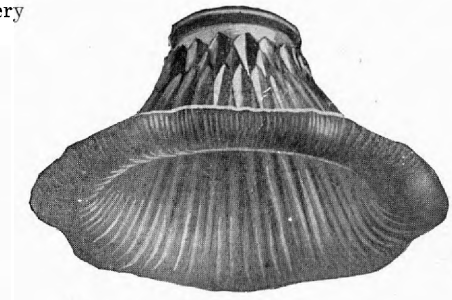


Special Spring Gallery for Holophane Shades (British Thomson-Houston Co.) and Mazda-Holophane Chain Pendant.

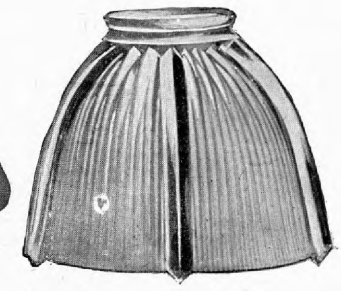
for the purpose, which is a great improvement over some types in use in that it contains no screws or other loose parts, but keeps the shade in position by a special arrangement of springs, as shown in the illustration. It is also of remarkably good appearance, especially in regard to the way the lamp-holder is hidden. The second illustration shows its application to a pendant, in which the weight of the lamp and shade is borne by a chain, and thus taken off the flexible leads. A number of special fittings are listed for the recently introduced stiletto holophane shades, and other patterns, such as spheres, bowls, &c., which, with metal filament lamps, produce an excellent effect.

We have received particulars during the past few weeks of several novelties in connection with holophane glassware from Siemens Bros. Dynamo Works, Ltd. (Incandescent Lamp and Fittings Department, Tyssen Street, Dalston, N.E.). One of these is the "Samson" holophane suspension, illustrated here, which they are placing on the market for "Stiletto" holophane reflectors. This is specially adapted to tantalum or one-watt lamps, and forms an efficient and at the same time artistic fitting. It is substantially designed, so that the maximum degree of strength is obtained, as, owing to the weight of the glassware, all suspensions should be thoroughly reliable. The "Samson" suspension is supplied either with the ordinary type of ceiling plate and hook for direct connection, or with ceiling plate and hook to cover conduit boxes or ceiling roses, and can therefore be adapted to any existing electric-light installation.

We also illustrate a few out of a series of fourteen new patterns of holophane reflectors, specially designed for household use, which are contained in a new list issued by the firm. These reflectors, we are given to understand, have been specially designed to combine artistic effect with the already well-known scientific properties of holophane glassware. Whilst the ordinary types of "Stiletto" holophane reflectors, which are noted for their exceptional efficiency, are of neat appearance, it has been suggested on many occasions that they were not sufficiently artistic to be used in conjunction with electric light fittings of elaborate design. The "Household" holophane reflectors, however, are made in a variety of shapes, suitable for various styles of electric light fittings. These reflectors are satin finished inside, whilst the outer surface is of clear glass. The prices vary from 2s. 4d. to 4s. 10d. each, according to the design selected. Some of the types are specially suitable for wall brackets, having an arrangement of prisms which strengthens the reflection of light in an outward direction, but which screens a certain amount of light from the wall surface. Other patterns are



Shade for Single Pendants.



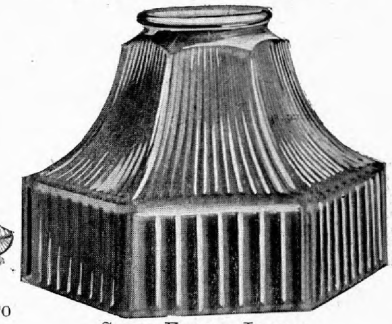
Shade with Satin Finish Inside and Four Clear Ribs.



"Samson" Suspension for Stiletto Holophane Reflectors.



With or Without Satin Finish on Lower Prismatic Surface.



Satin Finish Inside.

New Forms of Holophane Glassware. (Siemens Brothers Dynamo Works.)

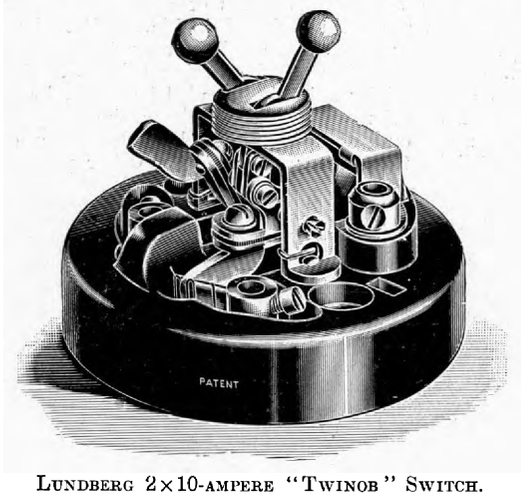
suitable for use on vertical lamps, such as table standards or upright bracket lamps. This is particularly suitable for table decorations, &c. The list in question mentions a number of galleries suitable for use with these reflectors, and we are convinced that the "Household" type of holophane reflector will appeal to a wide section of electric light users. Contractors should write for quantities of this list, over-printed with their name and address, as it is anticipated that a very large business will be done in this type of glassware.

Switchgear.

Messrs. A. P. Lundberg (477–487 Liverpool Road, Islington) have just introduced a larger size of their well-known "Twinob" switch, which should prove a very useful piece of apparatus. The new switch, which is illustrated here, has a capacity of 10 amperes per way, and the switch movements and arrangement of parts on the base are somewhat different from those in the smaller type. Knife contacts are now employed at both ends of the contact arms, so that a wide double break is obtained without excessive width, and mica is used for the insulation of current-carrying from other parts.

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The switch should find extensive adoption for cooking and heating apparatus, as variations in the degree of heat can be very simply arranged when the knobs are actuated separately, full heat being obtained when both are in their "on" positions together. By coupling the two levers together an efficient switch of 20 amperes capacity on a base 3¼ in.



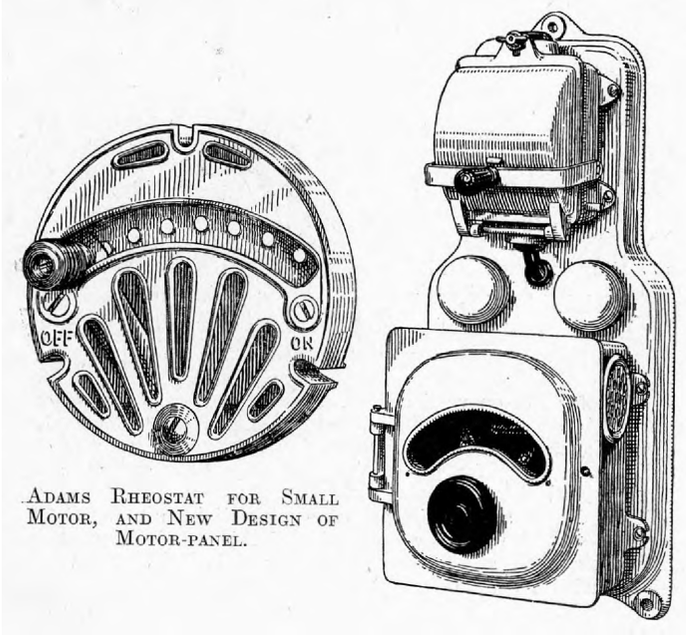
Lundberg 2×10-ampere "Twinob" Switch.

diameter is then produced, with subdivided double break, particularly as the circuit is broken in four places. In this application the supply wire to the apparatus controlled might need to be divided between two terminals, as a bridging strap cannot be conveniently fitted.

By coupling the levers in this way, and dividing the "common" strap which ordinarily connects the back contact-clips, a satisfactory double-pole switch of 10 amperes capacity is produced. In this case fibre-lined metal covers or porcelain covers would be supplied.

Again, by making one of the contact arms spring-controlled —*i.e.*, flying back into its "off" position immediately pressure on the knob is removed, the switch then forms a suitable pattern of starting switch for some types of small A.C. induction motors.

A simple and compact form of rheostat of substantial design for the speed regulation of small motors and similar purposes, which can also be used as a field regulator for



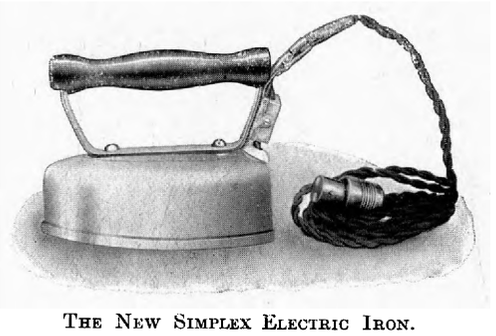
Adams Rheostat for Small Motor, and New Design of Motor-panel.

generators of small size, or as a dimmer for lighting circuits, has recently been introduced by the Adams Manufacturing Co. (London and Bedford). The apparatus, as can be seen from the illustration, is of the semi-enclosed pattern, with the contacts visible, but impossible to be touched accidentally. The resistance is dust-proof and moisture-proof, and the whole apparatus, which is quite self-contained, weighs only about 2½ lb. The porcelain former has embedded in it the resistance windings and the current-carrying contacts, and the lever is mounted directly on the casting forming the housing. There are thus two easily separable contacts, Six contacts are provided, one of which may be an "off" position.

Another novelty of the Adams Manufacturing Co. is the "Igranic" universal motor panel, also illustrated here, which is particularly intended for small industrial applications of electric drive where low cost is a consideration. The panel embodies many of the features of the larger panels made by the Company, and, besides being easily fixed and wired, is very compact.

Heating and Cooking Apparatus.

Messrs. Simplex Conduits, Ltd. (116 Charing Cross Road), are putting on the market the new pattern of electric iron illustrated here at very reasonable prices, in three sizes, from 3 to 7 lb. in weight. The heating elements are carried on mica and inserted in holes actually drilled in the iron casting, and are therefore entirely surrounded. The heating effect is



The New Simplex Electric Iron.

thus produced as rapidly as possible, whilst the iron maintains a considerable temperature some time after the current has been switched off. The original sample of this iron, made up in the Company's Birmingham works last October, where the apparatus is manufactured throughout, has been on circuit continuously ever since, and has not yet broken down. Heavier weights of the irons suitable for laundry work will shortly be introduced.

The Iron and Steel Institute.—The annual meeting is to be held on May 11th and 12th in London at the Institution of Civil Engineers. The annual dinner will be held on the first day at the Connaught Rooms, Great Queen Street, W.C., under the presidency of the Duke of Devonshire. Some seventeen Papers are down for discussion, among which is one on "Magnetic Properties of Some Nickel Steels, with Some Notes on the Structures of Meteoric Iron," by Dr. E. Colver Glauert and Dr. S. Hilpert, of Berlin. Dr. J. N. Friend and Mr. J. H. Brown (Darlington) will also read a Paper on "The Action of Aqueous Solutions of Single and Mixed Electrolytes on Iron." The autumn meeting will this year, by kind invitation of the Associazione fra gli Industriali Metallurgici Italiani, be held at Turin, commencing on October 2nd, and with the subsequent tour organised in connection therewith will occupy about fifteen days from the time of leaving London to the return. Several other Italian towns will be visited.

Crystal Palace School of Practical Engineering.—The annual award of certificates and the inspection of the various departments of the school were held yesterday. The Right Hon. Sir George Reid, K.C.M.G. (High Commissioner for Australia), was in the chair.

The Fire at Albany, U.S.A.—In view of the rumours that the fire at the New York State Capitol at Albany was due to the "fusing of an electric wire," Mr. H. B. Renwick, chairman of the Electric Supply Publicity Committee, has been in communication with authoritative sources of information in America, and learns that there is no evidence whatever to the above effect, and that the cause of the fire is quite unknown.

"The Generators."—The five hours' full-load run of the 66 generators, on the Caledonian Room Site of the Holborn Restaurant, was successfully completed, without any serious breakdown, on Friday evening last. Chief-generator Harrison, with the assistance of automatic-regulator Corneille, switched in the exciting coils common to all the generators. There was a certain amount of irregularity in the switching-in process, due to the chief-generator getting out of step occasionally. Otherwise, the excitation was up to standard, and no hot bearings were recorded. The next full-load run will not take place before the autumn.

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PREVENTION OF INTERFERENCE IN WIRELESS TELEGRAPH WORKING

By C. C. F. Monckton

THE Paper read last week before the Institution of Electrical Engineers by Mr. J. E. Taylor shows the small amount of definite knowledge as to the best means of preventing interference to the receiving of wireless signals. It is a question of some difficulty to compare different methods of avoiding interference, say, from atmospherics. Suppose signals are being received at a station B on the magnetic detector from a station A using a loosely coupled Marconi transmitter. Then suppose the three operations advocated by Mr. Taylor are adopted—to reduce the coupling and detune in the best possible manner; again, that a second circuit is fitted on the most suitable differential system; and, further, that the two arrangements are such that the signals come in with exactly the same strengths; then by switching over from one circuit to the other alternate minutes, at a time when atmospherics were abundant, a proper comparison could be made; but it has to be remembered that this comparison would only hold for a magnetic detector under the exact conditions of working. Even with precharged aerials I have noticed that receiving arrangements require considerable modification to obtain the best results under slightly different arrangements of sending.

It is a surprise to hear that Mr. Taylor expects to obtain as good results by detuning as by differential methods. In Trinidad the first operation of reducing the coupling as far as possible is carried out, and then a converse of the third operation—that is, a greater difference between the damping of the aerial and secondary circuit is made by decreasing the

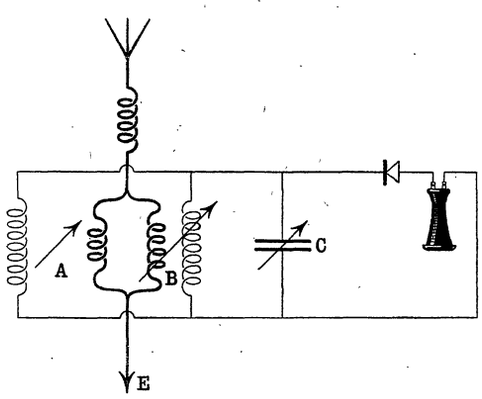


Diagram of Connections.

resistance and inductance of the secondary, keeping it still in tune with the aerial. Often when this has been done the signals come in as strong, or sometimes even stronger, than before, but in other cases the distance between the coils has to be reduced. It is to be noted in carrying out the second operation here described that the coupling is reduced at the same time as the damping of the secondary.

About a month ago, whilst in the West Indies, an operator, Mr. Barratt, informed me that he had been able to reduce atmospherics, and at the same time increase the strength of the signals. I found that he had made use of two receiving transformers in parallel with secondaries joined to the same condenser, as shown in the figure. One of these, A, was loosely coupled, whilst the other, B, was tightly coupled. As this arrangement is very simple, it is to be hoped that it will be tested independently. The writer tried the simple test of using two secondaries with a single primary to show the differential action. When both secondaries were equally coupled to the primary, no signals could be received. The loudness of the incoming signals depended on the difference of the coupling. As the capacity, C, had to be nearly doubled, using two equal secondaries each of the same inductance to that usually employed, the effect might have been due solely to decreased damping, so Mr. Barratt carried out a trial for the writer, comparing the use of one primary with two. To get the desired effect it required two secondaries. The inductance of both the primary and two secondary windings was probably not the same.

There is a curious difference between the Government stations at Trinidad and Tobago, about sixty miles apart. During the summer months there is a thunderstorm in the vicinity of the Trinidad station every few days, but at Tobago there is only about one storm a year. Now at Tobago the atmospherics are much worse; they are especially bad during, and for some time after, the Trinidad storms. I can only attribute this to the earth being better at Tobago. On the other hand, both stations appear to be able to pick up signals from the American stations 1,500 to 2,000 miles away with the same ease. It might be mentioned that most of these stations have waves with two maxima, the wave-lengths of which are about 200 metres apart. The signals from Washington and from a number of the United States battleships come in with a single maximum and a very shrill note. The operators call them "whistling spark" stations. They also find these stations especially easy to read during atmospherics, as the difference of note from the noise of the atmospherics is very great.

I agree with Mr. Taylor that the atmospherics are probably due to the release of charges in the aerial, for the charges required would be so small, the pressures which would cause them are so enormous, and the atmospheric vibrations are always in tune. I have on several occasions used atmospherics to calibrate an aerial. Using a known inductance as the secondary of a receiving transformer and a calibrated adjustable condenser, the secondary can be set at any given wave-length, and the inductance in the primary adjusted till the sound of the atmospherics is a maximum. Calibrating an aerial from about 400 to 3,000 metres by this method, there was no apparent alteration in the maximum sounds received.

In the opinion of the writer, the probable line of progress will be (1) in sending with a high-pitched "whistling spark," whose spectrum has only one wave of maximum power; and (2) in receiving with either a loosely coupled or differential arrangement, but that also the telephone or a relay will be used so made as mechanically to be in tune with the spark frequency of the sender whose signals it is required to pick up, also that this telephone or relay will be placed in a circuit whose natural period of vibration is that of the spark frequency of the transmitter.

THE LODGE WIRELESS PATENT

THE hearing before Mr. Justice Parker of the petition of the Lodge-Muirhead Wireless Syndicate for an extension of the term of the Lodge patent No. 11,575 of 1897 was concluded on Wednesday of last week, Mr. Justice Parker reserving his decision until after the Easter Vacation. Particulars of the patent and a report of the first day's hearing were given on page 176 of our last issue.

Sir Oliver Lodge, examined by Mr. Walter, explained that the well-known syntonic jar experiment, in which two Leyden jars were tuned so that one would respond by resonance to electrical oscillations taking place in the other, and which he showed in the Hertz lecture in 1894, depended for its effect upon the magnetic induction between the two circuits. He did not then associate this experiment with wave telegraphy. The 1897 patent in question, however, was the application of this principle to wave telegraphy. Inserting an inductance in the aerial would, he then knew, lengthen the wave and reduce considerably the range of transmission, but he realised that this was worth while in consequence of the possibilities of selective working. Further, he realised also that it was necessary to take the detector out of the main receiving circuit and put it in a derived circuit in order that the former might commence to oscillate with feeble impulses and build up a strong oscillation by resonance. Until this was done there was no real tuning; Hertz himself admitted ultimately that he had never had real tuning between transmitter and receiver. Sir Oliver Lodge was then cross-examined by the Solicitor-General with regard to the Parkstone Quay wireless station of the Great Eastern Railway Co., which employed the Lodge-Muirhead system. They were there able to tune out the signals from the powerful Admiralty station at Felixstowe, which was in sight of the other station, and receive weaker signals tuned to their own apparatus.

Dr. Silvanus P. Thompson, examined by Mr. Walter in support of the petitioners, interpreted the nature of the patent, and stated that in his opinion the invention was a most important one, and had not been anticipated.

Mr. H. Muirhead, a director of the Lodge-Muirhead syndicate, stated that the family of Muirhead was about £20,000 out of pocket in respect of the invention, and referred to the success of the Andaman Islands installation, which gave a range of over 300 miles with a plant of only one-half horse-power. Cross-examined by the Solicitor-General, he said that the Admiralty had suggested that they should take proceedings against Marconi.

Mr. C. F. Wilkins, of Muirhead & Co., Ltd., questioned by the Solicitor-General, stated that complaints had been made at one time of the interference by the Parkstone Quay, Lodge-Muirhead station with the Felixstowe station, which was, he believed, a Marconi installation. No complaints were now made, however.

The Solicitor-General, speaking on behalf of the Crown, pointed

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out how rarely extensions of patents were granted. The use of an inductance coil in the aerial circuit was common to many systems, yet no steps had been taken by the petitioners to protect their rights, and this was a serious objection to extending the patent. If an arbitrator were called in to settle the terms of licence, he would have to assume that the patent was valid. Sympathy for the petitioners because they had suffered from the refusal of a wireless licence under the Act of 1904 was not a ground for extending the patent.

Mr. Gray then spoke on behalf of the petitioners, emphasising the fact that other companies, including the Marconi Co., had had an opportunity to object, but had not chosen to do so. If the patent were extended, the petitioners would undertake not to take proceedings against any existing installation for infringement, nor attempt to obtain damages for past infringement. Further, they would grant anyone a licence to employ the invention on reasonable terms which could be settled by the Board of Trade or a suitable expert body. Mr. Gray also suggested that the Lodge-Muirhead Syndicate would make use of their rights under this patent to bring a counter-action against the Marconi Co., if the latter attacked them on the 7,777/04 patent.

Mr. Justice Parker here mentioned that he was of the opinion that Sir Oliver Lodge had not got what he deserved, and that he was anxious to help the company. On the other hand, he would not grant an extension if it was part of a plan to make money out of the Marconi Co. or the Government by attacking them for infringement, and not by legitimate trading under the protection afforded by the patent. On Mr. Walter's construction of the patent, it covered an essential part of the four-circuit system used by Marconi, but he was not satisfied that the patent so construed was valid.

Mr. Gray argued that the Marconi Co. ought to be able to look after itself, and Mr. Walter pointed out that under the Patents Act the Lodge-Muirhead Syndicate possessed rights for six years after the expiry of the patent, even if it were not extended, of suing for damages all infringers during the 14 years of its life. In answer to a suggestion by his Lordship that they might have enforced their rights before making this petition for extension, Mr. Walter stated it was their shortness of means which had prevented such litigation. The patent expired on May 10th, but under the new Act his Lordship's decision could be deferred until six months after that date if desired. Finally, Mr. Walter said that they would try to devise some way of settling the difficulty as regards the conditions under which a grant of extension might be given, and any proposal would be submitted to the Crown and his Lordship.

The Solicitor-General said that he was instructed by the Board of Trade to say that there would be difficulties in the way of its acting as arbitrator. This concluded the hearing.

A NEW FAULT LOCALISER

A COMPACT instrument for fault localising has just been put on the market by R. W. Paul (33 Leicester Square, W.C.). The apparatus is illustrated here, and has several points of interest. It is intended for use principally for carrying out tests by the Murray loop method, in which a balance is obtained on a slide wire, and the ratio of the distance of the fault to that of the whole cable under test is read direct. One important difference between this apparatus and some others is the much greater length of the slide wire, which is wound on a screw-threaded, insulated metal drum, enamelled and further covered with varnished cloth. The slider is brought over any turn, where it is retained by a click, and parts of a turn are read on the divided head at the end which rotates the drum. The movement of this is limited to one turn, and as the drum is mounted on a screw thread, the wire is always accurately under the contact. The disc is divided into 20 parts, there being 50 turns of wire on the drum; the position of the contact may be read to one-tenth of a division, or to one ten-thousandth part of the slide-wire length. The slide wire is connected to the terminals by flexibles without moving contacts. The contact itself can be put into or out of action by an ebonite head, so arranged that undue pressure cannot be put on it, but the actual battery key is separate, so that the slide wire is not exposed to continual tapping. Apart from these constructional points, a special feature is the fact that the distance of the fault can be read direct on the wire without the necessity for correction for the resistance of the connections, as the potential points are taken off the cable itself, and the connections form virtually part of the slide wire, which is graduated, taking this into account. The objection will at once be raised that faults very near the measuring point cannot be exactly determined, and the contact would have to lie beyond the end of the slide wire. An arrangement is provided for putting an additional resistance, nine times that of the wire, in series, to bring the position on to the slide wire. The terminals of the flexible slide-wire leads are arranged to be suitable for almost any kind of cable, and the potential connection is made by wrapping the bare copper braid end of the potential leads round the cable. The potential points are inside the current points, so that the fact in the case of large cables of only a few strands being taken up by the connector does not matter. One of Mr. Paul's well-known "Unipivot"



Fig. 1.—Fault Localising Set. (R. W. Paul.)

galvanometers completes the equipment. A modified form of the apparatus is made, in which a pair of comparison resistances are included in the same box. This can be used as an

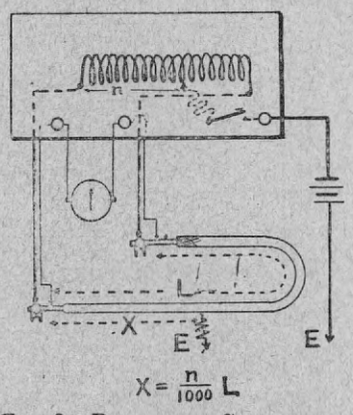


Fig. 2.—Diagram of Connections.

ordinary bridge for resistance measurement, but is not provided with the compensation for the resistance leads when used as a fault localiser

Railless Electric Traction.—Two out of the fifteen Bills which were deposited in Parliament, seeking powers to run trolley omnibuses have been abandoned for the present session. The Bills in question related to Croydon and the Western Valleys of Monmouthshire. The latter has been knocked out by the Standing Orders Committee.

Parliamentary Intelligence.—The Nottinghamshire and Derbyshire Tramways Bill has been passed by the Unopposed Committee of the House of Commons. The Bill authorises agreements between the company and the Nottingham Corporation and the Mansfield & District Electric Traction Co., by which the original scheme of the Notts & Derbyshire Tramways Co. will be carried out. An additional £150,000 capital is to be raised.

The Unopposed Committee of the House of Commons have also passed the Liverpool Overhead Railway Bill, which provides for the rearrangement of the company's capital by substituting debenture stock for the existing debentures, which are repayable in 1913. The Mersey Docks and Harbour Board guarantee 4 per cent. on the new stock.

The Metropolitan Electric Supply (Acton) Bill was read a third time in the House of Commons on Monday.

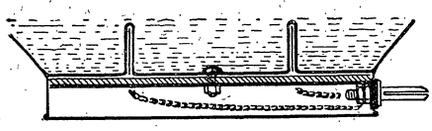
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CORRESPONDENCE

ELECTRIC HEATING.

To the Editor of Electrical Engineering.

Sir,—We notice that Professor Fleming, in his Cantor Lecture at the Royal Society of Arts, recently gave a number of interesting figures as to the efficiency of various methods of electric heating. The results of his tests show, of course, that the immersion form of heater is the most efficient, but we are surprised at the efficiency given in the case of the only one belonging to this class quoted, which is not so high as might be reasonably expected. This was the Therol heater, which,



with a consumption of 300 watts used for 24 hours, enabled 38·4 gallons of water to be raised from 50 degrees Fahr. to 110, giving an efficiency of 92 per cent.

The immersion form of heater is adopted in a modified form for a large proportion of Simplex apparatus; the method of applying the heating element to the utensil is shown in the accompanying sketch. The efficiency obtained would seem to be greater than that found by Professor Fleming.

In a three-pint copper kettle (actual capacity three pints), for example, the quantity of water is raised from 60 degrees Fahr. to boiling point in 14 minutes, with a consumption of 750 watts, giving an efficiency of 97·2 per cent. The construction of the kettle is by no means special, the particular type being of ornamental design in copper for general domestic use, and listed at 21s.

Yours faithfully,
SIMPLEX CONDUITS, LIMITED.
(*Heating Department.*)

116 Charing Cross Road, W.C.
April 3rd, 1911.

ELECTRICITY METERS.

To the Editor of Electrical Engineering.

Sir,—With reference to the letter from Messrs. Ferranti, Ltd., in your last issue, and especially to the figures they give for the accuracy of commutator meters, it seems rather a pity that they should have had to go abroad in order to get these figures. It is surely rather late in the day when the superior merits of the British makes of this type of meter are getting to be thoroughly understood for such a course to be taken. Moreover, with reference to the curve of the Ferranti mercury motor meter, which was stated to be within 1 per cent. from full to 1/20th load, it was really a pity that it was not mentioned what was the full load capacity of these meters.

For while to mention the accuracy of meters at various percentages of load has an understandable meaning in the case of commutator shunted meters, this is not so in the case of the mercury meters, and, consequently, it is impossible to tell from such figures as to the relative performance of meters on the really low loads, which, according to your correspondents themselves, are now the most important.

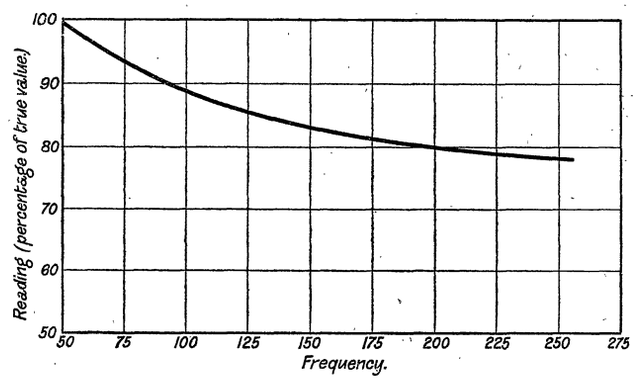
British meters of the commutator type are thoroughly reliable for accuracy within Engineering Standards' limits, anywhere from full to 1/20th load, and start on less than 1 per cent. load. Thus, commutator meters are obtainable that are accurate down to 0·05 amps., and will start at less than 0·015 amps., even after long periods of service. If your correspondents are able to produce any mercury motor meter, whether new or old, which will do this, it will, no doubt, interest your readers. The general experience is that mercury motor meters will not start on one lamp after being a month or two in service, whether owing to the mercury becoming dirty or to other causes, is not for us to say.

Queen's Road, Battersea, S.W.
April 7th.

Yours faithfully,
The Electrical Apparatus Co., Ltd.,
R. H. Barbour.

We have also received a communication on the subject from Mr. J. T. Irwin (Central Technical College, South Kensington), in which he considers Messrs. Ratcliff and Moore's statement that shunting reduces temperature errors, but may introduce errors on fluctuating loads, unless the inductances of the shunt and bath circuit are balanced. In considering the effect of a varying load it is necessary to divide the mercury ampere-hour meters into two classes, first where the torque is proportional to the square of the current, and second, where the torque is proportional to the current. In the first case if the ratio of the inductance and resistance in the shunt and bath circuits is unity, the current will divide up according to their resistances, and the torque will be proportional to the square of the current in the mains. If the fluctuations of the current are rapid, the speed of the meter will not have time to change as the current changes, and the meter will have a mean torque proportional if the voltage is assumed constant to the *root mean square* current; but the power taken from the mains is proportional to the mean current, and if the meter has been calibrated with a steady current it will always register fast by an amount which in quite ordinary cases might give an error of 5 to 10 per cent. The provision of a non-inductive shunt would tend, however, to decrease this inaccuracy. In the class of meter where the torque is proportional to the current, the introduction of inductance into either of the circuits will introduce no error as long as the voltage remains constant as the current (mean) in each circuit is determined only by the ratio of resistances, and the torque is proportional to the true power.

Mr. Irwin then deals with the effect of wave form, and shows that if the reading of a meter is made independent of frequency it will also be independent of wave form as long as there is no appreciable change in the permeance of the magnetic circuits. As to that, if only the meter reads correctly at one particular frequency, and if one of the curves is a sine wave, it does not matter how distorted the other is, the meter will still register correctly. That is to say, if the pressure wave form of an alternating-current system is kept a sine wave, then an induction type meter can be used to register the energy on very distorted waves of current. In the cases the authors consider they are dealing with a non-inductive load, and



the shape of the wave is the same for both current and pressure. In practice the meters always read slow, and the higher the value of the harmonic in the resultant wave the slower the meters read. This is undoubtedly due to the fact that they do not register correctly the power given by the higher harmonics. The curve reproduced here was obtained by Mr. Irwin for an induction meter tested on a varying frequency at unity power factor. It shows that a meter which was correct at its normal frequency of 50 was 15 per cent. slow at 150 cycles, and 23 per cent. slow at 250 cycles, and therefore we can tell at once, if we know the composition of any wave, how much the error in reading will be.

For the meter tested by Mr. Irwin the current in the disc due to the current coil was displaced from the flux in the disc due to the pressure coil at normal frequency, by an angle equal to the phase displacement between the current, and pressure in the mains, therefore, at zero power factor it did not turn, but as the frequency increased the phase displacement became larger, until at 200 cycles the phase displacement was eleven degrees, and the flux in the disc was lagging behind the current in the disc.

These results explain why it is that on an inductive load the meter reads more correctly than on unity power factor, because if a large inductance is put in to make the current lag, the inductance has three times the impedance to the third harmonic that it has to the fundamental, and in addition the phase displacement is greater, so the actual power due to the third, fifth, &c., harmonics is very small, and therefore the meter will register nearly correctly. The fact that the flux for the harmonics lags in the disc tends to make the meter read too fast for lagging currents, and so compensates at some particular power factor for the reduction in flux in the disc.

If the current in the meter is leading on the pressure the reverse holds, for not only are the harmonics in the current wave exaggerated, but the meter would not read the total power of these harmonics, even at unity power factor. As the frequency increases the flux in the disc due to the pressure coil lags more and more, and therefore for currents leading their pressure waves by nearly 90°, the torque will be negative, and will oppose the main torque. The effect of this is very evident to distributing engineers, as they very often find that at the sending end of a high tension underground main, where there is a capacity current flowing into the mains, the meter reads *less than* the one at the receiving end by as much as 10 per cent., and this even when the meters have been carefully calibrated beforehand. The conclusion to be drawn is that each type of meter should be tested at frequencies much higher than those at which it has to be used, and rejected if it is not up to a definite standard.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published April 6th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

19,932/08. **Tungsten Filaments.** A. G. Bloxam (*Siemens & Halske A.-G.*). This patent covers a process of manufacturing a ductile alloy of tungsten with nickel by heating a mixture of tungsten and nickel powders or oxides of these metals, which are afterwards reduced in order to obtain a ductile rod of the alloy. At a certain critical temperature (1510° C. for an alloy of 90 per cent. tungsten and 10 per cent. nickel) the alloy changes, so that when cold it is ductile enough to be rolled and then drawn into filaments. The nickel is volatilised so as to leave a pure tungsten filament by passing a current through the filament in a vacuum.

15,621/10. **Metal Filament Lamps.** F. Skaupy (Berlin). This specification describes the insertion into metal filament lamp bulbs of chemical compounds, which, when heated by the normal working of the lamp, will give off halogen vapours. If the pressure of the gas is so small as to be hardly measurable, its presence is said to diminish the disintegration of the filament and consequent blackening of the bulb.

20,491/10. **Cooling Armatures.** Siemens Bros. Dynamo Works, Ltd. (*Siemens-Schuckertwerke Ges.*). A cooling liquid (water) is passed through longitudinal passages in the core of the armature or rotor, and instead of conducting the liquid through the shaft stationary devices are provided at each end for carrying the liquid into and away from the passages. The passages increase in section towards the outlet end, and the cooling may be further assisted by a current of air drawn through other ducts and passages in the core. Four figures.

23,121/10. **Metal Filament Lamps.** K. Schröter (Berlin). Previous to placing the filament on its carrier, it is wound on a zig-zag former and the parts where it takes a sharp curve round the pins—*i.e.*, where it will engage with the supports—are bent or kinked by means of a heated pair of pliers. The method is particularly suitable for use in connection with delicate carriers which will not stand the tension in stretching the filament round the supports. Three figures.

29,595/10. **Waterproof Motor.** W. R. Macdonald (London). This specification describes a motor for working under water. It is totally enclosed, but clean water is circulated inside, and is supplied by means of pipes from an outside source. A valve is provided whereby the water may be expelled from the casing by compressed air for cleaning. One figure.

4,871/11. **Induction Motors.** H. Maxwell (Schenectady, U.S.A.). To improve the torque of induction motors with squirrel-cage rotor windings, the connections between the rotor conductors and the short-circuiting rings are doubled back upon themselves so as to have an appreciable length and resistance with minimum self-induction. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.
Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Siemens-Schuckertwerke Ges. [Search-lights] 28,356/10.

Distribution Systems, Cables and Wires, Insulating Materials, &c.: Conner and Peel-Conner Telephone Works [Cable coverings] 13,176/10; Western Electric Co. (*E. Zwietusch & Co.*) [Protective covering for flexible conductors] 24,122/10.

Dynamos, Motors, and Transformers: Kunkel, 29,941/10.

Electric Ignition: Smith and Curtis's & Harvey, Ltd. [Blasting cartridges] 14,905/10; R. Bosch [Drive of magneto apparatus] 24,157/10.

Electrochemistry and Electrometallurgy: Hannemann [Primary cells] 17,336/10; Canning [Electroplating apparatus] 18,695/10; Hesseln [Two-fluid cells] 26,959/10; Pucklitzsch [Electroplating apparatus] 29,473/10.

Incandescent Lamps: Atwood, 23,535/10; Skaupy [Metal filament lamps] 24,549/10.

Instruments and Meters: Jung [Recording apparatus] 6,802/10; Wimperis and Elphinstone [Speed and acceleration indicator] 7,285/10; Dunoyer [Instruments for measuring magnetic fields] 17,624/10; Eversheds & Vignoles, Ltd., and Eversheds [Hand spikes for making connections] 30,313/10.

Switchgear, Fuses, and Fittings: Hope [Fuses] 3,883/10; Field and Ferranti, Ltd. [Circuit-breakers] 6,633/10; Burley and Froude [Table or wall-bracket lamp] 6,905/10; Adams Manufacturing Co. (*Cutler Hammer Mfg. Co.*) [A.-C. motor control] 7,302/10; Rankin [Regulators] 9,530/10; Float Electric Co. and Sandy [Cases for batteries] 9,740/10; Regnart [Lamp-holders] 10,065/10; Siemens Bros. Dynamo Works, Bolton and Willcocks [H.-T. switches] 21,310/10; Lundberg [Plug and socket connections] 847/11; Siemens Bros. Dynamo Works and Laughton [Shade carriers] 950/11.

Telephony and Telegraphy: Egnèr & Holmstrom [Cooling of telephone transmitters] 7,656/10; Carpentier [Telegraph perforator and transmitter] 20,111/10; Siemens Bros. & Co. (*Siemens & Halske A.-G.*) [Telephone exchanges] 21,120/10; Fairweather (*Stein*) [Telephone system] 22,411/10; Bullers, Ltd., and Dagnall [Joints for telegraph poles] 24,368/10; Manny and Binzel [Selective signalling devices] 25,179/10; Gottschalk [Guards for telephone transmitters] 28,397/10; Siemens & Halske A.-G. [Signalling] 2,014/11.

Traction: McGinness [Trolley-head] 7,216/10; Maloney [Monorail cars] 17,075/10; Leslie [Coupling] 20,237/10; Duthie [Direction indicators] 26,538/10; Mitchell [Vacuum brakes] 28,408/10.

Miscellaneous: Gibb and Mavor [Coal conveyors] 8,364/10; Walton and Rayner [Conveyors] 9,729/10; Fisher [Minimising effects of explosions in mines] 14,006/10; Mitchell [Centrifugal drying-machines] 18,743/10; Miram and Seidel [Electromagnetic clutches] 19,786/10; Kraus and Maschinen-fabrik u. Muhlenbauanstalt G. Luther, A.-G. [Magnetic separators] 24,286/10; Robertson [Device for carrying cable, conduit, and rods] 27,448/10; Paillet, Ducretet, and Roger [Discharging electricity from textile materials] 28,552/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: Julius Pintsch A.-G. [Gas ignition] 29,363/10; Kettering [Ignition system] 5,902/11.

Electrochemistry, &c.: Heil [Primary cells] 473/11; Henri, Heilbronner and Von Recklinghausen [Sterilisation of liquids] 6,178/11.

Instruments: Carpentier, 5,961/11.

Switchgear: A.-G. Brown, Boveri et Cie. [Control of centrifugal pumps] 4,478/11, and [Astatic control of regulators] 4,915/11; Allgemeine Elektricitäts Ges. [Control systems] 6,293/11, and [Motor control] 6,557/11.

Telephony: Ruhmer [Multiple telephony] 6,549/11.

Traction: Klupathy [Signalling] 5,603/11; Harhorn [Hub-motors] 5,870/11, and [Reversing switch for hub-motors] 5,871/11.

The following amended Specification can now be obtained.
A. F. Rietzel [Spot welding of sheet metal] 18,909/05.

Amendment

23,077/05. **Electric Welding.** L. S. Lachman. Owing to an error in the *Official Journal of the Patent Office*, this patent was incorrectly numbered 23,077/04 in last week's Patent Record.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

9,853 of April 20th, 1897. **Photo-printing Apparatus.** B. J. Hall. In apparatus for taking prints from tracings, the tracing and sensitised paper are stretched on the outside of a glass cylinder, through which an arc lamp is lowered at a uniform speed by clock-work gear.

9,915 of April 20th, 1897. **Railway Brakes.** A. Kapteyn (*Westinghouse Brake Co.*). In emergency applications of pneumatic brakes, moderate pressure is at first applied to the brake piston and then gradually increased. Valves to produce this effect automatically are described.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: C. Perdrisat [Converging carbon lamp] 28,401/03.

Distribution Systems, &c.: British Thomson-Houston Co. (*General Electric Co., U.S.A.*). [Machine for cleaning wires before insulating] 28,063/04.

Dynamos, &c.: British Thomson-Houston Co. (*E. M. Hewlett, U.S.A.*) [Arrangement of plant and switchgear in generating station] 26,347/01; Vickers, Sons & Maxim and A. D. Williamson [Control of compound-wound motor] 28,414/02.

Electric Ignition: H. Frenay [Contact maker] 26,286/01.

Electrometallurgy, &c.: H. Hirtz [Diaphragms of nitrated cloth for electrolytic cells] 28,129/04; E. A. Ashcroft [Electrolytic production from salts, of aluminium, sodium, potassium, &c.] 26,813/05, and [Electrolytic deposition from ores of gold, silver, zinc, &c.] 26,813A/05.

Switchgear, &c.: L. Sunderland [Reflectors for theatre battens] 28,252/03.

Traction: P. M. Kling [Tramcar brakes] 27,858/04; T. Stave [Brakes] 26,669/05; O. S. Bragstad [Auto-transformer distribution for A.-C. traction system] 26,689/05.

Miscellaneous: C. J. Simeon, T. Parnall, and W. E. Hipkins [Electric weighing and feeding apparatus] 28,324/03.

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ELECTRIC HEATING AND COOKING

A PAPER was read by Mr. S. L. R. Price, on March 9th, before the Dublin Local Section of the Institution of Electrical Engineers, on heating and cooking by electricity. In heating large rooms, &c., by means other than coal fires, pipes are the generally accepted method, whether heated by steam or hot water. These are usually arranged completely round the room, or are fixed in banks at intervals. Such an arrangement evenly distributes the heat, the temperature of the heating surface being comparatively low, so that gentle hot-air currents, flowing rather in a lateral than an upward direction, are set up, due to cross draughts. The heat is thus absorbed in the lower strata of the air in the room where it is required, instead of it being carried up to the ceiling where it is not required, as happens in the case of heaters where the amount of heat given off per unit area of heating surface is high. It being practically agreed that this method of heating is sound in principle, it occurred to the author to deal with the problem electrically; that is to say, have an arrangement of pipes on identical lines with that of the ordinary hot-water or steam system, but without hot water or steam as a heating medium, inserting instead a spiral of some suitable high resistance wire, extending throughout the entire run of the pipe-work, as close as possible to the inside walls of the tubes. This arrangement is arrived at in the best possible way from a mechanical standpoint by winding the wire on to one tube, which is then slipped into a second of just sufficient diameter to permit of its entry. The resistance wire being thus sandwiched between the two tubes is thoroughly supported in every way, and cannot become displaced or sag. The wire is braided with asbestos so as to eliminate as far as possible the trouble of insulating during the process of construction.

In addition to possessing all the advantages of a hot-water system, it does away with one very serious disadvantage, due to the very high specific heat of water and its consequent sluggishness in transmitting heat, for a heater of this description, having very little thermal storage capacity, commences to do useful work within a few moments of being switched on. Experiments have shown that, in order to obtain a temperature of about 170° F. at the face of the tube, a consumption of approximately 50 watts per sq. ft. of tube area is necessary. The cost, of course, works out higher than that of ordinary coke-fired apparatus, if compared over equal periods of working; but, as the electric heater is so easily put in or out of action, the actual working hours can be cut down to at least one-half that of the ordinary coke-fired heater.

The problem of arriving at the amount of heating surface necessary to deal with a specific case is difficult. Prof. Carpenter gives the following formula for rooms which the author has found to work out fairly correctly in some cases :— Area of glass + ¼ area of exposed wall surface + 1/55 cub. ft. required for ventilation. The last term is governed by the number of changes of air required per hour. He suggests three changes per hour for halls, two changes for rooms on the first floor, and one for rooms on upper floors. The writer would, however, suggest three or four changes for ordinary dwelling-rooms.

The author then referred to Mr. W. W. Lackie's Paper, recently read before the Glasgow Section, which pointed out that the lower strata of air in an ordinary dwelling-room, heated by gas or coal fires, is changed about 60 times per hour, the air 3 ft. up 20 times, and the air 6 ft. up only twice per hour. The author then gave the results of some experiments he had made on the question of the spreading of heat in a greenhouse. On one occasion an electric tube-heater as described above, taking 800 watts, was used, and on another occasion a 1,000-watt convector. It was found that, whereas the tube-heater maintained an even temperature throughout the greenhouse, the heat from the convector mostly filtered through the roof. The rise in temperature was actually greater, although the wattage of the heater was less. The usual objection is that electric heating is too expensive; so it may be for constant use, but the author submits that there are a large number of cases in which it may be applied economically, where only intermittent heating is required.

Turning to the subject of electric cooking apparatus, Mr. Price considered that a great deal remained to be done in improving efficiencies and cheapening apparatus. Manufacturers should be able to turn out cheap, high-efficiency apparatus that will stand rough usage. Discussing the hot-plate system, the author thought such apparatus, as at present supplied to the public, was useless for rapid work. The three great drawbacks to this class of apparatus were bad contact between surface of plate and utensil, absorption of heat by the metal of the hot plate before efficient work commences, and loss by radiation. A means for clamping the utensil to the hot plate might minimise the first difficulty; the mass of metal of which the hot plate is generally constructed could be considerably reduced, and, perhaps, a polished metal shield arranged so that heat radiated off the hot plate is reflected back into the sides of the utensil, would make a further increase in efficiency.

Discussion.

Mr. R. N. Tweedy (Messrs. Wm. Coates & Son, Dublin) endorsed the author's condemnation of the hot plate system. He had to deal with a large system of electric ovens in Dublin which had been installed to take the place of gas ovens, and were employed to cook for about 500 persons daily. There were eight ovens built in two sections of four each. They had a total capacity of 38 joints, of an average weight of 30 lb. The dimensions of the ovens were 6 ft. by 4 ft. 6 in. by 3 ft. deep. Heating spirals were fitted at the top and bottom, and the ovens were well lagged. The total energy required was 34 kw., and the capacity of the ovens was 1,140 lbs. of meat. Mr. Tweedy thought that a very important matter for consideration was the great reduction in wastage which occurred with electrical cooking. In this case the current was obtained from the firm's private lighting plant, which was driven by suction gas engines. It was a curious fact that the cost of running the engines was practically nothing, as the amount of coal used while "standing by" was actually greater than when the engine was running and the cooking on operation.

Mr. G. F. Pilditch (Chief Electrical Engineer, Rathmines) thought that electricity was good for baking and roasting, but not for boiling. He advised caution in the matter of fixing the tariffs for this class of supply. The demand would probably coincide with the lighting peak of the load, and very large currents were required, so that it might become necessary to increase the section of the distributing mains, and in some cases even to increase the generating plant.

Mr. C. J. Cummins said that in his experience electric heating was not very expensive, and mentioned a case in Dublin where two large workrooms were heated by nine radiators, and there were in addition four large electric irons. A winter quarter's bill was only seven guineas. He recently tested a hatter's gas iron and found that it took 20 minutes to heat up, whereas, an electric iron was fit for use in two minutes.

Mr. M. Ruddle (City Electrical Engineer, Dublin) thought electric heating was too expensive to use excepting under special circumstances. If the apparatus were arranged in such a way that the air was circulated, he believed that the efficiency of the process could be greatly improved.

Mr. Wm. Tatlow (Chairman) said that Mr. Price's system was particularly satisfactory for greenhouses, because the heated air was equally distributed. If architects could introduce a scheme on the regenerative system, whereby the warmed outgoing air heated the cold incoming air, it would greatly reduce the cost of heating.

Mr. W. J. U. Sowter (Electrical Engineer, Bray) asked if the author had any particulars of an alternating current heating apparatus in which the energy was conveyed to the cooking utensil by eddy currents induced in it. This seemed to him to be a likely solution of the disadvantages of the hot-plate systems which Mr. Price had referred to. He suggested that heating apparatus should be placed across the outers of three-wire systems.

Mr. S. L. R. Price (in reply) thought that all ovens should be ventilated, as it was stated that poisonous gases were given off by meat while cooking. With regard to heating water, he was afraid that the ordinary kitchen range would never be done away with, and, as long as that was in existence, it could quite well be used for the hot water supply. He had tried an arrangement by Messrs. Fuller, in which the current passed through the water to be heated through two platinum plates. It answered very well, but the plates only lasted about six months, so that the cost of renewals was a rather costly matter. Regarding the limitations due to the capacity of distributing mains, he did not contemplate that electric heating would be used to so large an extent for some time to come.

Liverpool Engineering Society.—At a meeting on March 29th a Paper was read by Dr. Gwilym Owen on "Electrons and Röntgen Rays," fully illustrated by experiments.

Forthcoming Books.—Messrs. Constable & Company have just issued the first two volumes of a series of Electric Installation Manuals "By Practical Men for Practical Men." The prices range from 1s. net to 2s. net. The first two volumes to appear deal with (1) Motors, Secondary Batteries, &c., and (2) Arc Lamps and Accessory Apparatus. They will be followed at a short interval by others, amongst which will be :— "Electric Mining Installations," "Mill and Factory Wiring," "Ship Wiring and Fitting," "Bells, Telephones," &c.

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EFFICIENCY OF ELECTRIC HEATING APPARATUS

In his concluding Cantor lecture on Electric Heating, at the Royal Society of Arts on March 27th, Dr. J. A. Fleming dealt with domestic heating and cooking apparatus. To heat one pint of water from 60° F. to 212° F. required, theoretically, 190 B.Th.U., or 55 watt-hours (*e.g.*, 330 watts for 10 minutes). As a good electric kettle would do this with 60 watt-hours, its efficiency was over 91 per cent. A gas ring to do the same would consume 0·7 cu. ft. of gas (costing 0·021d. at 2s. 6d. per 1,000 cu. ft.), and gave a thermal efficiency of about 55 per cent. A "Therol" immersion heater taking 300 watts gave on a 24-hour test some 38·4 gallons of water at 110° F. heated up from 60° F. The efficiency worked out at 92 per cent., and the cost 1d. for 5 gallons with current at 1d. per unit. A simple immersion heater for placing in jugs gave an efficiency of 71 per cent. If the jug were lagged the efficiency would be 83 per cent., while if the heater were used in a Thermos flask the efficiency would be nearly 100 per cent. When purchasing an electric kettle the buyer should ask for a test of the efficiency. A figure of from 88 to 90 per cent. was common. A 2-pint 400-watt Prometheus kettle gave 90·5 per cent., and a 570-watt saucepan 93 per cent. There was a certain rate of heating which gave the maximum efficiency, and the apparatus should be designed for this. It should be remembered that an electric kettle or other device could not be forced, but took approximately the same time always to come to the boiling-point. The two different methods of minimising radiation from ovens were lagging with non-conducting material or keeping the outside highly polished. The former took time to heat up, but retained their heat and were highly efficient, while the latter were light and cheap. Comparing generally the cost of gas and electricity for small domestic heating and cooking apparatus, the lecturer stated that with electricity at 0·5d. per unit and gas at 2s. 9d. per 1,000 cu. ft., the cost was equal. However, it should be remembered that there was generally much waste with gas due to the rings being left on, and if this was considered electricity at 1d. per unit was probably not more expensive than gas. A useful rule for calculating the electricity required for cooking was 1 unit per day per person, and 1 unit for the oven. Dr. Fleming considered flexibles, plugs, and switches at 250 volts dangerous in kitchens, and recommended a maximum pressure of 100 volts and flexible steel tubing for all connections. With heating apparatus of the hot-plate pattern, it was essential that both the plate and the bottom of the cooking vessel should be clean in order to get a high efficiency, but this pattern was the most convenient for general use. An advantage of electric cooking was the possibility of control of the temperature—a high temperature to start with, and a lower temperature to finish.

Turning to house warming, Dr. Fleming differentiated between the two kinds of heaters. Radiators heated surrounding bodies, and, besides giving a cheerful glow, produced the maximum temperature where it was required—*i.e.*, in the lower part of the room. Convectors heated the air, and the highest temperature was then at the top of the room. It was perhaps a mistake to have red-hot wires in direct contact with the air, as they dried the air and destroyed organic matter, making it unpleasant to breathe. Electric radiators should not be put in the fireplace. No fireplace was required with electric heating, and ventilation should be by openings with fans if necessary. It was difficult to make comparisons with gas or coal fires, but if current could be obtained at ¾d. per unit there was a saving over gas for ordinary-size rooms. Electricity was not economical for heating very large quantities of water; to compete with a coal-fired boiler it would have to be obtainable at a price of 1/20d. per unit.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

TELEPHONES.—A new telephone catalogue, which is very comprehensive in spite of its small size, is being issued by the Sterling Telephone & Electric Co., Ltd. (200 Upper Thames Street). This contains particulars of direct-acting telephones for domestic and office use, battery and magneto call telephones in great variety for longer distances, inter-communication equipment on the "Primax" system, and special mining telephones. Details of several patterns of switchboards are also given, including those of the common battery lamp signalling type, and instruments on this system are also dealt with. Bells, relays, ringing keys, indicators, and various other accessories, complete the list.

STEAM TURBINES.—The British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester), have just produced a handsome descriptive book dealing with Westinghouse steam turbines of the impulse type. A full description of these turbines is given, with interesting illustrations of matters of detail, such as the arrangement of the fixed and moving blades, the governing gear, and other special features. A long series of excellent illustrations are also given depicting typical Westinghouse turbine installations, and of particular interest is the section on exhaust, mixed pressure, back pressure, and reducing turbines. The Company ask us to state that they will be pleased to forward a copy to any of our readers on receipt of business card.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

PROTECTIVE APPARATUS.—Messrs. Isenthal & Co. (85 Mortimer Street, W.) have sent us a copy of a comprehensive new catalogue which they have issued dealing with the protection of electrical plant and lines against surges. The subject is dealt with very lucidly and in considerable detail, and a system of protection is gone into employing the well-known Moscicki tubular condenser and the Giles electric valve. The book is divided into a general theoretical section on the nature of the surges to be provided for, a practical section describing the systems recommended to meet various conditions, and finally the catalogue proper, in which the apparatus required is fully set out. The work is worth careful study, and it is the object of the firm to put as much information on this intricate subject in the hands of their clients as possible. We understand that a considerable amount of this apparatus has recently been ordered for South Africa, Australia, China, and Japan.

NAILING AND CLEATING MACHINES.—A catalogue from Messrs. Matthew Wylie & Co. (57 Robertson Street, Glasgow) deals with nailing and cleating machines in various sizes and styles for construction of packing cases and boxes.

SWITCH PILLARS.—A recent pamphlet from the Allgemeine Elektricitäts Gesellschaft describes various patterns of switch and instrument pillars with and without regulator handwheels.

PLANING MACHINE DRIVE.—Another publication from the A.E.G. calls attention to a system of electrical reversing planing machine drive, and gives a list of engineering firms on the Continent who have adopted it.

LOCAL NOTES

Barnstaple: *Plant Extensions.*—The Council have asked the Islington Borough Council to allow Mr. Gay, their Electrical Engineer, to act in a consulting capacity in connection with the new plant which is to be installed.

Belfast: *Tramway Accounts.*—The accounts of the tramway department to March 31st show a net revenue, after meeting capital charges, of £54,050 16s., which is an increase of £7,755 over the previous year. Depreciation fund is credited with £13,000, and reserve fund with £16,730.

Darlington: *Tramway Loss.*—There was a loss of £1,426 upon the tramways undertaking for the year to March 31st; and as it is also deemed necessary to set aside £1,000 for depreciation, there is a net loss of £2,426.

Larne: *Purchase of Electricity Co.*—Mr. W. J. U. Sowter, Electrical Engineer to the Bray Council, has been retained by the Larne Council to prepare a report upon the proposed purchase of the Larne Electric Lighting Co.

Leeds: *Tramway Supply.*—The Electrical Engineer and the Tramways Manager have been instructed to proceed with a scheme for converting the present 25-period supply from the tramway power station to 50-period supply in order to unify the supply from the tramway and lighting power stations.

Manchester: *Tramway Arbitration.*—Sir David Harrel commenced the arbitration proceedings on Monday in connection with the dispute between the Tramways Committee and their employees.

Newcastle-on-Tyne.—Mr. J. A. Rodgers, who recently resigned the chairmanship of the Tramway Committee as a protest against the action of the Corporation in transferring £12,000 from tramway profits to the relief of taxes, has consented to remain on the Committee.

St. Helens: *New Turbo-alternator.*—On Wednesday last week a new 1,000-kw. Westinghouse turbo-alternator was put into operation. The machine runs at a speed of 3,000 r.p.m., and generates at a pressure of 6,600 volts. The steam consumption guaranteed is 15·9 lb. of steam per kw. hour at full load, but tests have shown this to be 1·63 per cent. better than the guarantee.

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Scarborough: *Tram Service Resumed.*—The tramway service having been renewed, and the Company having given an undertaking to continue the service during next winter, the Corporation have asked the Board of Trade to defer action in regard to the suggested cessor of the Company's powers.

Southend-on-Sea: *Electricity and Tramway Profits.*—Although the accounts of the electricity and tramways departments have not yet been issued, we understand that the net profits of the former for last year amount to £8,680, and of the tramways to £5,100. Of the profits of the electrical undertaking, £1,800 have been set aside for meters and wages of permanent employees, for which the Local Government Board will not grant loans; £1,500 have been transferred to reserve, and the balance handed over in relief of rates. Of the tramway profits, £1,500 have been set aside for doubling a portion of the track, £2,000 to reserve, and £1,000 to relief of rates, the balance being carried forward.

Worcester: *Plant Extensions.*—The scheme of the Borough Electrical Engineer to instal three-phase generating plant in connection with the supply to Messrs. Heenan & Froude has been referred back for further consideration. The total cost of the proposed extension is £7,100.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Ashton-under-Lyne.—The Corporation electricity works are to be remodelled at an estimated cost of £30,000. It is stated that several large firms have expressed their willingness to establish works in the borough if electrical power is available at a cheap rate.

Barmouth.—The Council is considering an electric lighting scheme, which has been prepared by Mr. Charles Balbiani.

Blackburn.—The Electrical Engineer has submitted a report on extensions at the electricity works.

Bradford.—The City Electrical Engineer has recommended the addition of a further 3,000-kw. turbo-generator with switchgear at an estimated cost of £20,000.

Bulgaria.—The *Board of Trade Journal* states that the conditions of tender for the installation of electric lighting at Varna may be seen at 73 Basinghall Street, London.

Derby.—Tenders are invited for inverted rotary converters, E.H.T. cables, and E.H.T. switchgear. Particulars from Borough Electrical Engineer.

Epsom.—A scheme of extensions into the Ewell district is being prepared by the Electrical Engineer. The estimated cost of mains and services is put at £1,300.

London: *Battersea.*—The Finance Committee of the L.C.C. recommend sanction to a loan of £2,000 for mains.

Islington.—Application is to be made for a loan of £6,500 for low-tension mains, meters, services, and transformers.

Shoreditch.—The Finance Committee of the L.C.C. recommend sanction to a loan of £11,236 for mains, house services, and meters.

Newcastle-under-Lyne.—Instructions have been given for extensions of plant at the Council's generating station.

Oulton Broad.—A scheme for the supply of electrical energy from the works of the East Anglian Ice Co. is under consideration by the Council.

South Shields.—A new scheme for the extension of buildings and plant at the Corporation power station at a cost of £10,080 is recommended. A loan of £7,580 is to be applied for, the balance being taken out of reserve fund. New plant will consist of a 1,500-kw. turbine driving a 1,000-kw. direct-current, and a 1,000-kw. alternating-current generator.

Woodbridge.—Messrs. Foot & Milne have presented a scheme of electric lighting to the Council.

WIRING

PROVINCES.

Ashton-under-Lyne.—Council school. Architect, Mr. E. Woodhouse, 59 Warrington Street.

Birmingham.—New police station.

Bolton.—New infants' school. Lancashire Education Committee.

Bootle.—Proposed memorial hospital.

Brighouse.—School. Architects, Messrs. Sharp & Weller, 32 Bradford Road.

Bury.—Tenders are invited for the wiring and fitting of the new Chamber Hall power station. Borough Electrical Engineer.

Colchester.—Asylum buildings. Architects, R. L. Curtis & Sons, Finsbury Square, London.

Dublin.—Tenders are invited by April 26th for the electric lighting of Charleville Mall Public Library extension. Particulars from the Public Libraries Committee at City Hall, Dublin.

Dundee.—Cinematograph Theatre in Hawkhill. Mr. A. E. Bennall.

Dunfermline.—New drill hall for Territorial Association.

Edinburgh.—New drill hall at Gilmore Place.

Hertford.—School. County Surveyor, Hatfield.

Motherwell.—New offices for Town Clerk.

Newark.—Hospital buildings in Barnaby Road. Town Surveyor.

Newcastle-on-Tyne.—New branch post office at Heaton. H.M. Office of Works, London.

Romford.—New post office. H.M. Office of Works, London.

Sheffield.—Rebuilding of Corporation Street baths. New wing for Applied Science Department of the University.

Worthing.—School of Art. Mr. L. Thompson, Thurloe House, High Street,

MISCELLANEOUS

Brighton.—The tramway lines in Lewes Road are to be re-anchored and re-seated at an estimated cost of £1,650.

Dudley.—Tenders are invited by April 19th for service cables, electrical fittings, arc lamp carbons, carbon filament lamps, and general stores. Particulars from the Borough Electrical Engineer.

East Indies.—The *Board of Trade Journal* states that a group of Chinese capitalists has applied to the Government of the Netherlands East Indies for the working of electric tramways in Batavia.

London: *L.C.C.*—Additional car traverses are required for the Streatham, Camberwell, and Hammersmith car sheds.

A large manufacturing firm desires to be placed in communication with makers of electric signs. The name of the firm in question is on file at this office.

TENDERS RECEIVED AND ACCEPTED

Bolton.—The Tramway Committee have accepted the tender of Mr. Chas. H. Blume for insulating compound.

Burnley.—The Council have decided, subject to the sanction of the Local Government Board, to accept the tender of the British Westinghouse Co. for a 1,500-kw. turbo-alternator at £6,433.

London: *L.C.C.*—The following tenders have been accepted for the supply of tramway parts, equipments, &c., for the year ending April 30th, 1912: Motor and generator spares, British Westinghouse Co.; Dick, Kerr & Co. Switchgear spares: Brecknell, Munro & Rogers; Dick, Kerr & Co.; British Westinghouse Co. Motor and generator brushes: Le Carbone; Sloan Electrical Co.; W. Geipel & Co. High and low tension cables, fuse wires, and cotton-covered copper wire: Western Electric Co.; W. T. Henley's Telegraph Works Co.; Liverpool Electric Cable Co.; London Electric Wire Co.; and Midland Electric Wire Co.

The following tenders have been received for the electric lighting of the trade school for girls, Belvedere Place, Southwark: G. Weston & Sons, Ltd., £275; Tilley Bros., £347 17s.; Johnson & Phillips, Ltd., £357; A. Hawkins & Sons, £369; Barlow Bros. & Co., £382 16s.; E. Newbald, £396; G. Harland, Bowden & Co., £423; Tredegar & Co., £432; Mann, Egerton & Sons, Ltd., £462 13s. The tender of G. Weston & Sons is recommended for acceptance.

Hammersmith.—The following tenders have been received for the supply of 24 frames and sub-station switchgear: Spagnoletti, £269; Ferranti, £271; Bertram Thomas, £283 10s.; Johnson & Phillips, £289; British Thomson-Houston Co., £319; Siemens Bros., £339; General Electric Co., £358; Electric & Ordnance Accessories Co., £366; British Westinghouse Co., £448; Electric Construction Co., £462; Reyrolle & Co., £529. The first-named tender is recommended for acceptance.

For the supply of two 100-kw. and two 200-kw. transformers the following have been received: British Electric Transformer

OSRAM-LAMPS

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Co., £477; British Thomson-Houston Co., £492; W. E. Burnand & Co., £499; British Westinghouse Co., £544; Foster Engineering Co. (two 100-kw. transformers only), £180. In view of satisfactory past experiences with machines of the British Electric Transformer Co., this firm's tender is recommended for acceptance.

Fourteen tenders have been received for water-tube boilers, superheaters, forced-draught furnace, mechanical stokers, economisers, &c., ranging from £5,007 to £9,602. In a report, the Electrical Engineer states that the two most favourable schemes are by the Stirling Boiler Co., at £5,602, and Messrs. Frazer & Chalmers, £9,510. The latter is for Messrs. Frazer & Chalmers' dust-fired boiler, which, whilst considered very attractive by the Electrical Engineer, is put on one side for the reason that the extra price outweighs the advantages. He recommends the acceptance of the tender of the Stirling Boiler Co. at £5,602, plus £229 for a larger air heater to enable the efficiency to be increased from 80 per cent. to 82½ per cent.

Tenders of the Universal Electrical Manufacturing Co. at £25 for 200 D.P. ironclad fuse boxes, and £86 15s. for 17 c.c. feeder pillars with switches and fuses have been accepted.

South America.—The British Westinghouse Co. have received an order from R. Jeffry for Pedro Perfetti, Valparaiso, for Tree Marias Oficina for two 75-kw. 230-volt D.C. generators and control gear, one 80-h.p., four 13-h.p., two 31-h.p. 220-volt D.C. motors and control gear.

Tonbridge.—The tender of the Electric Apparatus Co., Ltd., for a year's supply of motor type meters has been accepted.

West Hartlepool.—The tender of the Bastian Meter Co. has been accepted for 2½-ampere and 5-ampere meters.

Messrs. Venner & Co. have received orders for the supply of Chamberlain & Hookham meters during the ensuing year at Belfast, Barrow, and West Hartlepool. The Belfast Corporation have also accepted this firm's tender for "Venner" time switches.

APPOINTMENTS AND PERSONAL NOTES

Mr. A. L. Ballard, Gold Medallist of Faraday House (1909), has been appointed to the Assistant Lectureship in Electrotechnics at the South African School of Mines, Johannesburg (Transvaal University), at a commencing salary of £300 per annum. Whilst a pupil of Faraday House, Mr. Ballard served the practical part of his training with Messrs. Robey & Co., Ltd., of Lincoln, and at the works of the General Electric Co., Ltd., Witton, Birmingham.

Mr. J. H. Rider has been appointed President of the South African Institute of Electrical Engineers.

Mr. D. C. Redfern has been appointed Mains Superintendent at the Stoke-on-Trent Electricity Works at a salary of £130 per year. There were fifty-seven applications for the post.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 to £56 10s. per ton (last week, £56 15s. to £57).

Dissolution of Partnership.—Messrs. Robson & Coleman (Haymarket Lane, Newcastle) have dissolved partnership. Mr. R. E. Robson is carrying on the electrical business, and Mr. A. C. Colman is turning his attention to patent agency and consulting work.

Liquidations.—The petition of Messrs. Siemens Bros. Dynamo Works, Ltd., for the compulsory winding up of Arc Lamps, Ltd., was withdrawn on Tuesday before Mr. Justice Swinfen Eady.

The Rosario Electric Supply Co. is to be wound up voluntarily. Mr. H. E. Benthall, 52 Moorgate Street, London, is liquidator. A meeting of creditors will be held at the above address to-day (Thursday) at 12 noon.

Electrocars, Ltd., is to be wound up voluntarily. Mr. J. E. Denney, 3 Great St. Helens, London, is liquidator.

The Welsbach Incandescent Gas Light Co., Ltd., is to be wound up voluntarily for the purpose of reconstruction. Mr. H. E. Spinney, 344–354 Gray's Inn Road, London, is liquidator. A meeting of creditors will be held at that address on April 19th at 12 noon.

Bankruptcies.—A first and final dividend of 8¾d. in the £ will be paid on April 20th at the offices of Messrs. Corfield & Cripwell, 119 Finsbury Pavement, in the bankruptcy of J. A. Bauer, trading as the Electrical and General Engineering Co.

The discharge of R. Russell, Electrical Engineer, Felsham Road, Putney, has been suspended for two years.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Hastings & District Electric Tramway Co.—At the annual meeting last week a scheme for the reduction of the capital from £500,000 to £372,942 10s. was sanctioned. It was stated that the work of the past three years has shown conclusively the impossibility of paying the interest on the £200,000 6 per cent. cumulative preference shares and at the same time to make adequate provision for depreciation.

South Wales Electrical Power Distribution Co.—Mr. W. Gascoyne Dalziel presided at the annual meeting last week, and mentioned that the generating costs had been reduced by about 45 per cent. between September, 1907, and December, 1910. This result had been brought about by the use of steam turbines, and the additional machinery now being installed would, it was hoped, lead to further economies. Two large and important colliery companies had recently decided to take all their electrical energy from the company, and contracts had been let for the construction of the power lines to connect up these collieries. An additional £20,000 capital was necessary in this connection, which the Treforest Co. had arranged to find.

Tynemouth & District Traction Co.—There was a net balance of £5,068 for the year 1910, and, after placing £500 to reserve and £1,000 to debenture redemption fund, a 4 per cent. dividend is recommended for ordinary shares, carrying forward £187.

Cork Electric Tramways & Lighting Co.—After placing £5,000 to depreciation, a 4 per cent. dividend is recommended on the ordinary shares for 1910.

Gateshead & District Tramway Co.—At the annual meeting last week a suggestion that the £10 shares of the company should be divided into £1 shares was put on one side for the present, the chairman remarking that it would necessitate a special Act of Parliament.

Metropolitan Electric Tramways.—Mr. E. Garcke, who presided at the annual meeting last week, had a very satisfactory statement to make as to the past year's work. The development of the traffic has been so rapid that the company's cars were unable to cope with it, and cars had to be hired. The fact that the revenue per car mile was not so good as in previous years was due to the number of lines now serving sparsely populated districts. Their investment in the North Metropolitan Electric Power Co. still continued a good one, the dividend for the past year amounting to 6 per cent. in addition to the bonus. During the year, an issue of £250,000 second debentures had been made, and it was not expected that any further additions to the capital would be needed, after the balance of the ordinary shares, viz., £8,000, had been offered to the shareholders. The tramway scheme as originally designed was now practically complete. The directors thought highly of the use of trolley omnibuses for out-lying districts.

Calcutta Tramways Co.—A final dividend, making 6 per cent. for 1910, is recommended, adding £8,000 to depreciation, and carrying £1,662 forward. The traffic receipts increased by £10,546 during the year.

Obituary.—We regret to announce the death, through an accident, of Mr. Wm. Middleton, Assistant Works Superintendent to the Newcastle & District Electric Lighting Co., Ltd. Mr. Middleton was examining the back of a switchboard at the Close power station of the Company on Thursday afternoon, when a short circuit occurred. His face and hands were badly burned, and the upper part of his clothing was in flames. A doctor was immediately sent for, and he was conveyed to the Gresham Private Hospital, where he succumbed to his injuries on Friday morning. At the coroner's inquest the jury returned a verdict of "Death from shock following electric burns accidentally sustained," and expressed the opinion that a partition between the positive and negative bars should be provided in future to prevent danger from any accident or short circuit. Mr. Middleton was only thirty-seven years of age, and had been in the service of the above Company for fourteen years. He served his apprenticeship with Messrs. C. A. Parsons & Co., and as quite a young man was occupied in responsible positions. He was married in 1899, and leaves a widow and four young children.

Messrs. Connolly Bros.' Affairs.—Two debenture-holders in Messrs. Connolly Bros. obtained, a short time ago, the appointment of receivers, one in the Chancery Court and the other in the County Palatine Court. Subsequently, Mr. Justice Parker, in the Chancery Division, made an order restraining the proceedings in the County Palatine Court pending those in the High Court. On Thursday the Appeal Court, consisting of the Master of the Rolls and Lords Justices Fletcher-Moulton and Buckley, dismissed an appeal against the decision, on the ground that the learned judge in the County Palatine Court appointed the receiver in those proceedings after the other receiver had been appointed in London.

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ELECTRICAL ENGINEERING

No. 225 [Vol. VII., No. 16] THURSDAY, APRIL 20, 1911. [Price One Penny.
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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

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A Supplement "Electrical Engineering in Mines" is included (gratis) in "Electrical Engineering" on the first Thursday of every month.

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BINDING "ELECTRICAL ENGINEERING." — Vol. VI. of "Electrical Engineering" (Jan.—Dec. 1910) closed with our issue of December 29th, 1910. An index for the volume is now ready, and copies may be ordered from any newsagent or bookseller at the price of 1d. each (or post free, 2d.). Binding Cases, including index, price 2s. each, post free 2s. 4d. (Abroad 2s. 6d.) Readers can have their volumes bound by their own bookbinder; or, they may send their numbers to us, carriage paid (with the reader's name and address), and a remittance of 4s. 6d. under separate cover. The volumes will then be bound and returned carriage paid to any address in the United Kingdom, or carriage forward to the Colonies or abroad.

SUMMARY

The power station at the Trollhättan Falls erected by the Swedish Government, is designed for an ultimate output of 80,000 h.p., but something like 200,000 could be made available. Four turbines are already in place, each 10,000 h.p., and these, which run at 187·5 r.p.m., are coupled to some of the largest alternators yet constructed. (Page 203.)

Some illustrated particulars are given of the latest designs of Westinghouse impulse steam turbines. (Page 205.)

A Paper read recently at the Institute of Naval Architects described a new form of electro-hydraulic steering gear. (Page 206.)

The supply of electricity in rural districts was discussed at a recent meeting of the Yorkshire Section of the Institution of Electrical Engineers, when Mr. W. B. Woodhouse read a Paper describing the work done by the Yorkshire Electric Power Co. in this direction. (Page 207.)

The report of the Special Committee of the Tramways and Light Railways Association on speed indicators has now been issued. The Committee are not in favour of fitting all cars with speed indicators, but report satisfactory working of most of the instruments tested. (Page 208.)

Mr. C. Vernier's Paper on the laying and maintenance of cables has been further discussed by the Newcastle Local Section of the Institution of Electrical Engineers. (Page 208.)

A letter from Mr. H. Richardson (city electrical engineer, Dundee) continues the discussion on electricity meters. (Page 209.)

Substantial reductions are being made in the prices of high candle power metal filament lamps. Some interesting figures of the life of these lamps are also available. (Pages 209 and 214.)

Among the specifications published by the Patent Office on Thursday was one by V. Hope for an enclosed replacement fuse consisting of a subdivided carrier containing the several fuse wires, which is enclosed in the holder and can readily be replaced.—Siemens Bros. Dynamo Works describe improvements in the construction of oil-switches of the carriage type to prevent exposure of the live parts when the carriage is drawn out for cleaning.—A method of reducing the liability

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of the breakage of metal filaments at the supports by coiling the filament a few turns round the support to limit its movement at this point, is covered by G. F. Attwood.—A patent for a method of jointing filaments to supports has been granted to Pope's Electric Lamp Co., in spite of opposition. (Page 210.)

A PAPER on the mechanical design of induction motors, by Mr. H. L. Smith, bringing out some interesting points, was read before the Rugby Engineering Society recently. (Page 211.)

THE Cruse Controllable Superheater Co. have been successful in their action against Willans & Robinson, Ltd., to recover damages for defects in superheaters manufactured for them by the latter firm. The damages awarded were £3,535, but it is stated that the total costs of the action, together with damages, amount to over £20,000. (Page 211.)

THE costs of the arbitration in connection with the Torquay Tramway change over amounted to £1,399.—It is proposed to transfer certain portions of the Kent Electric Power Co.'s area to the East Kent Electric Supply Co.—The Ealing Council have refused to adopt a suggestion made by the Local Government Board inspector to purchase meters out of revenue.—All the remaining street gas lamps in Watford are to be converted to metal filament lamps. (Page 212.)

APPLICATIONS are to be made for loans as follows:—Barnsley, £16,100; Sale, £5,900; Aldershot, £2,500; Altrincham, £6,150; and Lowestoft, £3,000. An inquiry will be held shortly concerning a loan of £128,129 for electrical extensions at Dublin. Trunk mains, feeders, and distributers are required at Haslingden; a police fire alarm system at Salford; cooling tower and switchboard extensions at Walthamstow; generator, condensing plant, and cooling tower at Luton; a 1,500 kw. turbo-alternator at Fulham; and mains at St. Pancras. (Page 212.)

MESSRS. BABCOCK & WILCOX made a net profit of £425,443 in 1910, and a dividend of 8 per cent., together with a bonus of 8 per cent., is declared upon the ordinary shares. (Page 215.)

ARRANGEMENTS FOR THE WEEK

SATURDAY, APRIL 22ND.
Association of Mining Electrical Engineers.
2 p.m. Newcastle Branch. Visit to electrical installation at Chopwell Colliery.

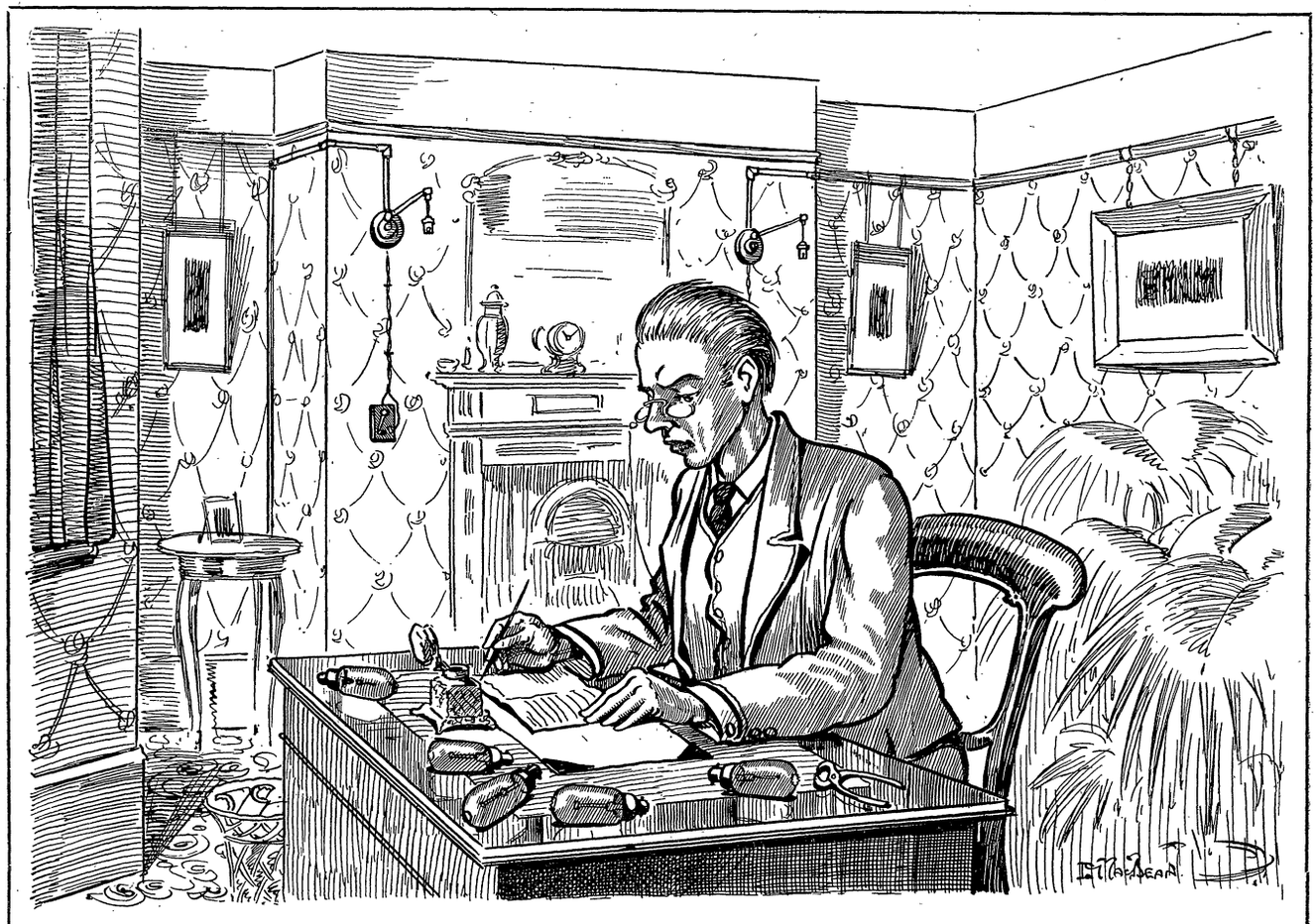
MONDAY, APRIL 24TH.
Illuminating Engineering Society.
8 p.m. At Royal Society of Arts. (1) "The Ratio of Light to Illumination," by H. T. Harrison. (2) "Some Notes on the Effect of Wall-papers upon the Illumination of Interiors," by P. J. Waldram.

TUESDAY, APRIL 25TH.
National Electrical Manufacturers' Association.
8 p.m. At Institution of Electrical Engineers, Victoria Embankment. "Foreign Compared with Home Industrial Finance," by L. Joseph.

WEDNESDAY, APRIL 26TH.
Electrical Trades' Benevolent Institution.
7 for 7.30 p.m. Festival Dinner at Hotel Cecil.
Faraday House Old Students.
7 for 7.30 p.m. Annual Dinner at Holborn Restaurant.
Institution of Electrical Engineers: Birmingham Section.
7.30 p.m. At the University. "Battery Economics and Battery Discharge Arrangements," by A. M. Taylor.

THURSDAY, APRIL 27TH.
Imperial Education Conference.
At the Foreign Office. (1) "Engineering Education," by J. A. Ewing, F.R.S. (2) "Higher Technical Instruction," by J. H. Reynolds.
Institution of Electrical Engineers.
8 p.m. At Victoria Embankment. "Battery Economics and Battery Discharge Arrangements," by A. M. Taylor.

SATURDAY, APRIL 29TH.
Old Ferrantians.
7 for 7.30 p.m. Dinner at Trocadero Restaurant, London.



MR. FLECKS WRITES TO HIS LAMP SUPPLIERS:—"Dear Sirs, The lamps you supplied me with to my recent order were all defective and burnt out immediately on being connected to the circuit, the bulbs were also very roughly finished, and I had to remove a projecting spike of glass from each before taking them into use."

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THE TROLLHÄTTAN POWER SCHEME

THE river Göta, in Sweden, flows from Lake Venern, which ranks as the third largest lake in Europe, and is navigable throughout the whole of its length of 56 miles except through the Trollhättan gorge and one or two other points, and from the sixteenth century onwards schemes have been carried out with a view to completing, by canals with the necessary locks, a practicable waterway from the great lake to the sea. At the present time a scheme is in hand by the State for the enlargement of the existing Trollhättan ship canal, which is expected to be completed in 1915. We are, however, more particularly concerned in this article with the way in which the difference of levels on this part of the river, the disadvantages of which to shipping are being removed by these canals, has further been made of use to the community as a source of power on a large scale.

The total difference of levels between Lake Venern and the sea is about 144 ft., of which about 105 ft. is actually in the Trollhättan series of falls, and the minimum flow of the river is over four million gallons per minute, rising to a maximum value of about 12 million gallons per minute. The enormous storage of Lake Venern, which has a surface of no less than 2,150 square miles, can, however, be utilised so that the total power which could actually be relied upon all the year round reaches the total of 200,000 h.p. The water-power rights for the whole river are owned by the State, who commenced in 1906 the construction of a station capable of dealing with some 3,300,000 gallons per minute, corresponding to about 80,000 h.p. at the turbines. The first portion of this station was inaugurated on October 28th, 1910, and the whole station is expected to be complete during the present year. £622,000 has so far been spent on the plant.

A general plan of the system is given in Fig. 1. The hydraulic part of the work included the construction of an intake dam at the side of the river well above the falls, with gates operated electrically and elaborate ice barriers at the head of a canal more than three-quarters of a mile in length, cut out of the solid rock and lined with masonry. There is also a regulating dam across the main river at the top of the falls. The canal leads to the head of the pressure tunnels leading down to the power station. At a future date a further canal is to be constructed, bringing an additional supply of water from the new ship canal, which it is intended ultimately to construct. The water is taken from the distributing basin or forebay, through eleven inclined tunnels in the rock, lined with concrete and steel plates. Each has a total length of 197 ft.; eight of them are 14 ft. in diameter, and are for supplying the large turbines, while the remaining three, for the auxiliary turbines, are about 4 ft. in diameter. Sluice valves are placed at the head of each of these, arranged to be closed rapidly by electric power from the power-house

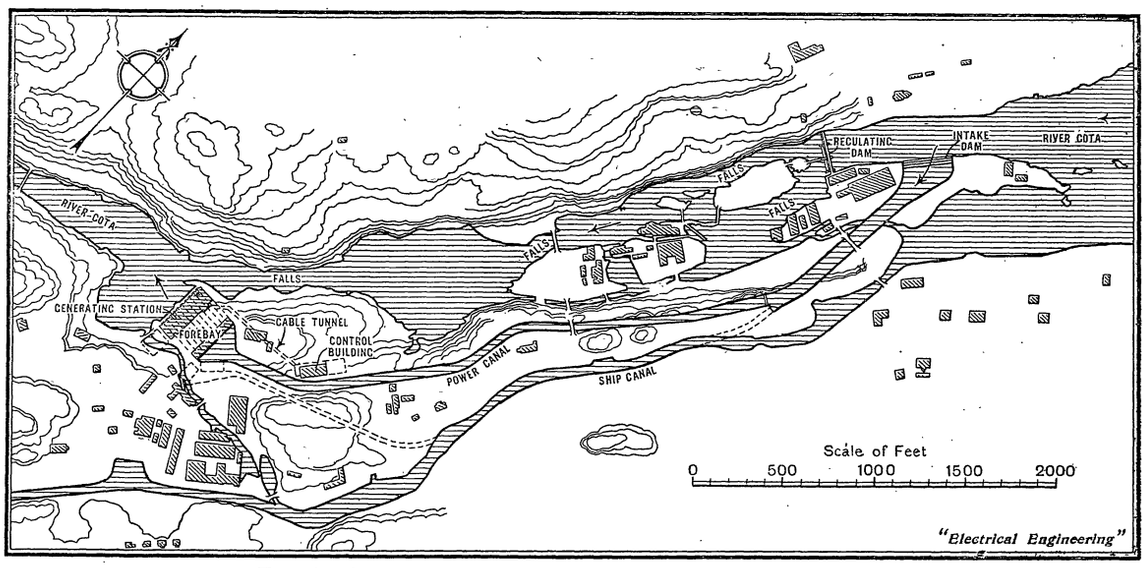


FIG. 1.—SKETCH MAP OF TROLLHÄTTAN FALLS POWER SCHEME.

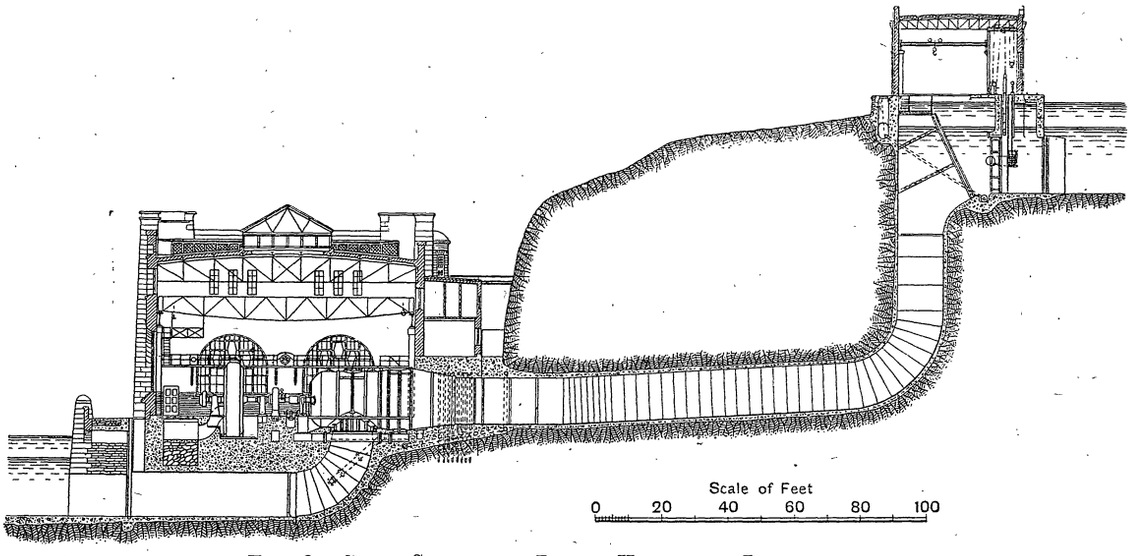


FIG. 2.—CROSS SECTION OF POWER HOUSE AND INTAKE.

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in case of necessity. They are elaborately protected by suitable grids against ice. A by-pass overflow channel direct down to the river is provided in case of an abnormal rise in the level of the canal or a sudden check of the water due to all the turbine regulating valves closing at once. The speed of the water at full load through the ice grid is about $3\frac{1}{4}$ ft. per second. A section of the power station, showing the arrangement of the pressure tunnels and generating plant, is given in Fig. 2.

The turbines in the power station are of the horizontal shaft pattern direct coupled to the generators. The main turbines will be eight in number, each rated at a normal output of 10,000 h.p. at 187·5 r.p.m., with a net head of 103 ft., but they are each capable of developing a maximum output of 12,500 h.p.

Each large turbine has two wheels in the same case, and has its own governing mechanism, with oil pumps, mechanical relays, &c., but any governor can, if necessary, be connected up to control any other turbine. The smaller turbines working the exciters are of the single wheel pattern, each capable of an output of 500 h.p. at a speed of 410 r.p.m. The four turbines forming the initial instalment of this equipment, were supplied by the Swedish firm of Nydqvist and Holm, and practically the whole of the electrical equipment, including the large generators, was supplied by the Allmänna Svenska Elektriska Aktiebolaget, of Vesteras. The main turbines are of the double Francis horizontal type, in centre casings of steel plate. The front cover, as well as the inner parts, are of cast steel. All the bearings have ring lubrication, and are accessible through vertical inspection shafts. The governors are worked by oil under pressure and have double return gear; 82 per cent. efficiency is guaranteed at three-quarter load.

The generators are wound for a pressure of 10,000/11,000 volts, three-phase, 25 cycles, and a continuous load of 11,000 k.v.a. each. They are completely enclosed, and are ventilated by air being drawn through the cases from ducts coming from under the machine-room floor by fans carried on the rotors. The heated air is expelled into the open air in summer, but can be used in winter for the warming of the various buildings. The two smaller generators, which are used for excitation, station lighting, and auxiliary power purposes, are of 350 kw. each, and generate continuous current at 220 to 300 volts. They work in conjunction with a 4,000 ampere-hour battery.

The excitation of the main generators is not controlled, as is usually the case, by series rheostats, but by means of boosters direct coupled to each set, which can produce any pressure from 110 to 220 volts, so that by opposing or aiding the pressure of the continuous-current bars any voltage from 0–300 may be applied to the fields of the generators. The continuous-current switchboard is placed in the turbine room, but all the high-tension switchgear is situated in a separate building. The cables from the main generators to the switch building are taken through a pair of tunnels about 650 ft. in length. Each tunnel contains at present the cables for two generators. The reason for this wide separation of the generating and distributing stations was purely the configuration of the rocky ground. The distributing station contains, as well as the main switchgear, the transformers for raising the voltage from 10,000 to 52,000 volts, at which pressure most of the outgoing transmission lines are worked. In the centre of the building is the control room, from which all the main generator and feeder switches are worked by electromagnetic remote control. The field regulation of the alternator is also controlled from this point. An elaborated system of signalling shows the attendants the state of all connections. Diagrams of connections with automatically moving representations of switches interlocked with the control switches show at a glance whether each main switch throughout the system is open or closed. Telephones connect the control room with the power station, and the transformer chambers, but in the case of the main generating plant, the orders are transmitted by visual electric telegraphs in order not to rely upon the telephones being audible above the noise of the running machinery. The building also contains an erecting and repair shop, provided with a crane, and a laboratory.

The main transformers are arranged in four cells, each containing the group of three single-phase transformers belonging to each generator. Each single transformer is rated at 3,670 k.v.a. They are oil-immersed and water-cooled. The cells are completely sealed up in case of fire, and arrangements are made so that the oil can be quickly run off if it catches fire. Special alarm signals are also provided to indicate any interruption in the cooling water circulation, as well as if the temperature of the oil exceeds a certain value. A group of four electrically-driven pumps are provided for the water circulation, and to provide the water jets for the lightning arrestors. Two of these pumps are held as spares, and there are elaborate systems of tanks and piping, both for this water service and for filling, emptying, and purifying the oil for the transformers.

Some of the outgoing lines are worked at 10,000 volts, and some at 50,000 volts, and the circuits can be sectionalised so that the individual generators can be run on separate lines or groups of lines quite independently. The connections are also so arranged by means of duplicate sectionalised high-pressure and low-pressure 'bus-bars, that any group of transformers can be coupled to any generator, so that the utmost flexibility is secured in view of breakdowns in any part of the equipment. The main switches are all arranged so that they switch in the machines or feeders through a resistance, before coupling them right up, to prevent surges, and all current-carrying parts of the equipment are designed to withstand the mechanical forces that would be produced by the short-circuit current of the eight generators together. Overload relays of the induction type are employed. The aerial circuits are protected, so far as discharges involving large amounts of energy are concerned by lightning arrestors of the horn pattern in conjunction with water jets, as well as oil resistances. Multicylinder arrestors are also used to protect against small disturbances.

With the exception of the cables in the tunnels between the generator and switch houses, all the H.T. conductors are bare metal mounted on porcelain insulators; bars are used for the 10,000-volt circuits, and tubes for the 50,000-volt circuits. The different phases are kept separated by concrete partitions in iron framing. The 10,000-volt conductors have everywhere 8 in. clearance from earthed surroundings, and the clearance round the 50,000-volt conductors is 16 in. Through the tunnels the cables lie each in its own masonry trough covered with sand. The various cells containing high-tension apparatus are separated by concrete partitions through which suitable insulators lead where a conductor has to be passed through. The cells containing the oil switches are entirely closed in, and provision is made for draining off the oil rapidly in event of the bursting of an oil container.

As already stated, the longer transmission lines are fed at 50,000 volts, while the distribution in the nearer neighbourhood of the station is at 10,000 volts. Energy is in neither case actually supplied to a consumer at 50,000 volts, but is transformed down to 10,000 volts, or in some cases to 3,000 or 6,000 volts, in sub-stations, which, like the generating station, are the property of the State. The secondary distribution networks are also erected and maintained by the State, and the cost to the consumers is reckoned to include the losses in transformation at the sub-stations. The lines already constructed aggregate some 76 miles.

All the 50,000-volt lines are of copper, arranged as a general rule six to a tower, protected by an earthed iron cable mounted on the same poles. Lines of this nature are erected or are in course of construction to the towns of Skara, Gotenburg, and Alingsas. The Skara line is equipped with pin-type insulators, while suspension insulators are used on the other lines except at towers where side stresses due to angles are taken. These strain towers are placed as a rule about 1 kilometre apart, and are substantially constructed to resist forces in any direction, while the intermediate supports are rigid only in a direction at right angles to the line, and have a certain elasticity in the direction of the line. In the case of lines composed of six 70 mm. wire, these supporting towers are about 660 ft. apart, and where 16 mm. wires are used they are about 460 ft. apart.

The 10,000-volt lines, where the largest amounts of energy are transmitted, are of aluminium, but the smaller lines are of copper. Pin insulators are used throughout, and steel towers similar to those for the 50,000-volt lines are used, except for a few of the lighter lines, where impregnated wood poles are employed. Transformer sub-stations are placed at various points of the system.

The price charged to the various local authorities and private consumers to whom power is supplied, varies with the distance from the power station, but is in all cases very low. Contracts have already been entered into with the towns of Gotenburg, Skara, Skövde, Alingsas, and other minor places. The State is also favouring the establishment of industries requiring cheap power in the district of Trollhättan itself by granting manufacturing sites on very favourable terms.

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THE WESTINGHOUSE IMPULSE TURBINE

IT is now well known that after investigating fully various designs of steam turbine, the British Westinghouse Co. have adopted the impulse turbine as their standard machine, and manufacture these under the Rateau Patents. The Company have issued a handsome descriptive book relating to these turbines, from which it is of interest to take a few particulars.

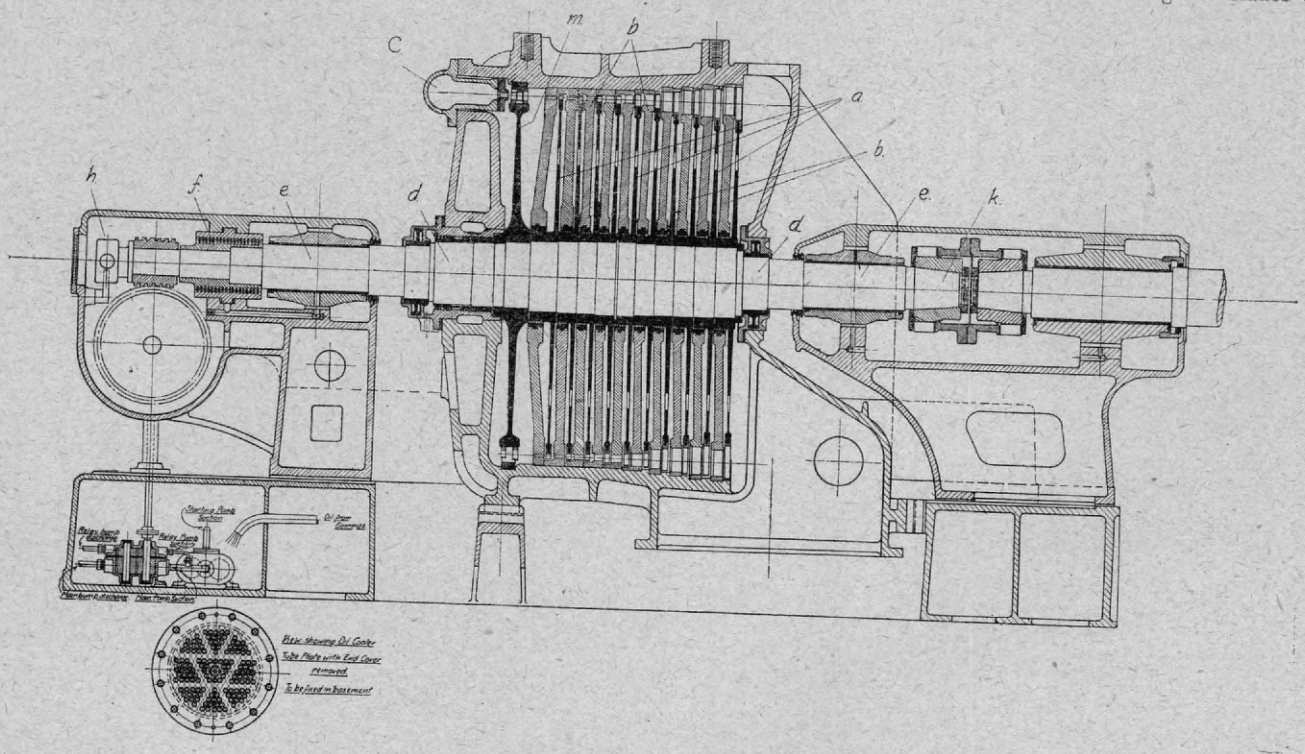


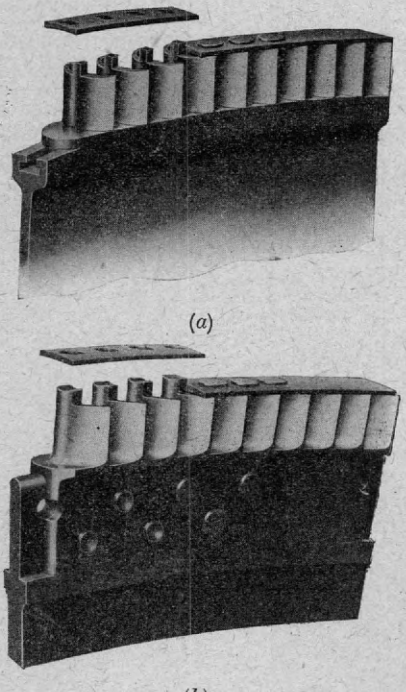
FIG. 1.—LONGITUDINAL SECTION OF WESTINGHOUSE IMPULSE STEAM TURBINE.

Fig. 1 gives a section of a high-pressure impulse turbine as made by the Company. The discs carrying the moving blades are shown at (*aa*), and the diaphragm with fixed blades or nozzles at (*bb*). The nozzle blocks through which the steam first expands are shown at (*c*). These are generally three in number; one will take up to half load, two up to full load, and the third is for overload or running non-condensing. Two of these nozzle blocks are generally arranged in such a manner that they may be cut out if desired when running on small loads for a long time. Special glands (*dd*) are provided at each end of the cylinder.

The bearings (*ee*) are separated from the glands by small isolating chambers, which separate the cylinder from the bearing-housings and casings in which the parts requiring lubrication are situated and which are best kept cool. To maintain the spindle in its correct relative position with the cylinder, a registering block (*f*) is provided. Next to this on the spindle is a worm driving a worm wheel, which in turn drives the main governor. On the extreme end of the spindle is the safety governor (*h*). At the other end of the spindle is the flexible coupling (*k*). The oil pump, driven by a vertical shaft through bevel gears from the main governor shaft, is placed in the oil tank at the end of the bed-plate. This pump delivers the oil under pressure to the cooler, from whence it is forced to the various bearings. After passing through the bearings it flows back by gravity to the oil tank, so completing the cycle. A small auxiliary oil pump is also fitted for starting up.

The diaphragms are arranged in such a manner that the respective halves in cylinder cover and lower half are not disturbed when the cover is lifted. The outer periphery fits in a groove in the cylinder, and the inner periphery is provided with special glands, which almost touch the shaft, and are of such a nature and design that if touching takes place between them they wear their own clearance without causing any trouble. The nozzles, or guide-blades, are made of a special steel, and are cast into the cast-iron diaphragms by a special process.

The blade wheels taper in thickness from the centre to the periphery, where the thickness is again increased and formed to take the blades. Each wheel, machined all over, is provided with large balance holes to ensure the pressure at each side always being the same. Each blade is machined out of the solid bar, each curve being given by a former or matrix fixed to the machine. Two methods of fixing the blades to the wheels are adopted. These are illustrated as (*a*) and (*b*) (Fig. 2). The "straddle" formation (*b*) is secured by means of rivets (in double shear), while (*a*) is a dovetail, the portion



(*a*)

(*b*)

FIG. 2.—ALTERNATIVE METHODS OF ATTACHING BLADING.

of the blade accurately fitting the groove formed in the periphery of the wheel, which is provided with two "ports" to allow of the blades being put into position. Each blade is finely finished and polished, to reduce skin friction to a minimum. The clearance between the blades and stationary

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parts varies from $\frac{1}{8}$ inch in the smaller to $\frac{3}{16}$ inch in the larger sizes.

The main governor is enclosed and is of substantial design, and a separate over-speed safety device is also provided.

The low-pressure, exhaust, and mixed-pressure turbines are similar in principle, but, of course, different in proportion, and the Company make a speciality of back-pressure and reducing turbines suitable for those working conditions where steam, at a pressure which cannot be described as either boiler or exhaust pressure, is used for some process in manufacturing, and where, at the same time, electrical energy is required. Large savings can be effected with these turbines in paper mills, dye and bleach works, chemical works, sugar refineries, laundries, distilleries, and large public institutions, such as hospitals, workhouses, and asylums, where steam is required for heating the buildings.

A good example of the most recent design of Westinghouse turbine is that driving the new 1,000-kw. set just installed in the St. Helens Electricity Works. This drives a 6,000-volt alternator at 3,000 r.p.m., and takes steam at 160 lbs. per sq. in. The steam consumption guaranteed by the manufacturers when they obtained the order was 15·9 lbs. of steam per kilowatt hour at full load; the actual consumption, however, which was obtained when the machine was tested came out at 15·64 lbs. per kilowatt hour, which is 1·6 per cent. better than the guarantee. The condenser is of the low-level jet type, manufactured by Mirrlees Watson, Glasgow, with Westinghouse motors driving the various pumps. Up to the installation of the 1,000-kw. turbo-alternator, the whole of the alternating current generated was supplied by two Westinghouse rotary converter equipments of 250 and 550 kw. respectively. Each of the rotaries is designed specially to be reversible, that is to say, they can convert direct-current into polyphase alternating-current, or *vice versa*. Now that the turbo set is installed, these rotary converters will form a very flexible and most efficient link between the direct-current and alternating-current systems of supply.

AN ELECTRO-HYDRAULIC STEERING GEAR

A PAPER by Dr. H. S. Hele-Shaw, F.R.S., and Mr. F. L. Martineau, read on April 7th before the Institute of Naval Architects, describes a form of electrically driven steering gear with a new form of hydraulic transmission, the first example of which has been installed on the steam-turbine yacht *Albion* (1,700 tons displacement), belonging to Mr. H. Loeffler. The gear is alternative to ordinary steam steering gear, but has been used practically exclusively since its installation.

Fig. 1 is a diagrammatic view of the gear. The rudder-head, *A*, is operated by rams, working in two cylinders, *B* 1 and *B* 2. The rams themselves are actuated by oil, which is supplied from a Hele-Shaw rotary variable stroke pump, *C*. The pump itself, which we describe in more detail below, is driven by a shunt-wound electric motor, *D*, which is kept continuously running whenever the boat is under weigh. The action of the gear is as follows: *E* is a rod controlling the effect of the pump in such a way that when it is in mid-position no oil is being pumped. According as it is moved in or out from the central position the oil is transmitted under pressure to the cylinders *B* 1 and *B* 2. In this way, by the mere movement of the spindle *E* the rudder-head can be put over to port or starboard as required. The actual operation of the spindle *E* is effected by means of a floating lever, *G*, coupled near its middle point to the spindle *E*, and controlled at one end by a lever, *H*, which is connected with the telemotor, and operated from the bridge. The other end of the floating lever *G* is connected, by means of the link *L*, to the tiller-head. Thus, as the link *H* is moved, the other end of the lever *G* being for the moment fixed, the spindle *E* starts the pump in operation, and as a consequence the tiller-head begins to move. In doing this, the link *L* moves the other end of the lever *G*, and hence tends to bring the spindle *E* to its middle position, and so stops the pumping action (although the pump continues rotating), and in doing so the rudder-head is left exactly in the position corresponding to that which the wheel and telemotor have been made to take up. The only other essential feature is the pipe *P* connecting the two ram cylinders, in which is placed a spring-loaded by-pass valve, *M*, so arranged that, if the rudder be subjected to any shock which would bring about more than certain predetermined stresses, the rudder-head is able to yield by the transfer of oil from one ram cylinder to the other, and, since the floating link is thereby moved, the pump is automatically set in operation and the rudder restored to the position corresponding to that of the steering wheel (without the intervention of the steersman).

The principle of the variable stroke pump is shown in fig. 2. It is direct coupled to the motor, and its construction is such that it can run at very high speeds with a good efficiency for a large range of pressures. The pump consists of four parts—namely, the containing case, carrying the bearings in which the rotating portion works; the revolving cylinder body, in which the working rams operate; a central fixed shaft, in which are the induction and eduction passages, *P* and *Q*, lengthways, and which acts as a fixed valve in communication with the various cylinders; and the guide ring, a circular frame capable of being moved to and fro by the spindle *E*, so that it can either be placed in the central position, as shown in the first diagram, or moved to and fro on either side of centre as shown in the second and third diagrams.

Suppose the guide ring to be in the central position, and

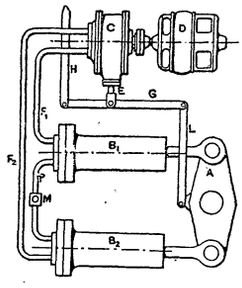
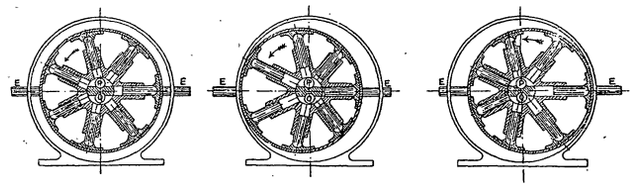


Fig. 1.—Diagram showing General Arrangement of Electro-Hydraulic Steering Gear.

the cylinder body rotating in the direction shown by the arrows, then, inasmuch as the slippers rotate in a circle, no movement of the plungers takes place, and there is no suction or delivery. This is the usual condition of affairs when the helm is steady. Suppose now a movement of the wheel is made; the telemotor moves the guide ring in one direction or the other, according as the helm is put over to port or starboard. Let us suppose, in the first place, it is put over in the direction of the second diagram. In this case the plungers moving above the centre line will evidently be moving outwards, and, therefore, will be drawing oil along the passage *P*; and, having reached the extreme outward position on the left, they are in turn closed by passing the



Middle position. No discharge.

Full stroke. *P*, suction. *Q*, delivery.

Full stroke, reverse. *P*, delivery. *Q*, suction.

Fig. 2.—Sketches showing Principle of Variable Stroke Pump.

shaded portion of the bridge, and on passing through the lower half of the circle are gradually forced inwards, the oil contained in them being driven along the passage *Q* shown in cross-section, and, finally, when empty, are closed by passing over the bridge on the right-hand side. Thus *P* becomes the induction and *Q* the eduction passage, and the oil in the ram cylinder to which these parts are respectively connected becomes greater or less, and causes corresponding movement of the ram. The reverse operation takes place if the guide ring is moved by the spindle *E* to the position in the third diagram, when *Q* becomes the induction and *P* the eduction passage. In actual use the full-stroke position is rarely reached.

The gear is being fitted on the Orient s.s. *Orama* and on two new Austrian Lloyd steamers. The Paper describes a long range of experiments which were made on the gear on board the *Albion*. A special lag recorder was devised to show the relative movement of the telemotor and the rudder-head at any instant. This showed that the rudder in the case of the electro-hydraulic gear followed the wheel much quicker than with the steam steering gear in action, and this confirms the opinion of the captain of the superior working of the new gear. Results of power and efficiency movements are also given, from which it would appear that a 3-h.p. motor would have been quite sufficient for the work, instead of the 10-h.p. machine used.

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PUBLIC ELECTRICITY SUPPLY IN COUNTRY DISTRICTS

THE above was the title of a Paper by Mr. B. Woodhouse (Chief Engineer, Yorkshire Electric Power Co.) read on Wednesday of last week before the Yorkshire Section of the Institution of Electrical Engineers at Leeds. In his introductory remarks the author referred to the rapid advances electric lighting and power had made, and sketched the influence of the various Acts of Parliament dealing with the matter from time to time up to the Power Acts of 1901 and 1902, under which his own Company had its powers. He referred to the opposition to large power schemes which had often been offered by local authorities, and the serious restriction which had been imposed in many cases in consequence. Despite these restrictions, however, a number of power companies have developed their supply in such a manner that the cost of electric power in the last ten years has been more than halved, and a public supply has been made available for purposes formerly undreamt of. At the time the Power Acts were passed many small boroughs, &c., had taken out provisional orders, and some were running supply systems too small to be economical; but there was now a greater tendency towards supply on a large scale. Thus, in Yorkshire, when the Power Company started operations in 1905, there were twenty-five districts in which the local authorities had taken out electric light orders.

Of these orders, twelve have been revoked by the Board of Trade, seven transferred to a company taking a bulk supply, and four put into force by the local authorities taking a bulk supply from the Power Company. In not a single case has a small generating station been erected.

Mr. Woodhouse then went into figures to show how the size of the undertaking affected the costs, and said that cost of production in a 10,000-h.p. station was less than one-third that in a small station, and there is the additional advantage of a better load factor owing to greater variety in the nature of the load.

Passing on to the question of distribution, Mr. Woodhouse said that an analysis of the results of supplying electric light by means of underground mains in a number of small undertakings showed that for lighting alone there is a yearly sale of ten units of electricity for every £ of capital spent in mains. In other words, to obtain 8½ per cent. return on the capital, a profit of 2d. per unit must be earned. It was clear, then, that any reduction in the cost of distributing mains would have an important effect on the cost of electricity.

In agricultural districts electricity supply can only be given at a cheap rate by the use of overhead mains, as the cost of underground cables becomes prohibitive where the houses, farms, &c., are scattered. Estimates are worked out to that in a case with forty services and thirty-six street lamps per mile, with a special switching wire for the public lighting; the main, services, lamps, &c., with a wood pole line would be £440 per mile, as against £760 for underground mains. The author considers that objections on the score of danger and unsightliness of overhead mains have been much exaggerated. Their use, however, is much extending, and on the Yorkshire Company's system over ninety miles are already in use. In Leeds low-pressure overhead wires are in use for street lighting; in Barnsley overhead work of very neat design has been employed in a recent street-lighting extension; and in Honley both street and private lighting is carried out by overhead wires; in Whitwood the same plan is being adopted. At Horseforth the street lighting is carried out by the Yorkshire Electric Power Co. at £2 per lamp per annum, including provision of cables, conversion of gas-lamps, lighting, cleaning, and extinguishing. Street lighting is also being supplied in Mirfield and Whitwood, and the following figures are typical of the cost: Lantern with one 35-watt lamp, lighted 2,000 hours per year; current at 1½d. per unit, 8s. 9d.; cleaning and lamp renewals, 5s. 6d.; maintenance, 1s. 3d.; interest (6 per cent.) on expenditure, 5s. 9d.; total, 21s. 3d. With two 35-watt lamps per lantern the cost came out at 32s. 6d. per post.

Considerable advance is being made in the use of electricity on farms. Power is obtained from motors mounted on waggons taking current from any convenient point on an overhead line, and lighting for the buildings is taken from the same wires.

In a number of cases the Power Company's supply has been used for cottage lighting, an inclusive charge per week being made for the supply of current and lamps, there being no restriction on the hours of lighting. In one such case a group of fourteen cottages is supplied, each cottage being lighted by two 60-watt lamps and two 120-watt lamps. The annual consumption of current per cottage is 160 units. The current consumption is very large on account of the use of carbon lamps. The same illumination from metal lamps would reduce the consumption to 54 units per annum, or 18s. per annum at 4d. per unit. In another case a group of twelve cottages are lighted each by three 16-c.p. tantalum lamps at an annual cost of 15s. 1d. Six other cottages, each lighted with four 60-watt lamps, use an average of 78 units per annum, costing 6d. a week at a price of 4d. per unit.

The author also drew attention to the assistance of electricity in mitigating the smoke nuisance, and at the conclusion of the Paper showed a number of slides illustrating the methods in use at the places mentioned above for street lighting, and the way in the supply of groups of cottages the wires were run on insulators on the outside walls and taken in through the woodwork of the window-frames. Views of typical farm installations were also given.

The discussion was opened by Mr. W. Emmott, who had been formerly in favour of municipal supply, but now advised local authorities to make the best terms they could with the power companies.

Mr. A. Lupton (Chairman, Yorkshire Power Co.) spoke a few words emphasising particularly the flexibility of electric power.

Mr. J. W. Hame (City Electrical Engineer, York) remarked that industries would settle not only where rates and taxes were low, but where electric power was cheap. He asked for some further particulars regarding the charges for current in cottages and the method of collection.

Mr. S. D. Schofield (Borough Electrical Engineer, Shipley) agreed that small generating stations and underground mains were prohibitive in scattered areas. Mr. H. Wilson Hartnell also favoured overhead distribution.

Mr. E. A. Barker (Borough Electrical Engineer, Barnsley) gave some further particulars of the street lighting at Barnsley. The electric lighting had come out considerably cheaper than the gas lighting in the borough. Private supply was given from the same mains as the street lighting.

Mr. F. Thursfield looked forward to extended adoption of electric heating with the cheapening of supply. Small concerns had often disadvantages in lack of capital. The author had said that the revenue rarely exceeded 15 per cent. of the capital expenditure, but on looking the matter up he thought that 23 per cent. was nearer the mark. He also thought that in his estimate of a yearly sale of only 10 units per £ expended on mains, and the subsequent figures depending on this, that the author had been unduly pessimistic as regards the small undertaking. At Chester he had found it impossible to bring the cost of street lighting below £3 per lamp per annum. He thought Mr. Woodhouse's figure of 2,000 lighting hours per year was too low.

Mr. H. H. Wright (Messrs. Wright & Wood) gave some particulars of a windmill electrical plant, but stated that if the Yorkshire Electric Co.'s supply had then been available it probably would not have been erected.

Mr. Holliday (East Ardsley) spoke in favour of overhead mains.

Mr. I. F. Fawcett (Messrs. Loxley & Co.) asked where the critical point was reached when the cost of running mains to a farm would be more expensive than putting down independent plant.

Mr. A. M. Sillar (Yorkshire Electric Power Co.) also asked some questions, and

Mr. H. Dickinson (Chief Electrical Engineer, Leeds Corporation), referred to the saving effected in capital cost by having combined tramway and lighting stations.

Mr. Woodhouse, in reply, remarked that in the Tyneside district, where something like 95 per cent. of the power used was electrical, there had been a very noticeable effect on the smoke nuisance. In reply to Mr. Hame, he would favour a fixed charge for cottage lighting included in the rent. The 2,000 hours objected to by Mr. Thursfield was not a fixed figure, but even at 4,000 hours the cost would not be much increased. With regard to the cost of overhead mains to farms, these were usually carried across fields, &c., which could be done very cheaply, so that independent plant would rarely be cheaper. In reply to one of Mr. Sillar's questions, he quite favoured arrangements whereby power mains and telephone lines could be run on the same poles.

Blackpool Fatality.—On April 10th, T. G. Sidney, an employee of the Blackpool Electricity Works, was killed by shock from a 2,000-volt street lighting main upon which he was working. It appears that certain extensions were being made, and that it was expected that the work would be completed before the time for switching on, and no notice was given to the works to keep the mains dead. The work took longer than was expected, and Sidney received the full pressure to earth. The foreman on the job gave evidence to the effect that he warned Sidney and advised him to use rubber gloves after he had complained of a slight shock, but that he had taken no notice.

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SPEED INDICATORS FOR TRAMCARS

THE Tramways and Light Railways Association's Journal for April contains a Report on "Speed Indicators," drawn up at the suggestion of the Board of Trade. The Members of the Special Committee signing the Report are the following:—A. H. Pott (Chief Engineer, Metropolitan Electric Tramways), *Chairman*; R. W. Cramp (General Manager, Birmingham and Midland Tramways Joint Committee), H. England (General Manager, Wakefield and District Light Railways Co.), W. E. Ireland (Rolling Stock Superintendent, L.C.C. Tramways), C. W. Mallins (General Manager, Liverpool Corporation Tramways), and S. Sellon. Full reports of tests of a large number of instruments are included, and the Committee finally came to the following conclusions:—

That there are now speed indicators on the market which, as far as the instruments themselves are concerned, have worked satisfactorily during the tests, although it is not at present possible to state what their life is likely to be when fixed on tramcars. That transmission gears could be made which might stand for some time the rough conditions met with underneath a tramcar; their first cost and maintenance, however, must be considerable. That in view of the first cost and the cost of maintenance of instruments and transmission gear, it would be a serious burden on tramway undertakings to have to equip service cars with indicators. That as the proper maintenance of the existing equipment on a car already fully occupies the attention of the staff during the short time available between cars leaving and returning to the sheds, it is most undesirable to add anything more to a car which will require attention, especially if this is not a vital part of the equipment. That the electrical form of speed indicator is the cheapest and easiest to fit, but from the tests it will be seen that indicators of this type appear unable to stand the rough conditions of tramway operation. That if speed indicators are required at all, they should only be fitted on cars for instruction and test purposes. That except for special test purposes, no speed recording chart is necessary, and a mileage recorder is not required. That no indicator showing the maximum speed attained (by ringing a bell or moving a maximum pointer) is of much value, as the authorised speed varies at different parts of the same route: and whereas it may be safe to exceed an authorised speed of say 16 miles per hour on one part of a route, it may be dangerous on another part of the same route to exceed even four miles per hour. That since the most successful form of transmission gear is that in which a belt or chain is driven from one of the car axles, the wear of the wheel will necessitate a constant adjustment of the instrument, otherwise there would be a considerable inaccuracy in the reading of the indicator.

CABLE LAYING AND JOINTING

MR. C. VERNIER'S Paper on "The Laying and Maintenance of Transmission Cables," which was discussed before the Institution of Electrical Engineers on March 9th, and also at Newcastle (see ELECTRICAL ENGINEERING, March 16th, page 135, and March 23rd, page 151), was further discussed at Newcastle on March 20th.

Mr. P. V. HUNTER reopened the discussion. He considered that so far as external damage and pressure surges were concerned, the solid and armoured systems might be considered as equal, but for resisting chemical action, subsidence, over-running, and vibration the armoured type was superior. The original type of jute sheath was unsatisfactory as it would not absorb heavy bitumen, but the bitumen and tape protection used in the north-east coast districts was highly satisfactory. The fact that their generators gave practically pure sine waves probably accounted for the immunity from breakdown when cables were switched in without the intervention of charging gear. Another point was that the higher the working voltage of the cable, the lower the capacity per mile. Cable insulation breakdowns were largely due to heating by dielectric hysteresis, and this explained why high pressure surges of extremely short duration did not break down a cable, there being no time for the dielectric to reach a dangerous temperature. Experience in this district had shown that there was nothing to fear from creosoted troughing. He pointed out that coal gas had a very serious action on bitumen, and further that air affected vulcanised bitumen.

Mr. E. FAWSSETT confirmed that cables could safely be run at very high densities if excessive voltage drop is not objected to.

Prof. W. M. THORNTON explained how a cable could break down at a point some distance from the place where a surge originated. A cable broke down in exactly the same way as any other condenser.

Mr. G. B. BURROWS showed a design of a cast-iron oil-filled joint box into which the cable ends were led and joined by flexible braids, which he had used on cables liable to breaks due to subsidences and overrunning.

Mr. H. W. CLOTHIER (Messrs. A. Reyrolle & Co.) pointed out that cable-charging devices were still sometimes specified, but they tended towards complication of the switchgear. Surges might be caused by the clearing of short circuits on other feeders, and in this case the charging devices were, of course, inoperative. They were, however, useful in preventing current rushes when switching in open circuited transformers.

Mr. H. BRIDGES said that in designing manholes the fact that cables had to be drawn in seemed often to be overlooked. A straight pull should always be arranged for, and corners avoided as far as possible. He advocated the use of coffin-shaped manholes.

Mr. G. B. ADDISON advocated the solid system, with earthenware troughs, porcelain bridges, and pitch of the correct proportions, and suggested that faults on armoured cables were more difficult to locate.

Mr. T. H. HARRIS said that his firm was at present laying a cable having a bitumen covering, which adhered to the lead, and the best protection was a well-creosoted board. He thought that the proposal to run cables at 150° F. would lead to trouble.

Mr. G. L. PORTER advised care in the selection of testing apparatus, as he had found that choking coils sometimes altered the wave shape considerably.

Mr. J. E. DAWSON pointed out in a communication that it was not always necessary or advisable to spend money in elaborately bonding ordinary L.T. cables. His own practice was to break the continuity of the lead and armour at every joint box, as he considered that by bonding everything up solid one was simply providing a return circuit which competed with the earth and water mains. The distribution system at West Hartlepool was installed on these lines over twelve years ago, and no more than the usual trouble due to earth currents had been experienced.

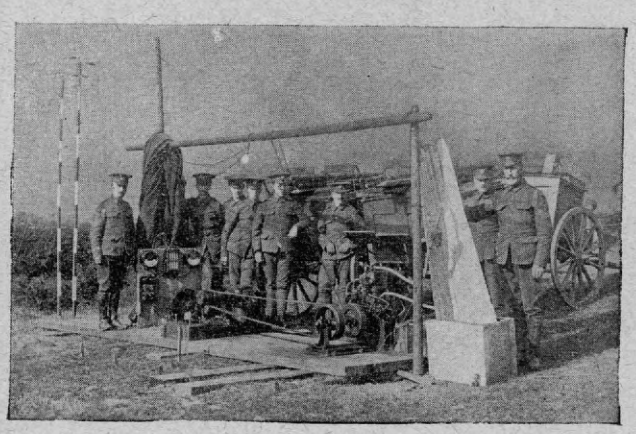
Mr. W. HOGG (communicated) advocated the use of armoured cables laid solid where passing through made-up ground. He described an expansion joint which he had used in India.

Mr. C. BEAVER (communicated) suggested that breakdowns due to cable movement usually occurred close to joint boxes—*i.e.*, at the point when the cable was held rigidly—and he advocated looping the cable at each side of the joint. To ensure that boxes are completely filled with compound, he favoured the use of a funnel for filling, making sure that a head of compound was maintained in the funnel at a higher temperature than that in the box.

Mr. C. VERNIER replied briefly.

OSRAM LAMPS IN CAMP

THE General Electric Co. have sent us the accompanying illustration, showing the use of Osram lamps at the Bexhill summer camp of the Royal Engineers. The plant comprised a portable 4 h.p. petrol dynamo, complete with battery. This equipment was used in the day-time to charge the cells for wireless service, and at night provided current for groups of Osram



lamps in the officers' mess, sergeants' mess, orderly tent, mess canteens, &c. Overhead lines attached to service poles were used for the distributors. The average distance of the lamps from the plant is 300 yards, and they are run on a 50-58-volt circuit. The interior of the waggons carrying the wireless apparatus was lighted by Osram motor-car lamps.

Rubber and Allied Trades Exhibition.—The International Rubber and Allied Trades Exhibition, to be held at the Royal Agricultural Hall from Monday, June 26th, to Friday, July 14th, at which a number of foreign Governments will be represented, will contain exhibits of varying nature relating to the production and preparation of rubber, rubber machinery, &c. Not the least interesting feature will be the display, for the first time, of commercial synthetic rubber, and the opportunity of comparing this product with natural rubber will be afforded.

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CORRESPONDENCE

ELECTRICITY METERS.

To the Editor of Electrical Engineering.

Sir,—With regard to the paper recently read at the Institution on Electricity Meters, I am inclined to agree with those gentlemen who, in the discussion, disapproved of the criticisms passed on the mercury motor meter. The fact that the sale of this type represents a huge majority of meter sales alone proved that it is a very good and useful article. The statement that it is difficult to obtain sufficiently high driving torque as the current capacity is reduced is not correct, in my experience during the past few years, which, on the contrary, shows a 1½-ampere meter registers well within the limits of an 8 c.p. lamp, and beyond this it is surely unnecessary to go under present commercial conditions. Further, the curve obtained is good. The principal disadvantage of the mercury motor meter appears to be its tendency to amalgamate, but in cases where the armature is properly and carefully protected, such amalgamation goes on at a very slow rate, if at all; with the exception of meters which are constantly much overloaded, the error from this source rarely exceeds 3 per cent. within a reasonable period of overhauling. This is assuming, of course, that the meter was originally provided with clean and pure mercury. Enamelled discs are now being made, and, so far, appear to get over the difficulty; but even if this new introduction is not entirely successful, it must still be remembered that cases are comparatively common where the fibre-covered discs of the old type Hookham meters have been out on circuit for ten to twelve years without suffering from such troubles at all. As regards electrolysis taking place in the bath, this is practically limited to cases where the meters have been severely overloaded, and the baths thus unduly heated. This is also probably the cause, partly, of many amalgamation troubles.

As regards commutator ampere hour meters, beyond the fact that they are cheap there is nothing in their favour, and even their cheapness is more than overbalanced by their unreliability and the expense and difficulty of repairing them. Their fragile nature, construction, and excessive speeds will be found serious drawbacks to their general adoption.

Regarding the dynamometer type watt hour meter, it is possible that, if sold cheaply enough and well constructed, a meter on this principle will have a fair chance; yet it remains that its only advantage over any other good ampere hour meter is that it registers correctly fluctuations of the voltage, and in any well-regulated system this should not amount to more than 2 per cent., if that, and even in cases where the supply voltage is known to be above the declared voltage the meters could be left 1½ per cent. or 2 per cent. on the fast side at the higher load, where the greatest loss from this source is considered to take place, and this alteration could be made without in any way departing from the limit of accuracy imposed by the Board of Trade. Further, this type of meter is still subject to trouble with the commutator, bottom bearings, and jewels, and is not so well fitted to withstand weather conditions to which meters are occasionally subjected to on service, as are those of the best ampere-hour type. Further, with regard to watt-hour meters, the shunt loss on a large system becomes an important consideration, especially under the conditions produced by large tenement buildings having a number of separate consumers with a comparatively small load.

With reference to electrolytic meters, if one excepts the small hermetically sealed production of Messrs. Reason—which is to be found very good on the smallest jobs—their advantages are not easily seen, whereas their disadvantages are very considerable, and, from the commercial point of view of the meter department, render their use altogether inadvisable.

Aron meters undoubtedly embody the best theoretical design for any meter, and naturally they are by no means cheap in first cost. Further, they are not easy to clean and repair. They require a lengthy test, and are liable to error if out of plumb. They rely on very good insulation, and are still subject to the inevitable shunt loss attached to watt-hour meters.

The old "Elihu Thomson" meter was one of the best revolving armature watt-hour meters of its day, and the advantage of being equally suitable for use on A.-C. or D.-C. circuits was an important factor. Further, it could be overhauled easily, pivot and jewels could be replaced without upsetting any adjustments, but still there were features which unfitted it for present-day use in house services.

As regards A.-C. meters, the induction type is favoured on account of absence of friction and light weight of the armature, and good results are obtained with comparatively small driving torque and corresponding shunt current. Unless the load gives rise to considerable distortion of wave-form, error due to this will not be prohibitive on any well-designed induction meter. The quadrature adjustment mentioned by Mr. Edgecumbe in the discussion is very quickly and simply made, and is surely sufficiently accurate when the power factor does not deviate widely from unity.

Yours faithfully,

H. Richardson,
General Manager.

Electricity Supply Department,
Dundee, April 11th, 1911.

THE PRICES AND LIFE OF OSRAM LAMPS

Considerable reductions in the prices of high candle-power Osram lamps are announced in a circular from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), and the 100, 200, 400, and 600 c.p. sizes, which are now so much used for street lighting, are now listed at 4s. 9d., 9s., 17s., and 20s. each. The Company in doing this are giving great assistance to central station engineers in encouraging the extended use of the metal filament lamp for street lighting. They have always endeavoured to arrange that the prices of high candle-power lamps should not be unduly above those of small candle-power, but should be strictly in accordance with cost of production. The growing use of the larger lamps now enables the high candle-power lamps to be made in economical quantities, and the cost accurately ascertained. We understand that arc lamps have been recently replaced by Osrams at Torquay, Acton, West Hartlepool, Cardiff, and Hammersmith, and in the last-mentioned district a saving of £2 16s. per lamp has resulted. At Yarmouth both gas and arc lamps have given place to Osrams, and at Wimbledon, in addition to replacing arcs, they are in use for side street lighting. In the stations of the Underground Electric Railways of London metal filament lamps have also replaced some thousands of arcs, and other localities where Osram lamps are in extensive use for public lighting are Kensington, Paddington, St. Marylebone, Kingston, Shoreditch, Croydon, Partick, Nuneaton, Wolverhampton, and Exeter.

Some interesting life tests of these lamps are contained in an extract from the lamp register of the Hammersmith Electricity Department. Of seventy-five lamps, of which particulars are given, only five were alight under 1,000 hours, while the average life was 3,613 hours, the individual figures varying from 793 to 8,480 hours. The sizes of these lamps are not stated, but presumably they are all of high candle-power.

With regard to the life of Osram lamps of smaller size, the company have sent us a copy of part of a report of some life tests carried out at the National Physical Laboratory on six 100-volt Osram lamps. The average c.p. during a 2,000 hour test worked out at 16·0 (British c.p.), and the watts per c.p. at 1·29. One filament broke after 1,990 hours, but the remaining five lamps were intact after the full 2,000 hours.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

"ONEWATT" LAMPS.—A new list announcing reductions in the prices of "Onewatt" lamps of 100, 200, and 300 c.p., and dealing also with "Onewatt" lamps from 20 to 50 volts, is to hand from Siemens Bros. Dynamo Works, Ltd. (Incandescent Lamp and Fittings Department, Tyssen Street, Dalston, N.E.). The list is printed in two colours, and can be overprinted with the name of any contractor. The reduction in price of these lamps is referred to further in our Business Notes.

HOISTS.—A leaflet from the Union Electric Co., Ltd. (Park Street, Southwark, London, S.E.), illustrates and describes several patterns of the "Union" friction hoists, which are especially suitable for use in connection with building construction. They are supplied for both D.C. and A.C. (three-phase) circuits, and various sizes capable of lifting from 5 to 45 cwt. are listed. Motors, gear, and starters are designed to withstand the rough usage unavoidable in building work.

AUTOMATIC STARTERS.—An illustrated leaflet from the British Thomson-Houston Co., Ltd. (83 Cannon Street, London, E.C.), describes a series of starters for non-reversing D.C. motors of 15 h.p. and over, designed primarily for the automatic control of motor-driven pumps, and depending for their operation upon a change in level of liquid or pressure of liquid or air. They consist of a number of contactors and current relays assembled on a slate panel, which, together with the resistances, is attached to a pipe framework.

METERS.—Another leaflet from the British Thomson-Houston Co. contains a list with prices of the various sizes of the B.T.-H. "High-Torque" A.C. watt-hour meter, house-service pattern, for two- and three-phase power circuits. It has two single-phase driving elements acting on a single disc, and special care has been taken to prevent interference between these elements.

SWITCHES.—Two other leaflets from the British Thomson-Houston Co. describe respectively float switches for use in connection with automatic starting rheostats for the control of pump motors, and a gauge-type pressure governor also for use with automatic starters controlling pump motors for maintaining a predetermined air or water pressure.

RADIATOR LAMPS.—Radiator lamps with either Edison screw or Bayonet caps finished to match the finish of the radiator in which they are to be used, and consuming about 250 watts each, are described in another B.T.-H. leaflet.

WINCH.—Another B.T.-H. leaflet describes a small automatic hoisting winch suitable for raising and lowering arc lamps, small machine tools, &c., and adapted for outside use. It is claimed to be absolutely fool-proof.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published April 13th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

3,883/10. **Fuse Carrier.** V. Hope (Manchester). An enclosed replacement fuse has a number of fuse wires in parallel mounted in a fire-proof carrier independent of the enclosing casing. Each wire is in a separate longitudinal cell divided again by partitions into several short cells. Further, another compartment opening into all these different cells, but otherwise closed, serves to cushion the explosive effect. When the fuses have blown, a new carrier can readily be inserted in the holder. Ten figures.

7,656/10. **Long-distance and Wireless Telephony.** C. E. Egner and J. G. Holmstrom (Stockholm). A telephone transmitter for dealing with heavy currents has a vessel containing a cooling liquid attached to it so that the bottom of the vessel is in contact with the chamber containing the granules. The heated liquid rises and thus creates a circulation of the liquid. Another method of cooling the transmitter consists in filling the vessel with paraffin wax or other solid body which is melted by the heat produced. Three figures.

10,065/10. **Candle-lamp Holder.** C. C. Regnart (London). A holder for candle-lamps has a cap screwing on to the back to retain the insulating body, and on this cap are a number of upwardly projecting spring fingers which engage with the interior of the sconce. A threaded ring on the holder expands the fingers against the interior of the sconce when it is screwed down. Three figures.

13,176/10. **Protection of Cables.** M. S. Conner and Peel-Conner Telephone Works, Ltd. This specification describes an apparatus for coating the braiding of telephone and other cables with preservative paint. It consists of a metal vessel containing the compound, and having dies or bushed openings at the bottom below the level of the liquid through which the cable is passed. Compressed air is supplied to the vessel above the liquid to force it into the interstices of the braiding. One figure.

21,310/10. **H.-T. Switchgear.** Siemens Bros. Dynamo Works, Ltd., R. A. R. Bolton, and J. C. Willcocks. This patent covers certain improvements in the construction of oil-switches of the pattern in which the casing containing the movable parts can be slid away from the chamber containing the fixed live contacts. The levers for working the switch and for moving the carriage are separate and independent. It is impossible to move the carriage out far enough to expose the live contacts, nor can the carriage be moved inwards again until the oil tank and lid have been replaced and the switch put in the off position. Six figures.

23,535/10. **Metal Filament Lamps.** G. F. Attwood (Newark, U.S.A.). Metal filaments are particularly susceptible to breakage adjacent to the supports because the rigid connections render them less flexible at these points. According to this invention, the filament is fused to the extremity of the support as usual, but its movement at this point is limited by coiling the filament a few turns round the support. The use of two or more filaments in parallel for low voltage lamps similarly coiled round the supports at their extremities is also covered by this patent. Two figures.

24,122/10. **Telephone Switchboard Cords.** Western Electric Co., Ltd. (*E. Zwietusch & Co., Berlin*). To protect telephone switchboard cords at the point near the plug, the cord is enclosed in a sheathing consisting of a number of interlocking rings, the adjacent members of which slide one within the other. The sheath also prevents the cord having too sharp a bend. One figure.

24,549/10. **Metal Filament Lamps.** F. Skaupy (Berlin). In order to reduce disintegration of the filament and consequent blackening of the bulb, the stem of the filament carrier is made hollow, and contains a small quantity of a halogen compound, the gas from which tends to prevent the disintegration. The hollow stem is in communication with an open sphere or bulb at the free end of the stem, and any deposit from the halogen compound is retained in this. Five figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.
Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Kamm [Cinematograph projectors] 7,815/10.

Distribution Systems, Cables and Wires, Insulating Materials, &c.: Siemens Bros. & Co. and Dieselhorst [Electrical conductors] 13,672/10.

Dynamos, Motors, and Transformers: Lake (*Weston Electrical Instrument Co.*) [Synchronising of alternators] 13,336/10; Milch [Control of induction motors] 23,958/10.

Electric Ignition: R. Bosch, 22,580/10; Macquaire [Sparking plugs] 23,577/10; Goodhart, 219/11.

Electrochemistry and Electrometallurgy: Electrochemische Werke Ges. [Improving mechanical and electrical properties of copper] 7,657/10; Weber and Schmidt [Zinc-carbon primary cell] 10,561/10; Thomson [Electric furnaces] 15,164/10 and 15,165/10; Langbein-Pfanhauser-Werke A.-G. [Manufacture of ductile electrolytic iron] 25,969/10.

Incandescent Lamps: Pakenham and "Z" Electric Lamp Manufacturing Co. [Machines for making lamps] 12,754/10; Harrison [Exhaustion of electric lamp bulbs] 10,870/10.

Instruments and Meters: Burstyn [Electrical condensers] 11,787/10; Perman [Speed-recording apparatus] 24,482/10; Lowne [Indicator of revolutions expressed in money-value at a rate per unit adapted to be varied] 29,692/10.

Storage Batteries: Pritchett [Boxes for accumulators] 15,425/10.

Switchgear, Fuses, and Fittings: Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [Electrically-controlled pressure-regulating devices] 7,428/10; Clarke, Chapman & Co. and Harris [Resistances] 12,428/10.

Telephony and Telegraphy: Neuhold [Automatic telephone systems] 7,659/10; Egner and Holmstrom [Cooling of telephone transmitters] 8,019/10; Burney and Bell [Intercommunication telephones] 18,180/10; Gottschalk [Telephone instruments] 28,396/10.

Traction: Samaia [Actuating conduit covers of slot conduit tramways] 8,862/10.

Miscellaneous: Rausch [Electric time signalling apparatus] 12,316/10; Custance and Miller [Galvanic socks and other articles of clothing] 14,739/10; Bailey [Scenery-raising gear] 26,503/10; Baker and Longstreth's, Ltd. [Means for projecting a beam of light through relatively opaque atmosphere] 30,298/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: Reno and Bois [Distributor] 21,949/10.

Switchgear, &c.: Fuss [Voltage regulators] 7,220/11.

Traction: Bacon [Rail-joints] 2,027/11; Balachowsky and Caire [Electric vehicles] 7,062/11.

The following amended Specification can now be obtained.

British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Protective devices for transformers] 13,276/04; H. Leitner [Train-lighting dynamo] 8,219/10.

Opposition to Grant of Patent

16,076/09. **Metal Filament Lamps.** Pope's Electric Lamp Co., Ltd. (*C. Trenzen*). This patent has been granted in spite of opposition. It covers a method of joining metal filaments to their leading-in wires, and was abstracted in Electrical Engineering, Sept. 29th, 1910.

Amendment

18,036/09. **Circuit-breaker.** S. Jevons and V. D. Green. Certain corrections have been made in this specification. It describes a circuit-breaker for electric welding apparatus, which is opened by de-energising a relay-magnet or solenoid energised from a source other than that of the welding transformer.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

10,353 of April 26th, 1897. **Rail Sanding Apparatus.** J. and H. E. Gresham. This patent covers a device for discharging sand between the rails and wheels of vehicles by compressed air.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: J. Rosemeyer [Clutch mechanism] 28,628/04.

Dynamos, &c.: Siemens Bros. & Co. (*Siemens-Schuckert Werke*) [Single-phase motors] 29,435/04 and 29,436/04.

Incandescent Lamps: E. Bohm [Lamp bulbs blown with spiral corrugations] 26,746/01.

Switchgear, &c.: M. B. Field and Ferranti, Ltd. [Fuses] 29,377/04.

Telephony, &c.: Siemens Bros. & Co. (*Siemens & Halske A. G.*) [Telephone exchange system] 28,455/04.

Traction: E. Tyer [Electrically-operated points and signals] 27,607/98.

Miscellaneous: F. W. Hurd [Coal-cutters] 28,353/04 and 28,647/04.

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THE MECHANICAL DESIGN OF INDUCTION MOTORS

A PAPER on the above subject by Mr. H. L. Smith was read on March 30th before the Rugby Engineering Society. The author discussed the various parts of such machines in the order that they have to be put in hand in practice, and, commencing with dies, gave notes on the graduation of a series of slot dies and the dies for the punchings themselves. The die for the central hole should be separate from that for the axial vents, and the diameters of the various sizes of stators and rotors should be arranged in regular sequence like a genealogical tree, so that the same die which is used for the gap of a large machine can be used for the outside diameter of a small one, the gap in the stator being the even dimension, and the allowance for air gap being put on by circular-shearing the rotor coreplates.

Considering next the stator frames, &c., the author laid down the principle that stationary parts should be of cast iron and massive to resist vibration, and that moving parts should be of wrought iron or steel and light. End shields should be cast iron with the ends flat, and not oblate cones. The stator flanges should be ordinary and not malleable cast iron. The rotor flanges should be malleable cast iron, or even steel where necessary, and light. The spider, being a part revolving at less peripheral speed than the flanges, can be ordinary cast iron. As regards the important question of cost, it should not be lost sight of that a strong casting is cheaper to machine than a light one, because it can be gripped in the jig more firmly.

In discussing the design of baseplates, the author differentiates between the plain or monolith style of design, ribbed designs of the nature of steel rolled joists and designs of more complicated nature analogous to built up girders. The first calls for more metal, but is cheaper as regards pattern-making and moulding, but more refined designs are often easier to machine without fear of springing. The degree of complication in the design should depend upon the size of the machine, the number required off each pattern, and in special cases upon the destination to which it has to be transported.

An important point to be borne in mind in designing shafts is that, since turning is one of the cheapest of manufacturing operations, and the shaft in point of peripheral speed comes within the slow-moving category, it should be of ample diameter.

It is important that the shafts should fit well in the spiders to take full advantage of their support in lessening deflection. Again, in order to reduce the risk of the portion of the shaft under compression receiving any permanent set during the operation of forcing the shaft into the spider, it is advisable to arrange for the full pressure to come on only at the final forcing of the spider into position.

In speaking of end shields, it is remarked that in the case of explosion-proof motors the ribbed style is necessary, because there the ribs are used to dissipate the heat. Seeing that cast iron is six times as strong in compression as in tension, the ribs should be on the inside and in compression, while the plate should be on the outside and in tension, especially as the heat is conducted away equally well whichever side of the plate the ribs are on. The covers should be designed strong enough to resist 130 lb. per square inch. Under the influence of the explosion, the end shield tends to assume a spherical shape. Those portions of its contour which shroud the stator end-windings, and which are, or should be already, spherical, are in pure tension, and do not need any ribs, while as regards the flat plate which forms the end of the end shield, the ribs should be on the inside and in compression. The flange where the end shield is bolted to the stator frame can be ribbed externally to the spherical portion of the end shield, or it can be made thick enough to stand on its own merits. The straining actions on an explosion-proof end shield are exactly opposite to those on an open type end shield. In the former it is the flat plate at the end which requires special attention, whereas in the latter it is the curved portion round the stator end-windings.

In conclusion, some formulæ are discussed for bearings on belt pulleys, and a method of calculating the strength of binding bands is given.

Railless Electric Traction.—The promoters of the Rotherham, Maltby & District Railless Traction Bill have notified the authorities of the House of Commons that they do not propose to proceed with their scheme this session. The Bill in question was a competing one with another Bill, having the same objects, promoted by the Rotherham Corporation, and is the third scheme of this character to be withdrawn this session.

ACTION AGAINST WILLANS AND ROBINSON

£23,435 Costs and Damages

JUDGMENT was given on Wednesday, April 12th, by Mr. Pollock, Official Referee, in an action brought by Mr. H. Cruse, of the Cruse Controllable Superheater Co., Salford, and Messrs. Ernest Grether & Co. against Messrs. Willans & Robinson, Ltd., Rugby, to recover damages for alleged breach of contract in respect of the manufacture of superheaters.

It appears that Willans & Robinson manufactured superheaters for the plaintiff company to the designs of the latter, who alleged that certain superheaters were defective, and refused payment. Messrs. Willans & Robinson pleaded in defence that if there were any defects they were caused by defective design, and that they were not, therefore, responsible. Further, they counterclaimed for £1,900 to cover the balance of the price of superheaters delivered to the plaintiffs, the price of certain rejected ones, and the cost of dies, &c., made for their manufacture.

Mr. Pollock, in giving judgment, held that the evidence of both parties proved that the superheaters did not fail by reason of faulty design, but entirely through bad work. He therefore found for the plaintiffs, and awarded them £3,535 damages, with costs on the higher scale. The hearing of the case commenced in October last at Manchester, and after a few days was transferred to London. The case has occupied 55 days, and over 60 witnesses were called. It is stated that counsels' fees amounted to £7,000, solicitors' and witnesses' and other costs to £11,500, while shorthand notes and transcripts are said to be responsible for £1,400. Mr. E. Pollock, K.C., and Dr. Atkinson appeared for the plaintiffs, and Mr. Sankey, K.C., and Mr. Stewart for the defendants.

Electric Traction on Main Lines.—A Paper was read by Mr. J. B. Sparks before the Students' Section of the Institution of Electrical Engineers in London on April 12th, containing a record of the present position of electric traction on the main lines of Europe. The Prussian State Railways have decided upon the conversion of 95 miles of double line between Magdeburg, Leipzig, and Halle, and a 16 mile section is already equipped. Some 180 miles of line in Silesia will also shortly be worked electrically. In both cases the single-phase system at 10,000 volts, 15 cycles, has been adopted. The Bavarian and Baden State Railways are both equipping short sections of main line on the same system. In Austria, the State Authorities are introducing electric traction on the single-phase system upon 29 miles of main line track leading into Trieste, and plans have been prepared for 2,750 miles of main line railways. The three-phase system may be employed upon some of these lines, and also upon the lines of the Austrian South Railway Co. A new main line, which will be worked on the single-phase system, is now being constructed to connect the Bavarian and Austrian State systems. In Hungary, main line sections are to be converted at Prague, and the electrical working of the important line from Buda Pesth to Fiume is also under consideration. The Swiss Federal Railways have adopted the single-phase system at 15,000 volts, 15 cycles, and the St. Gothard line will probably be the first to be equipped. A short section of the new Loetschberg tunnel line is already worked electrically on the same system. The equipment of the Simplon line (3,000 volts, 16 cycles, three-phase) will shortly be extended at the Italian end. The 12-mile Giovi tunnel line, near Genoa, equipped on the same system, is practically complete, while the Mont Cenis tunnel line is also being converted to three-phase working. Other main line sections in Italy will shortly be equipped, but not necessarily on the three-phase system. Various proposals for the conversion of lines near Paris are before the French State Railway authorities, who are assisting in the conversion of the belt railway round Paris. The Chemins de fer du Midi are equipping a 70-mile main line section near Toulouse, and it is probable that the 250 miles of line between Bayonne and Toulouse will be working electrically in a few years. The single-phase system at 12,000 volts, 16 cycles, has been adopted by this company. The P.L.M. Co. is carrying out trials on an experimental line with a view of equipping the main line from Cannes to Ventimiglia. The Swedish State Railways will shortly have an 80-mile line in the extreme north working electrically, and plans have been prepared for the whole State system south of Stockholm, aggregating 1,300 miles of route. The system adopted is 15,000 volts, 15 cycles, single-phase. A 30-mile line in Norway is being converted to single-phase working at 10,000 volts, 16 cycles, and the conversion of certain lines in Denmark is under consideration. Short lines in Russia, Spain, and Holland are referred to in the Paper, which concludes with some notes on the possibilities of electrical working on the main lines in this country. Some interesting slides were shown.

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LOCAL NOTES

Boston (Lincs): *Electric Lighting.*—Mr. C. Pullan, of Bradford, has asked the Council whether they would consider an electric lighting scheme for the borough, and, if not, whether they would oppose the formation of a company.

Darwen: *Power Tariff.*—The General Purposes Committee have decided to supply electric current for power purposes to customers taking not less than 5,000 units per quarter at a flat rate of ¾d. per unit net.

Ealing: *Meter Purchase.*—Reporting upon the recent Local Government Board inquiry, when Mr. Ross Hooper impressed upon the Council the desirability of purchasing meters out of revenue or reserve fund, the Electricity Committee states that they do not feel disposed to accede to this request. The amount in question is £5,000, and the Council have adopted the Committee's report.

East Kent: *Electric Supply.*—An application is to be made to Parliament for the transfer to the East Kent Electric Power Co. of certain powers of the Kent Electric Power Co., which the latter Company obtained in their Power Acts of 1902 and 1906. The area in question is bounded at points at Swalecliffe, the Isle of Thanet, Hythe, Cheriton, Folkestone, Dover, Stone Street, and Canterbury. Under the proposed agreement the East Kent Co. will erect the necessary generating stations.

Golborne: *Electric Lighting.*—The Board of Trade have agreed to defer the revocation of the Council's electric lighting order for twelve months.

Kingswood: *Overhead Wires.*—The Kingswood Electric Supply Co. have asked for the Council's permission to place overhead wires in certain streets, but the Council have refused, so far as these particular streets are concerned.

Motherwell: *Fire.*—A fire occurred at the Council's electricity works last week, doing damage estimated at about £800. Most of the damage occurred in the storerooms, which were stocked with electrical fittings.

Nuneaton: *Tramways.*—On the suggestion of the Mayor, the question of a tramway system has been referred to the Highways Committee for consideration. It appears that inquiries with this object in view have been made by representatives of a company.

Stourport: *Electric Supply.*—The Board of Trade having threatened to revoke the Electric Lighting Provisional Order for this district, which was granted to the Kidderminster-Stourport Electric Tramway Co., the Council have asked that the Order be extended for a further twelve months. The main reason why the Order has not been put into force is that the Council have refused their permission for the Company erecting overhead wires.

Torquay: *Tramway Arbitration Costs.*—The total costs of the arbitration to decide as to whether the Dolter surface contact system should be retained in Torquay, and which resulted in the system being rejected in favour of the trolley system, amounted to £1,399 15s. 6d., of which the tramway company have contributed £500 as agreed.

Watford: *Street Lighting.*—A report has been prepared by the Electrical Engineer providing for the conversion of all the public gas lamps to metal filament lamps during the ensuing twelvemonths.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Aldershot.—Application is to be made to the Local Government Board for sanction to borrow £2,500 for extensions at the electricity works. It is proposed to instal Deisel engine plant.

Altrincham.—A Local Government Board inquiry was held last week concerning a loan of £6,150 for the provision of generating plant.

Barnsley.—An application is to be made to the Local Government Board for sanction to borrow £16,100. Mr. J. F. C. Snell, who is advising the Corporation, is impressed with the great scope in the borough for a considerable increase in the sale of electricity.

Bulgaria.—The date for receiving tenders for an electrical installation at Varna has been extended from May 5th to May 18th. We gave particulars in our last issue.

Dublin.—A Local Government Board inquiry will be held on the 24th inst. concerning an application by the Corporation for a loan of £128,129 for extensions to the electricity works. The opinion is held in some quarters that the rapid growth in the demand for electricity in Dublin necessitates the erection of a new power station rather than further extensions to the Pigeon House Fort Works.

Egham.—The Egham and District Electric Light Co. require two high-speed Diesel oil-engine driven generating sets; switchboard and overhead travelling crane. Consulting Engineers, Messrs. Handcock & Dykes, 1 Victoria Street, London. Specifications from Secretary, 50 Cannon Street, E.C.

Haslingden.—Tenders are invited for the supply and laying of extra high pressure trunk mains, with medium pressure feeders, and the distributer cables. Particulars from Mr. S. J. Watson, Electricity Works, Bury. (See an advertisement on another page.)

London: *St. Pancras.*—The Council invite tenders by May 15th for three-phase high-tension cable. Particulars from the Borough Electrical Engineer.

Fulham.—A 1,500-kw. turbo-alternator and condensing plant is required. Particulars from the Borough Electrical Engineer, and tenders by April 26th.

Lowestoft.—A loan of £3,000 for new mains is to be applied for.

Luton.—Tenders are invited by April 24th for a turbo-generator, condensing plant, and cooling tower. Particulars from Borough Electrical Engineer.

New Zealand.—Plans and specifications are being prepared for the extension of the municipal station at Wanganui.

Sale.—A Local Government Board inquiry was held last week concerning a loan of £5,900 for electric lighting extensions. This sum is required for the erection of a power station for the supply of the district by the Council itself, as the bulk supply agreement with the Trafford Power and Light Supply Co. expires on March 1st, 1912.

Walthamstow.—The Council invite tenders by April 28th for a cooling tower and switchboard extension. Particulars from Borough Electrical Engineer.

WIRING

Bradford.—New church at Thornbury. Architects, Messrs. Austin & Paley, Lancaster.

Canterbury.—The Electric Lighting Committee recommend that electric light should be installed at the workhouse and infirmary.

Croydon.—Electric theatre, High Street, Thornton Heath.

Edinburgh.—New drill hall for Territorial Force Association. Mr. T. E. Turnbull, 33 Gilmore Place.

Eltham.—New Post Office. H.M. Office of Works, Storey's Gate, London, S.W.

Glasgow—Additional weaving sheds in Fordneuk Street, Bridgeton, for Messrs. John Lyle & Co. Architect, Mr. George Simpson.—Children's hospital at Yorkhill. Architects, Messrs. John Burnet & Son.

Leeds.—Extensions to infirmary.

Maidstone.—County Offices. County Architect, 86 Week Street, Maidstone.

Salford.—School in Nashville Street. Architects, Messrs. Woodhouse, Corbett & Dean, 100 King Street, Manchester.

Wakefield.—New West Riding police headquarters and County Hall.

MISCELLANEOUS

Australia.—Tenders are invited by the Deputy Postmaster-General, Melbourne, by May 23rd, for supply of telegraph and telephone material, and by the Deputy Postmaster-General, Sydney, by June 7th, for the supply of 4,052 yards of submarine telephone cable. Copies of specifications may be had at 72 Victoria Street, London.

OSRAM-LAMPS

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OSRAM

REDUCED PRICES

Beginning April 15th, 1911, the following are the new prices to consumers, for . .

HIGH C.P. 'OSRAM' LAMPS

100 to 260 Volts.	100	WATTS, approx.	100 C.P.	4/9	each.
	200	" "	200 C.P.	9/-	"
	400	" "	400 C.P.	17/-	"
	600	" "	600 C.P.	20/-	"

LARGE STOCKS READY FOR IMMEDIATE DELIVERIES.

All existing Trade Terms and Conditions of Sale continue in force, subject to Monthly Settlement. All unexecuted orders will, from April 15th, 1911, onward, be charged at above reduced prices.

The GENERAL ELECTRIC COMPANY, Ltd.,

Head Office : 67, Queen Victoria St., London, E.C.

Telephone : 3600 London Wall (19 Lines). *Telegrams : "Electricity," London.*

BRANCHES AND AGENCIES—

REGD TRADE MARK

MANCHESTER—Victoria Bridge
BIRMINGHAM—42 High St.
GLASGOW—71 Waterloo St.
CARDIFF—Womanby St.
NEWCASTLE-ON-TYNE—30 Gallowgate
BELFAST—13 Queen St.
DUBLIN—16 St. Andrew St.
PARIS—10/12 Rue Rodier
MADRID—Fuencarral 134
MILAN—via Aurelio Saffi 12
CAPETOWN—corner of Waterkant and Chiappini Streets
JOHANNESBURG—corner of Loveday and Anderson Streets
SYDNEY—Magnet House, 257 Clarence St.

TRADE MARK

WORKS:—London, Witton, Birmingham, Manchester.

OSRAM

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The City Council of Melbourne invite tenders for the supply of 120 5-ampere 200-volt A.C. watt-hour meters. Particulars from Messrs. McIlwraith, McEacharn & Co., Ltd., Billiter Square Buildings, London, E.C.

New Zealand.—According to the *Board of Trade Journal*, the Hastings Council propose to invite offers from companies for the construction of tramways in the town.

The Palmerston Council is seeking particulars of the Edison tramway batteries in connection with the proposal to construct tramways at a cost of £61,000.

Salford.—Tenders are required for the supply and erection of fire and police alarm street boxes and switchboard. Particulars from Chief Constable, Town Hall. (See an advertisement on another page.)

Spain.—A supply of 50 tons of steel or iron telegraph wire is required by the Direccion General de Correos y Telegrafos, Madrid.

TENDERS RECEIVED AND ACCEPTED

Australia: Sydney.—The contract for 270 1,200 ampere-hour cells, and 270 2,400 ampere-hour cells, for the Darlinghurst and Burwood tramway sub-stations, has been placed with the Chloride Electrical Storage Co., Ltd.

Derby.—The Electricity Committee have accepted the tender of the British Westinghouse Co. for the supply of 17 half-horse-power motors for hiring out to Metalite, Ltd.

Nuneaton.—The Electricity Committee have resolved to give Messrs. Callenders' Cable Construction Co. the refusal of an order to supply cable at a cost of £83, and failing acceptance by this company, to accept the tender of Messrs. Aubert Grenier & Co., at this sum.

Swindon.—The Electricity Committee have accepted the tender of the Electrical Apparatus Co., Ltd., for the supply of a portion of their meter requirements for the current year.

Watford.—The tender of Messrs. Drake & Gorham, Ltd., has been accepted for the alteration of 550 street gas lanterns to take metal filament lamps.

APPOINTMENTS AND PERSONAL NOTES

Mr. T. Buckley, Chief Electrician of the New Zealand Post and Telegraph Department, will shortly visit England to investigate the latest forms of telephone equipment and installations.

The Wolverhampton Electricity Committee require an assistant canvassing engineer. (See an advertisement on another page.)

A young engineer is wanted immediately for the Mining Department of a large Continental electrical works. (See an advertisement on another page.)

A large number of candidates applied for the post of assistant electrical engineer at the Devonport Electricity Works, in succession to W. F. Stamp, who recently resigned. The short list consisted of J. A. Goodall (Devonport), F. V. Jordan (Warrington), F. D. Martin (Middlesborough).

Mr. B. Sankey, Borough Electrical Engineer at Whitehaven, is to be granted a bonus of £50 for his services in connection with the extension of the power-station plant.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 to £56 10s. per ton (last week, the same).

"Onewatt" Lamps.—Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston, N.E.) inform us that they have reduced the list prices of their well-known "Onewatt" lamps, of 200 c.p. and 400 c.p., and that the prices of these in all voltages are as from the 15th inst., 9s. and 17s. each respectively. They have every expectation that the lower prices will enable contractors to do an even larger trade in these "Onewatt" lamps than previously. We may add that the price of their 100 c.p. lamp remains unchanged at 4s. 6d., and that they have issued a new price list, printed in three colours, containing the above alterations, quantities of which will be forwarded, we understand, printed with contractor's name and address, on receipt of application, accompanied by trade card.

The Metalite Lamp Works.—It is stated that Metalite, Ltd., will shortly open a factory at Derby for the manufacture of the British Metalite lamp. The works which we understand the company have taken at Derby were originally erected for a firm of incandescent gas mantle makers.

Agency.—An Englishman who has resided in Sweden for 15 years desires to represent British manufacturers of electrical plant. The name and address is on file at 73 Basinghall Street, London, E.C.

Plant for Sale.—A quantity of electrical and steam machinery is offered for sale by Elektron, Ltd. (in liquidation), Gothenburg. (See advertisement on another page.)

Change of Address.—The Midland Electric Manufacturing Co., Ltd., Conybere Street, Birmingham, inform us that they are moving to more commodious premises at Stafford Works, Rea Street South, Birmingham.

Liquidations.—Creditors of the Rosario Electric Co., Ltd., are requested to send particulars of their claims not later than May 30th to the liquidator, Mr. E. H. Benthall, 52 Moorgate Street, E.C.

REDUCTION IN PRICES OF HIGH CANDLE-POWER METAL FILAMENT LAMPS

A NUMBER of leading makers and suppliers of metal filament lamps have reduced the prices of lamps of from 100 c.p. upwards. Particulars of these reductions in the case of Osram lamps appear on p. 209, and we understand that among other makers who have reduced or are contemplating a corresponding reduction of price on the same lines are the British Thomson-Houston Co., the Sunbeam Lamp Co., and the Westinghouse Co. Messrs. G. M. Boddy & Co. inform us that they have made similar reductions in prices. An announcement with regard to "Onewatt" lamps appears on this page.

NEW COMPANIES

PERRY & GRISNELL, 1-2 Leopold Street, Birmingham. Capital, £2,000. Manufacturers of electrical, heating, and ventilating appliances.

F. W. VAUGHAN & CO., 22 Cross Street, Islington, London. Capital, £5,000. Electrical engineers and contractors.

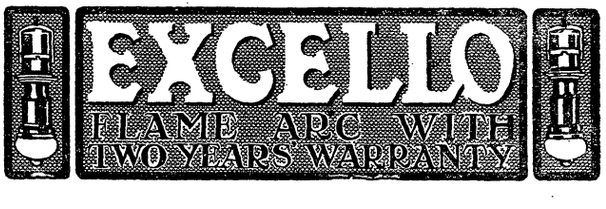
C. FENTON LINDOP, 16 Moss Lane, Liverpool. Capital, £2,000. To take over the electrical contracting business now carried on.

GENERAL ELECTRIC COMPANY OF CHINA, 67 Queen Victoria Street, London. Capital, £21,000. To secure the sole representation and agency in the Chinese Empire and Hong Kong of the General Electric Co., Ltd., of London.

ECONOMIC ELECTRIC CO., 17A South Castle Street, Liverpool. Capital, £2,000. To carry on the existing business at the above address.

R.E.T. CONSTRUCTION CO., 56 Moorgate Street, London, E.C. Capital, £52,000. To adopt agreements with the Railless Electric Traction Co., Ltd., and the Railways & General Development Co., Ltd.

L.C.C. Free Studentships at the Imperial College of Science and Technology.—In return for a maintenance grant of £8,000, the London County Council has secured the privilege of nominating twenty-five students for one year's free instruction at the Imperial College, beginning in October, 1911. Only advanced students who are qualified to enter on the fourth year of the course should apply. There is no restriction as to income, but intending candidates must be ordinarily resident in the administrative County of London, and must be students at an institution aided, maintained, or approved by the Council for this purpose, who have attended regularly courses of instruction for at least two sessions. The free studentships do not entitle the holders to any maintenance grants, but cover all ordinary tuition fees. The studentships will be awarded on consideration of the past records of the candidates, the recommendations of their teachers, and the course of study they intend to follow. In special cases the free places may be extended to two or more years. Application forms (T. 2/268) can be obtained from the Education Officer, London County Council, Victoria Embankment, London, W.C., and must be returned not later than Saturday, May 27th, 1911.



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COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Kalgoorlie Electric Power & Lighting Co.—The full dividend on the 6 per cent. preference shares for the year to March 31st has been declared.

Anglo-Argentine Tramways Co.—At the annual meeting last week Mr. J. B. Concanon called attention to the satisfactory nature of the net revenue for 1910, viz., £868,870. A dividend of 7¾ per cent. for the year has been paid upon the ordinary shares, carrying forward £13,044. An agreement has been come to with the directors of the Buenos Ayres Western Railway Co., which will have the effect of preventing competition between the two companies in the construction of subways for carrying tramways in certain parts of Buenos Ayres.

Kidderminster & District Electric Lighting and Traction Co.—After meeting debenture interest there is a balance of £4,222 for 1910, and after placing £1,175 to depreciation and renewals and meeting preference dividend, a dividend at the rate of 2½ per cent per annum is declared upon the ordinary shares, carrying forward £122.

Kidderminster & Stourport Electric Tramway Co.—There was a net profit of £2,418 for 1910, and a dividend at the rate of 3½ per cent. per annum is declared upon the ordinary shares, carrying forward £166.

Dudley and Stourbridge Electric Traction Co.—After meeting the preference dividend and placing £600 to renewals, the accounts for 1910 show a net profit of £1,060. The directors recommend placing £600 to depreciation, £300 to sinking fund, and carrying forward £160.

Babcock & Wilcox.—The accounts for 1910 show a net profit of £425,443, including £63,083 brought forward. Interim dividends of 3 per cent. and 10 per cent. have been paid upon the preference and ordinary shares respectively, and a further dividend of 3 per cent. is declared upon the preference shares for the December half-year, and 8 per cent. on the ordinary shares, in addition to which a bonus of 8 per cent. is recommended upon the ordinary shares. After meeting these dividends, placing £100,000 to the reserve fund, £25,000 to the dividend equalisation fund, and £10,000 to the staff pension fund, a balance of £68,643 remains to be carried forward.

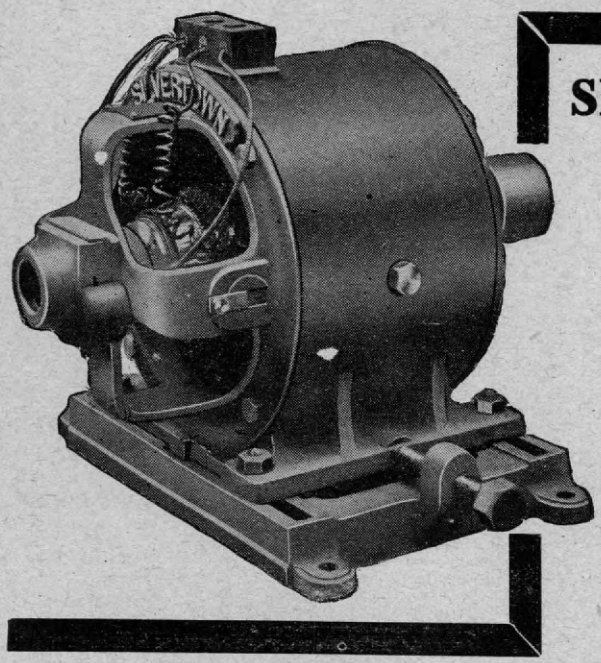
Wolverhampton District Electric Tramways.—The accounts for 1910 show a credit balance of £659, after placing £100 to renewals fund. It is proposed to place £250 to sinking fund, £250 to depreciation and reserve, and to carry forward £159.

Hindhead & District Electric Light Co.—After adding £755 to depreciation account from the profits for 1910, a final dividend is recommended on the ordinary shares, making 6 per cent. for the year, carrying forward £282.

East London Railway Co.—We understand that a meeting of the Joint Committee is to be held on Wednesday next to consider the question of converting this railway to electric traction.

Chiswick Electric Supply Corporation.—There was a net profit of £3,934 for 1910, and a dividend at the rate of 6 per cent. for the year is recommended on the ordinary shares. The report makes reference to the satisfactory results which have been obtained with the Diesel engine plant by the Aberystwyth Company, in which concern the Chiswick Company holds the controlling interest.

Electric Cranes.—In a Paper read before the Institution of Engineers & Shipbuilders in Scotland on April 18th, Mr. R. Boyle gave particulars and illustrations of a large number of electric cranes, with lifting capacities of from 150 to 200 tons. The Paper dealt mainly with the mechanical features, and examples of derrick, portal jib, floating, tower, hammerhead, and giant cantilever cranes were described. A typical equipment for a 150-ton revolving cantilever crane is given as follows:—Two 50-b.h.p. main hoist motors, with series parallel control arranged for nine steps on both lighting and lowering, five series and four parallel steps. Overwinding switch, rheostatic, hydraulic, and band brakes.—One auxiliary hoist motor of 50 h.p., with seven steps on hoisting, three for lowering, and four braking steps, rheostatic and band brakes.—One main rack motor of 50 h.p., with seven steps out or in and three braking steps each way. Minimum and maximum radius switch, rheostatic and band brakes.—One 50-b.h.p. slewing motor, with seven power steps and three braking steps on each side, also rheostatic and band brakes.—One jigger hoist motor, with five power steps on the hoisting side and two on the lowering side, four braking steps, overwinding switch, and rheostatic and band brakes.—One jigger-rack motor, with five points of control in or out, and two braking steps.



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British Thomson-Houston Co., Ltd., Rugby.
General Electric Co , Ltd., 67, Queen Victoria St., E.C.
Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.
Jandus Arc Lamp and Electric Co , Ltd , Hartham Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Union Electric Co., Ltd., Park Street, Southwark, S.E.

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Marryat & Place, 28, Hatton Garden, E.C.

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Fraser & Chalmers, Ltd., 3, London Wall Buildings, E.C.
Hawksley Wild & Co., Ltd., Brightside, Sheffield.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co , Ltd., 22 & 23, Jewin St., E.C.
Rickard (Wm), Ltd., Ashbourne Road Mills, Derby.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Mirrlees Watson & Co., Ltd., Glasgow.
Willans & Robinson, Ltd., Rugby.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

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FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

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British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
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Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.

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British Prometheus Co , Ltd , Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87-89, Cleveland Street, W.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.

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Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
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Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

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Brush Electrical Engineering Co., Ltd., 1, Kingsway, W.C.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Horvath (S.), 51, Standen Rd., Southfields, S.W.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Krupka & Jacoby, 11, Queen Victoria St., E.C.
Philips Metallic Glowlampworks, Ltd., Eindhoven, Holland.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
'Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

METERS.
Aron Meter Co., Ltd., 80A, Salusbury Road, Kilburn, N.W.
Bastian Meter Co , Ltd , Kentish Town, N.W.
British Thomson-Houston Co., Ltd., Rugby.
Ferranti, Ltd., Hollinwood, Lancs.

MICA AND MICANITE.
Jaroslaw (D.), 5, George St., Tower Hill, E.C.

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British-Thomson Houston Co . Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Spagnoletti, Ltd., Goldhawk Rd., W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

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Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
General Electric Co., Ltd., 67, Queen Victoria St. E.C.
Ingleby & Co., Elland Road, Leeds.
J. L. Manufacturing Co., Ltd., Southall.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
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Raworth (J. E.), 30, Broadway, Westminster.
Sokal (S.), 55, Chancery Lane, W.C.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

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Electric Journal, 422, Mansion House Chambers, E.C.
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Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

We publish portraits of Mr. S. Z. de Ferranti, who has again been chosen as President of the Institution of Electrical Engineers, and of the new members proposed for the Council. (Page 219.)

A loud-speaking telephone is employed at the tramway centre on the North side of Blackfriars Bridge, in conjunction with the system of queues, to assist the regulation of passenger traffic during rush hours. (Page 220.)

We publish the first part of an article by Mr. G. W. Partridge (Engineer-in-Chief of the London Electric Supply Corporation), describing the single-phase plant supplying the L.B. & S.C. Railway. Specially designed three-phase generators are used, arranged so that they can be employed either for the single-phase supply to the line or for three-phase supply for the general power distribution. The pressure is kept absolutely constant by means of a Tirrill regulator, in spite of rapid variations in load from 3,000 kw. to zero, and a simple but effective arrangement of duplicate feeders prevents unnecessary interruptions of supply from momentary short circuits. Mr. Partridge also discusses some interesting points in connection with switchboard design. (Page 221.)

A letter from Willans & Robinson explains that the lawsuit, reported last week, in which they were unsuccessful, related to work done in 1906–1908 at their old Queensferry works, now closed, and not at their main works in Rugby. Mr. Haydn T. Harrison also writes regarding recent contracts for electric street lighting. (Page 224.)

In their report for 1910 the Light Railway Commissioners again call attention to the need of strengthening the Light Railways Act of 1896, if any permanent benefit is to be derived from it. At present the applications under the Act show a strong tendency to decline. (Page 224.)

A 10-mile section of the Stratford-on-Avon and Midland Junction Railway has been equipped by Railophones, Ltd., to demonstrate the possibilities of the company's system of inductive telephony to and from moving trains. (Page 225.)

Among the specifications published by the Patent Office on Thursday last was one by the Elektrochemische Werke Ges. for a new process for the manufacture of hard copper wire by the addition of calcium and molybdenum. A conductivity of 98 per cent. and a tensile strength of 52 kg. per sq. mm. are said to be obtained.—F. Harrison describes a method of exhausting lamp bulbs with the aid of phosphorus and a high-tension discharge, and a sealing-in machine is described by W. L. Pakenham, of the "Z" Electric Lamp Manufacturing Co.—Siemens Bros. & Co. cover the use of a layer of paper strip between the insulation and sheathing of metal-sheathed cable for wiring.—Opposition has been entered to the grant of a patent for an arc furnace for treating gases. (Page 226.)

At a meeting of the National Electrical Manufacturers' Association on Tuesday, a Paper was read by Mr. L. Joseph, in which he drew attention to the advantage which foreign industries have by reason of the assistance received from the banks. In the dis-

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cussion, it was suggested that steps should be taken to form industrial banks in Great Britain in connection with the electrical industry. (Page 227.)

THE gas and electric lighting companies have been unable to send in separate tenders for street lighting in Holborn, and have presented a joint tender for lighting the borough partly by gas and partly by electricity. The matter has been sent to the Works Committee for report. (Page 227.)

IT is announced that a number of important Canadian electrical companies are to be amalgamated.—Malvern ratepayers support the railless electric traction proposals.—The company which proposes to run trolley omnibuses in Macclesfield are asking for sanction to equip further routes.—Mr. J. M. McElroy, General Manager of the Manchester tramways, has been retained to advise the Swansea Corporation in connection with the proposed purchase of the tramways.—A sum of £51,000 has been transferred to relief of rates from the Leeds tramway profits for last year. (Page 227.)

A 1,500-K.W. turbine driving a D.C. generator and an A.C. alternator is required at South Shields; a feed-water heating plant at Barnes; distributing switchboard, feeder, cable, &c., at Ilford; and electrically-driven centrifugal pumping plant at Mirfield.—The Auckland (N.Z.) Council require complete boiler-house and engine-room equipments; additional generating plant is to be installed at Greenock and Alloa, and a large quantity of telephone and telegraph material is required at Brisbane. (Page 228.)

AFTER meeting all charges and wiping out the deficit for 1909, the British Westinghouse Co. carry forward a net profit of £5,117 for 1910.—A scheme for dealing with the arrears of preference dividends is under consideration by Edmundsons' Electricity Corporation. (Page 229.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, APRIL 27TH.

Imperial Education Conference.

At the Foreign Office. (1) "Engineering Education," by J. A. Ewing, F.R.S., (2) "Higher Technical Instruction," by J. H. Reynolds.

Institution of Electrical Engineers.

8 p.m. At Victoria Embankment. "Battery Economics and Battery Discharge Arrangements," by A. M. Taylor.

SATURDAY, APRIL 29TH.

Association of Mining Electrical Engineers.

3.30 p.m. *Notts and Derbyshire Branch.* At University College, Nottingham. (1) Discussion on the Revised Rules for the Use of Electricity in Mines. (2) "Considerations Specially Relative to Small Colliery Installations," by T. Thomson.

5.30 p.m. *Warwickshire and S. Staffs Branch.* At Imperial Hotel, Birmingham. (1) "Three-phase Motors for Haulage in Mines," by J. Simpson. (2) "Oil for Transformers and Switches," by G. Humphrey.

Old Ferrantians.

7 for 7.30 p.m. Dinner at Trocadero Restaurant, London.

TUESDAY, MAY 2ND.

Batti-Wallahs' Society.

7.45 p.m. Smoking Concert at Holborn Restaurant.

Faraday Society.

8 p.m. At Institution of Electrical Engineers, Victoria Embankment, E.C. (1) "Hydro-Electric Plants in Norway and their Application to the Electrochemical Industry," by A. Scott-Hansen. (2) "Electrometallurgy in the Steel Foundry," by Verdon Cutts.

WEDNESDAY, MAY 3RD.

Institution of Electrical Engineers: Students' Section.

7.30 p.m. At Victoria Embankment. Annual General Meeting.

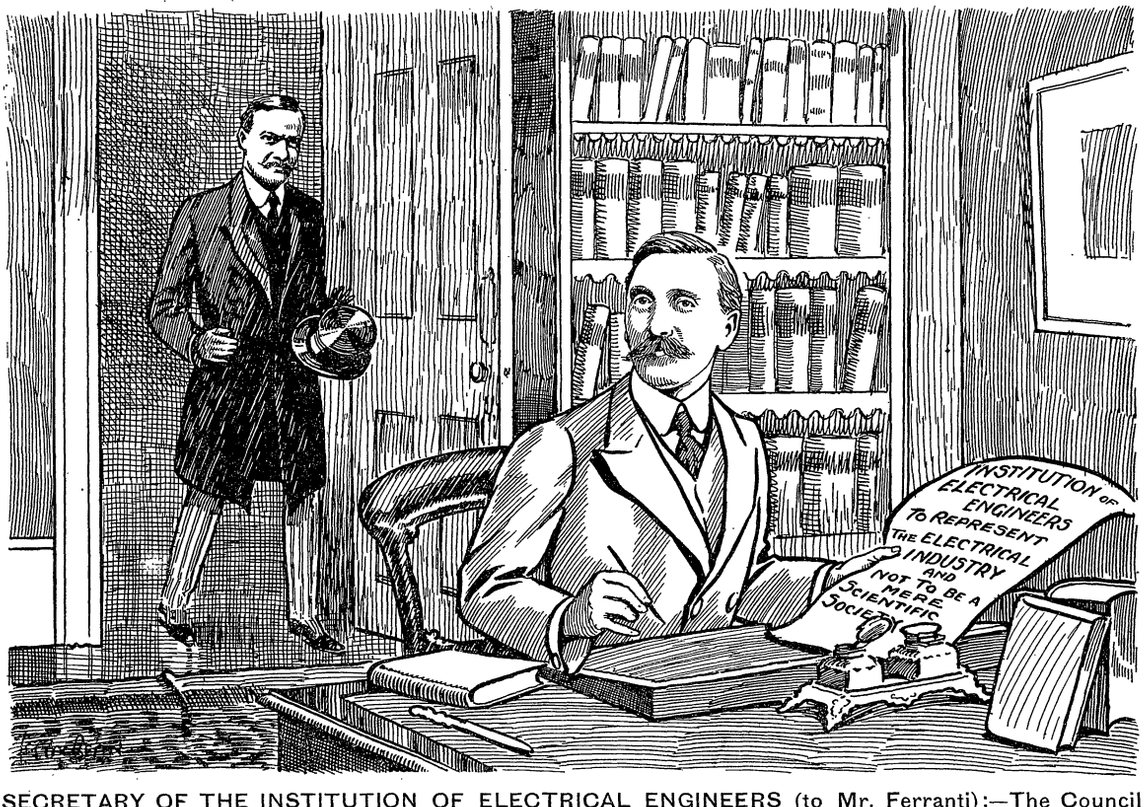
Royal Society of Arts.

8 p.m. "Improvements in the Transport and Distribution of Goods in London," by A. W. Gattie.

THURSDAY, MAY 4TH.

National Electrical Manufacturers' Association.

2.30 p.m. Council Meeting at Balfour House, Finsbury Pavement, E.C.



SECRETARY OF THE INSTITUTION OF ELECTRICAL ENGINEERS (to Mr. Ferranti):—The Council hope that you will continue President for another year, Sir, to develop the new policy, and I am sure that the member is universally in favour of it.

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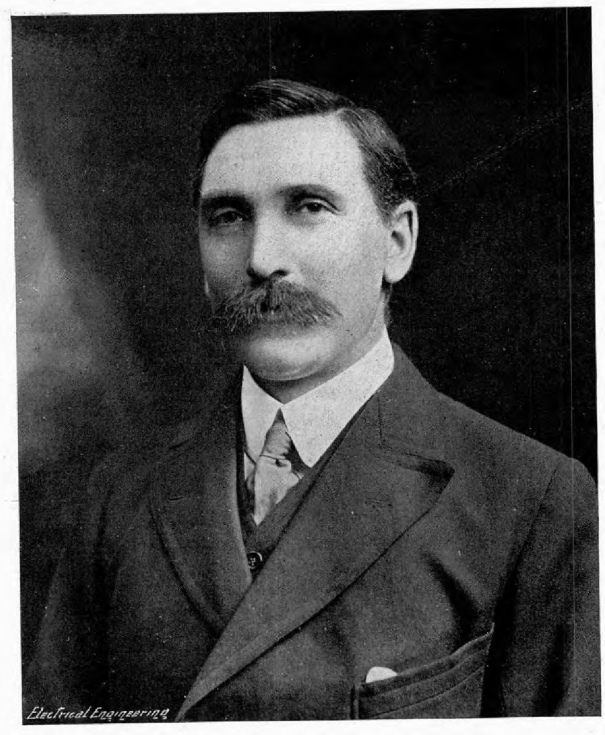
NEW COUNCIL OF THE INSTITUTION OF ELECTRICAL ENGINEERS



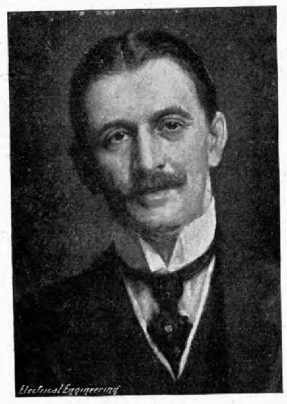
Major W. O'Meara, C.M.G.
(*Nominated Vice-President.*)



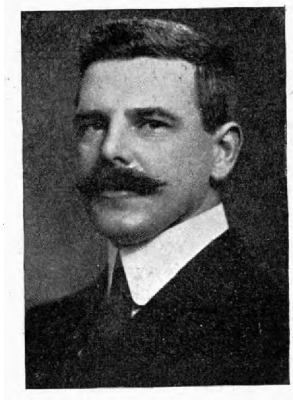
J. F. C. Snell.
(*Nominated Vice-President.*)



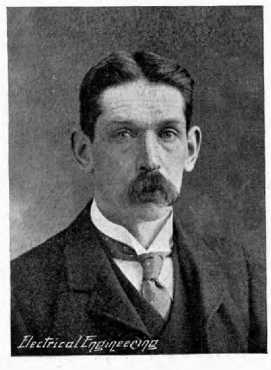
S. Z. de Ferranti.
(*President.*)



Hugo Hirst.



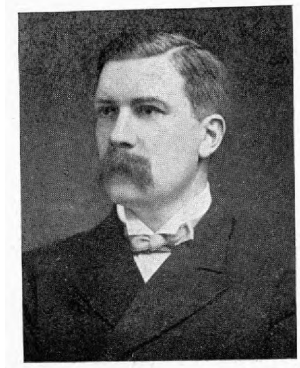
J. S. Highfield.



B. M. Jenkin.



J. E. Kingsbury.



C. P. Sparks.

THE Council of the Institution of Electrical Engineers have nominated Mr. S. Z. de Ferranti to serve as President for a second year of office; this will meet with the approval of every member of the Institution. In all probability the Council, having noted the cordial reception given to Mr. Ferranti's views that the Institution should represent the electrical engineering industry itself and not only the scientific and purely technical side of electrical engineering, have finally adopted this policy and have recognised that they could not do better than to ask Mr. Ferranti to remain another year in office in order to develop it.

Major O'Meara (Engineer-in-Chief to the Post Office) and J. F. C. Snell (Consulting Engineer) are proposed as Vice-Presidents to replace J. H. Rider and Sydney Evershed, who retire by rotation. Both have been on the Council for the last three years.

The other new members of Council nominated are J. S. Highfield, Hugo Hirst, Bernard M. Jenkin, J. E. Kingsbury, and C. P. Sparks, in place of Major O'Meara and Mr. Snell (who are nominated as Vice-Presidents as already mentioned), and G. Stoney, A. H. Walton, and Prof. Mather, who retire by rotation after three years' service; and Mr. H. E. Wimperis succeeds Mr. J. E. Taylor as Associate Member of Council.

Mr. Highfield is Engineer and Manager of the Metropolitan Electric Supply Co. He has been Engineer-in-Chief since the beginning of 1903, and was appointed Manager on Mr. Connacher's retirement early last year. Mr. Highfield has been on the Council before (from 1904 to 1907).

Mr. Hirst is the Chairman of the General Electric Co., Ltd., and we are glad to see the head of one of the large electrical manufacturing firms once more invited to sit on the Council. We may take this as a sign of the new policy. Mr. Hirst has already served twice on the Council from 1900 to 1903, and from 1904 to 1907, and did valuable work there, especially in connection with financial and business matters.

Mr. Jenkin is in partnership with Sir Alexander B. W. Kennedy, and the firm of Kennedy & Jenkin has been consulting engineers to some of the largest electrical undertakings of the country, including the Westminster Electricity Supply Co., the

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Edinburgh Corporation Electricity Works, the Waterloo and City Railway, and the electrification of the suburban section of the Great Western Railway.

Mr. Kingsbury was Manager of the London branch of the Western Electric Co. from 1883 until the end of 1909, when he retired from the active management and took a seat on the Board. He has served three five-year periods on the Council, once as Vice-President.

Mr. Sparks has been Engineer-in-Chief to the County of London Electric Supply Co. since 1899, and from the early days until that date was associated with Mr. Ferranti in his pioneer work, and with the firm of Ferranti, Ltd. He has been on the Council twice before, from 1900 to 1903, and from 1904 to 1909 (from 1906 to 1909 as Vice-President).

Mr. Wimperis is Deputy Chief Inspecting Engineer to the Crown Agents for the Colonies. He is author of a book on Internal Combustion Engines, and is a member of the Gaseous Explosions Committee. Recently he has been engaged on experiments on the acceleration of trains around London.

The following members remain on the Council: *Vice-Presidents*: W. Duddell and W. H. Patchell. *Members*: W. W. Cook, H. Dickinson, G. K. B. Elphinstone, W. Judd, P. V. McMahon, R. K. Morcom, W. M. Morrison, S. L. Pearce, H. Faraday Proctor, and C. H. Wordingham. *Associate Members*: E. Russell Clarke and Sydney Morse.

Mr. Robert Hammond (*Honorary Treasurer*) and Messrs. H. Alabaster and Sidney Sharp (*Honorary Auditors*) retire, and are nominated for re-election.

LOUD-SPEAKING TELEPHONES AT THE L.C.C. TRAMWAY STOPPING-PLACE AT BLACKFRIARS

MUCH public interest has been aroused by the loud-speaking telephones adopted by Mr. A. L. C. Fell, Chief Officer of the L.C.C. tramways, for facilitating the handling of traffic during rush hours at Blackfriars Bridge. At the stopping place on the north side of the bridge there are immense crowds every evening, waiting for the cars going southwards. A shelter has recently been completed, upon which the queues form. This is roofed in, and consists of a central part about 26 yards long, in front of which the cars stop, and two approaches, one on either side, each divided by low galvanised iron partitions into four passages, 1 ft. 10½ ins. wide. These approaches are about 17 yards long, and the names of the routes for which the eight queues form in them are displayed in illuminated signs at the end of each. As each car approaches the official who is called the "regulator" allows only as many people to pass from the corresponding queue to what may be called the "landing stage," as there is room for in the cars. This avoids any struggling for precedence on the arrival of the cars, as the passengers know that there is enough room for all. The arrangement is made clearer by the sketch diagram above.

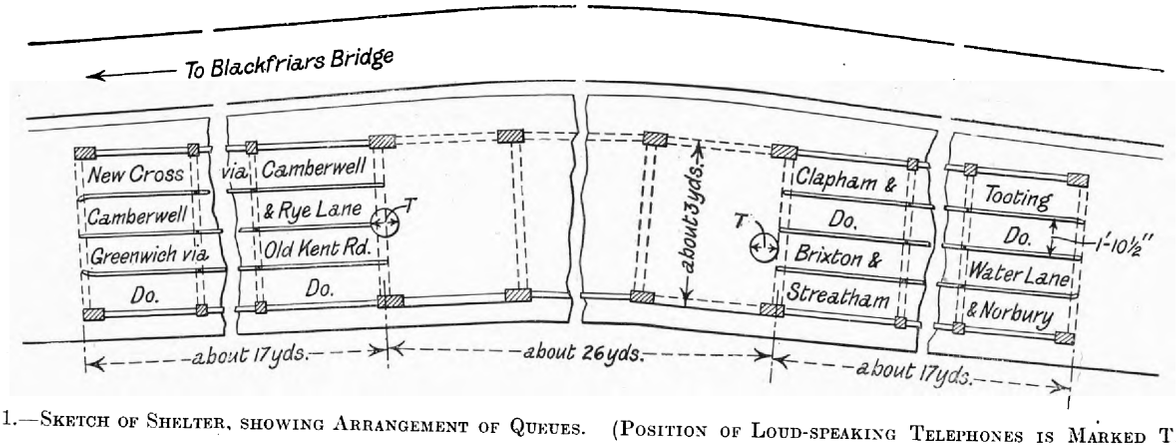


Fig. 1.—Sketch of Shelter, showing Arrangement of Queues. (Position of Loud-speaking Telephones is Marked T.)

It is to save time when the car arrives at the stopping place that the loud-speaking telephones have been installed. A transmitter is fixed on an electric light standard at a stopping place about 100 yards before the shelter, and is connected to two receivers in the shelter just above the heads of the two "regulators" there. The instruments have been supplied by Messrs. Alfred Graham & Co. (St. Andrew's Works, Crofton Park, S.E.), and are of a similar pattern to that used for ship telephones, being enclosed in painted gun-metal cases. The transmitter is a carbon-granule instrument with carbon diaphragm, and the set is direct-working, no induction coil being employed. When the transmitter is to be used, a switch handle is pulled down, which, in addition to connecting up the circuit, removes a protecting cap from the diaphragm, and moves the microphone to shake up any packed granules. Eight six-block agglomerate Leclanché cells are employed. A twin 16 S.W.G. vulcanised rubber lead-covered cable, laid in the subway under the Embankment connects the transmitter with the two receivers. The receivers are of Messrs. Graham's standard loud-speaking pattern, fitted with a 12 in. sound amplifying trumpet, and they are connected in parallel.



Fig. 2.—Transmitter.



Fig. 3.—Receiver.

Fig. 2 shows the transmitter in use, and Fig. 3 one of the receivers. We are indebted to Messrs. Alfred Graham & Co. for the loan of the negatives.

The South London Single-phase Railway.—Acording to the *Times*, the London, Brighton, and South Coast Railway will, it is anticipated, start the single-phase electric train service from Victoria Station to the Crystal Palace on May 12th, the opening day of the Festival of Empire and Imperial Exhibition. It is stated that the work of electrification is practically completed. The Company in several ways have utilised the experience gained by the working of the South London electric line from Victoria to London Bridge. For instance, the trains will be composed of six coaches instead of three or four; and the corridor, not having served its purpose of inducing people to entrain quickly, will be abolished, the extra space being devoted to increased seating accommodation. Most of the cars have already been delivered, and are at the new workshops of the Company at Norwood Junction. The electrification of the London Bridge section from Peckham Rye, where a junction is made with the South London line through East and North Dulwich and Tulse Hill, to a junction with the line from Victoria at West Norwood, and thus to the Crystal Palace, will not be ready until after the opening day of the Festival.

I.E.E. Students' Tour.—Preliminary arrangements have been made for a tour to Sweden by the Institution of Electrical Engineers Students this year. Permission is being asked to visit, amongst others, the following works:—Trolhättan Water Power Station, Nydquist Turbine Works, Domnarfvet Iron and Steel Works, Power Station and Paper Mills, Fahlun Copper Mines, Amalgamated Electrical Company's Works, Grangesberg Iron Mines, and the Westeras Electrical Machinery Works and Metal Mills. It is proposed that the party shall leave Hull on Thursday, July 20th, arriving at Gothenburg on the following Saturday, remaining there until Monday, July 24th, afterwards setting out on a tour through Trolhättan, Fahlun, Berlauge, Ludvika, Grangesberg, Westeras, and possibly Stockholm. It is estimated that the tour should not cost more than £15. Full particulars can be obtained from Mr. Douglas Betts, Hon. Secretary of the Students' Section.

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THE SINGLE-PHASE PLANT SUPPLYING THE LONDON BRIGHTON AND SOUTH COAST RAILWAY

By G. W. Partridge, M.Inst.C.E.

(Engineer-in-Chief to the London Electric Supply Corporation.)

PART I: THE ELECTRICAL PLANT.

NOW that the single-phase system has proved to be a success, both from an engineering and a commercial point of view, it may be of interest if I give some particulars of the present installation at the Deptford generating station for supplying the single-phase current to the South London Line of the Brighton Railway. A full description of the equipment of the line itself has been given by the Consulting Engineer, Mr. Philip Dawson.

Historical Notes.

The Deptford generating station of the London Electric Supply Corporation was first set to work in the year 1889, and was the first station in the world to generate and distribute extra-high tension alternating-current. The system was condemned by many engineers, and it is recorded that Mr. Edison, when he visited the station in October, 1889, stated that he did not believe in the system.

However, in spite of the uphill work which such an enterprise necessitated, including the expenditure of enormous sums of money on experimental work, as we had to manufacture our own H.T. mains and electric generators (some of which were made two or three times over before reaching perfection), the E.H.T. system was finally made a success, and has since been adopted by other engineers all over the world. Some of the 10,000-volt mains we manufactured over twenty years ago are still in constant use, in spite of the joints at every twenty feet, which was the method of manufacture and construction then adopted.

Large generating stations have lately been erected by engineers in this country and in America with complete success, but in the early days of the Deptford generating station the generation and transmission of current of 10,000 volts' pressure was unknown in any other country, and it speaks volumes for the enterprise of the directors and the perseverance of the then chief engineer of the company, Mr. Ferranti, as he had to design every detail of the system with no previous experience to guide him. It is a remarkable coincidence that the contract for the supply of single-phase current should be placed by the Brighton Company with the very company who some twenty years ago did all the pioneer work in the generation and transmission of this particular system.

The Brighton scheme has up to the present been a complete success, and the supply of energy to the railway has given every satisfaction to the officials since they first commenced to run electric trains in December, 1909. Extensions of a capacity of 14,000 E.H.P. are now in hand in order to supply that portion of the suburban lines of the Brighton Railway at present undergoing conversion to electric traction, but I propose now, however, only to describe the plant which has already been installed.

The engine room is divided into two bays, one containing the old lighting plant, some of which was installed in 1889 and is still running and supplying some of the original Ferranti mains at a pressure of 10,000 volts. The other bay contains the traction plant, which I propose to describe in detail.

The generators of the latter are three-phase star wound machines, four in number, and capable of giving 2,000 kw. single-phase and 2,500 kw. three-phase. Each generator is connected to a three-pole oil switch. The three conductors are then taken to three isolating plugs which can be thrown over into two positions. By putting the plugs into the top contacts, the machines are connected to the railway 'bus bars, *i.e.*, one pole is connected straight through to the earthed rails of the railway, the switch on that pole being short circuited, whilst the other two poles of the generators are controlled by the oil switch, and thence taken to the 'bus bars. As will be seen by reference to the diagram Fig. 1, the railway feeders are connected across the two phases of the generators. The third phase is merely connected to the 'bus bars to make the parallel running more stable and to enable us to supply three-phase current for rotary converters during certain hours of the day. When the plugs are

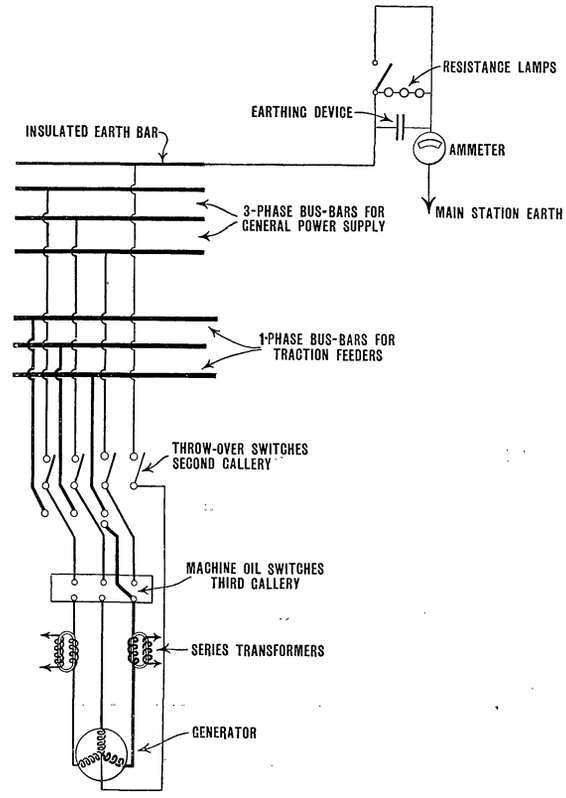


Fig. 1.—Diagram Showing Connection of Generator to Bus-bars.

placed in the bottom position the machines are connected to a three-phase 'bus bar, and all three poles are broken by the oil switch in the ordinary manner. By this means, any of the machines can give a single- or three-phase supply to either system.

Design of the Generators.

The four generators were manufactured by Messrs. Dick, Kerr & Co., and were designed to withstand the effect of heavy short circuits which sometimes take place. That is to say, they were made mechanically as strong as possible, and the regulation was not too close, the self-induction being high, thus reducing the momentary short-circuit current to as low a figure as possible. The special method of insulating the coils with pure mica has proved a complete success, and we have had no trouble with the coils of the machines since this method of insulation was adopted by the contractors. The ends of all the stator coils are securely clamped so as to prevent any movement due to the heavy currents which are taken from the machines. The mechanical stress on the ends of the coils varies as the square of the current, and as the current on short circuit may go up to 15 or 20 times the normal, the stress on the ends of the stator coils may be from 200 to 400 times normal. I am informed that tests have been made on a 6,000-kw. two-pole machine which showed that the stresses on the ends of the stator coils vary from five to ten tons at the time of short circuit.

Great care has also been taken to fit heavy damping coils on the rotors of these machines to overcome the difficulty of the pulsating current set up in the rotors when the machines are giving single-phase supply. The pulsating flux set up in the rotors of single-phase generators has caused so much trouble that perhaps it may be of interest if I refer more particularly to this part of the subject.

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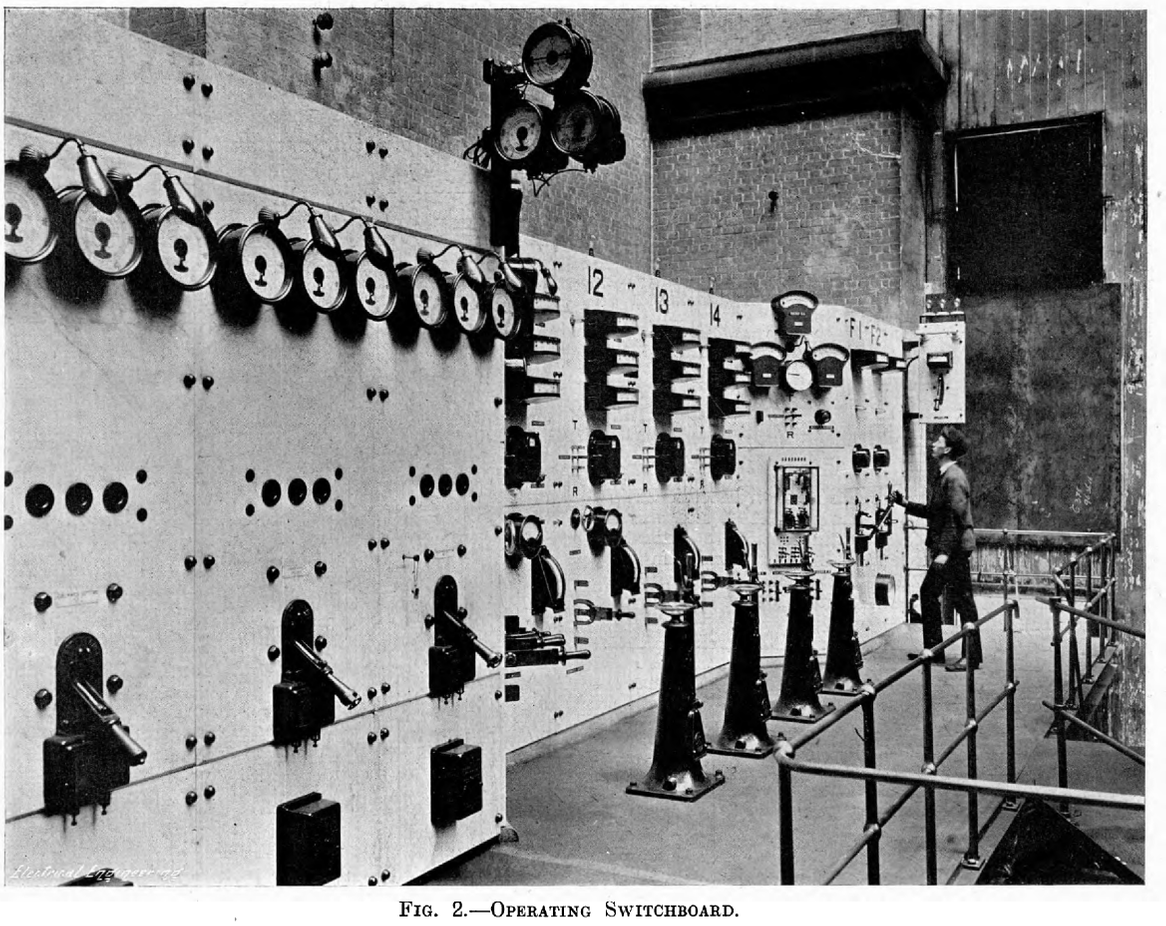


Fig. 2.—Operating Switchboard.

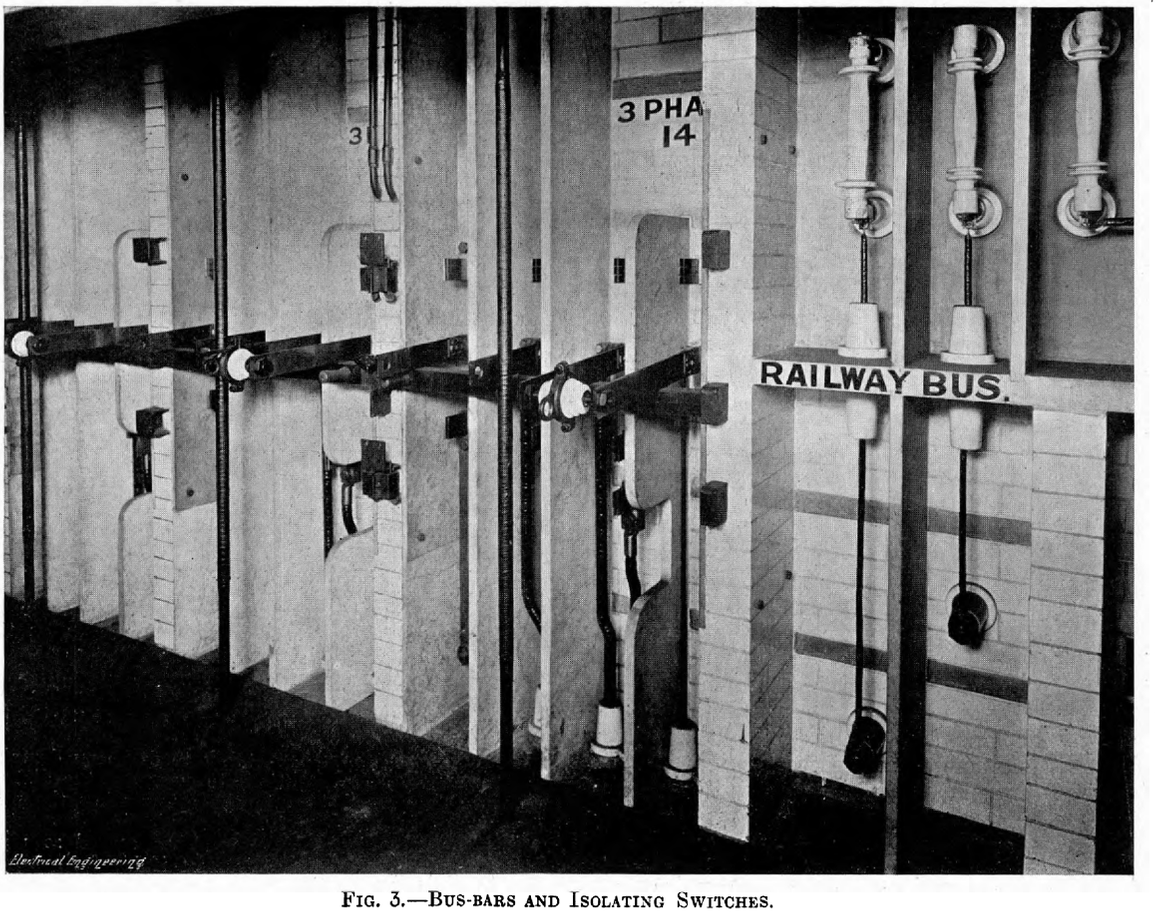


Fig. 3.—Bus-bars and Isolating Switches.

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The behaviour of three-phase and single-phase generators are somewhat different in this respect. With a three-phase generator the magnetic flux rotates synchronously with the machine, and, being constant, it causes practically no loss in the rotor circuit. In the case of a single-phase generator, on the other hand, the armature current sets up a pulsating flux in the rotor, which does not rotate in the same manner as the three-phase generator, but is practically stationary. This flux causes hysteresis and eddy-current losses in the rotor, more especially in certain designs of generators running at low periodicity. The losses under certain conditions are considerable, and cause excessive heating and considerably reduce the efficiency of the generator. By placing heavy copper damping windings on the rotor, as near to the field of the pulsating flux as possible, all this trouble has been overcome. It means a very careful design of damping winding, and plenty of copper should be used so as to have the resistance of the circuit as low as possible. The best damping winding of all would be similar to a squirrel-cage winding of an induction motor, but all generator rotors are not designed to make such an arrangement possible.

A great deal of trouble has been experienced both in America and on the Continent with electric generators supplying single-phase current of low periodicity for traction purposes. Low periodicity, as a rule, means fewer stator coils and large pole pitch, which accentuates the trouble. In one particular case I have in mind on the Continent the trouble was so considerable that the whole of the generators had to be practically rebuilt, and the traction system was shut down for some weeks in consequence.

I think the manufacturers are to be congratulated on the satisfactory results they have obtained in their generators. No expense or trouble on their part has been spared to make the generators suit our special requirements. I am indebted to Mr. William Murray, chief engineer of the New York New Haven Railroad, for his experience in connection with this kind of work, which has been of assistance in settling the design of these generators.

The Switchboard.

The switchboard manufactured by the British Thomson-Houston Co. is divided into three galleries. The top gallery contains the operating board (see Fig. 2); on the second gallery are the high-tension 'bus-bars and isolating plugs, where the machines are connected to the railway, and also the three-phase 'bus-bars (see Fig. 3), and the third gallery contains the remote control oil switches.

Taking the control gallery first, each machine has its own instruments and excitation panel, together with a cast-iron pedestal from which the oil switch is mechanically operated, and the field resistance adjusted by means of a hand wheel and mechanical gearing to the resistance itself, which stands at the back of the board. The back of the board is almost as neat in appearance as the front; all the resistance contacts can be inspected, and every circuit can be easily traced and repaired if necessary. Two panels set at an angle on either side of the four generating panels contain the exciter switchboard, the Tirrill regulator, and the synchronising instruments. The Tirrill regulator takes care of the pressure on the traction system, and it does its duty so well that I think I cannot do better than give curves showing the variations in the traction load and the abnormally straight pressure curve.

The Railway Feeders.

The railway feeders are in duplicate, being connected at the railway switch cabins, where the current is measured. Each feeder has automatic trip gear. In practice we arrange that each pair of feeders is connected so that one trip acts instantaneously and the other has a considerable time lag. Thus if a short circuit takes place on any section of the line, one of the feeders to that section is cut out instantaneously, and the resistance between the station and the feeding point is doubled, as there is only one feeder in circuit. If the "short" does not clear itself at once, the time limit apparatus acts on the second feeder and cuts off the whole supply from that particular section. In practice, the "short" nearly always clears itself in time, so that the supply to the faulty section is never entirely cut off, although possibly there may be a heavy drop in pressure until the second feeder is switched on again. A certain time (30 seconds) is allowed to elapse before closing the second feeder switch, so that if the short circuit comes on again during this period there is an extra resistance or buffer between the fault and the generators.

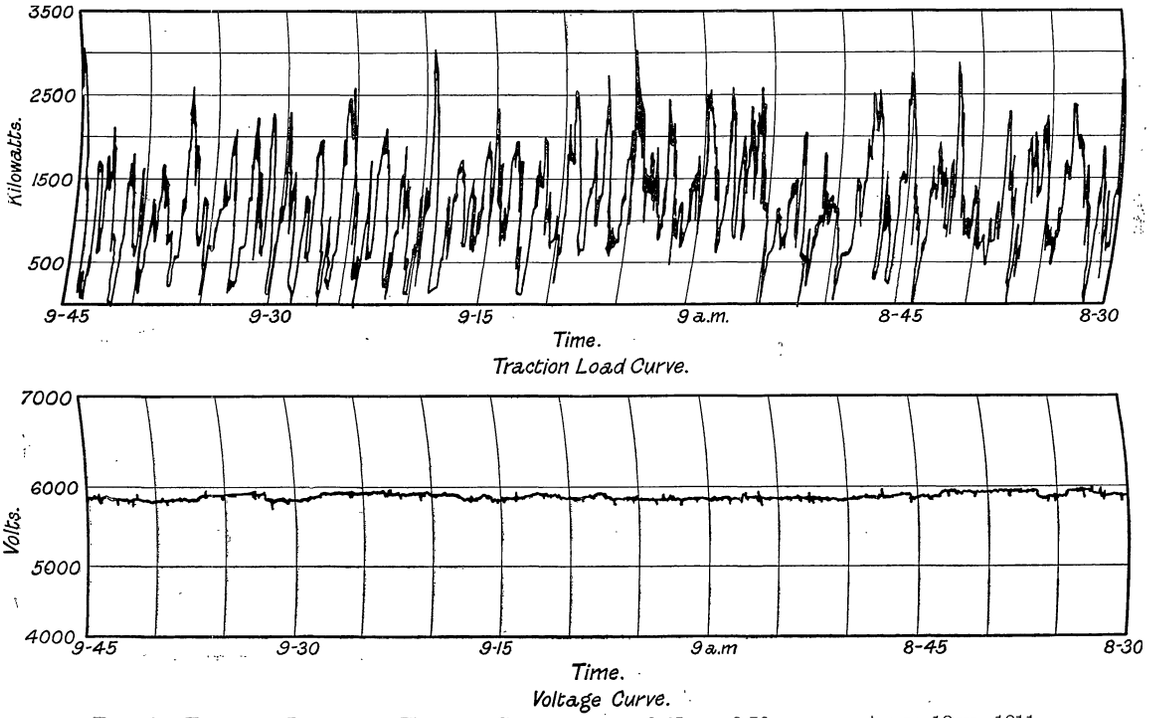


Fig. 4.—Traction Load and Voltage Curves from 9.45 to 8.30 a.m. on April 12th, 1911.

Arrangements have also been made to cut out a section of the Tirrill regulator automatically when the first feeder opens, so that the pressure on the whole system automatically drops when a short-circuit takes place, thereby reducing the strain on the electric generators as much as possible.

The generators are controlled by hand only, no automatic apparatus being used, as we find that automatic apparatus nearly always acts at times when not required. It has been our practice for the past 17 years to leave the switching in and out of the generators to the switchmen only; and many times we have been thankful that no automatic apparatus was in circuit.

The 'Bus Bars and Isolating Switches.

The 'bus bars (Fig. 3) consist of ordinary bare conductors supported on insulators with stone slabs dividing the phases. This system is, I believe, generally adopted in most generating stations; but, unless it is installed in a very rigid manner and entirely

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covered up, I am not at all sure that it is the best system to adopt. The drawbacks to such a system are:

(1) The insulators break and conductors move when very heavy short circuits take place.
(2) It requires cleaning periodically, depending on whether the switchboard is in or outside the generating station. If it is inside, a bad leakage of steam is liable to cause all the insulators to leak, and probably make it impossible to start up again till they have all been dried.
(3) Animals, such as rats, mice, and crane fly (commonly known as "daddy-long-legs"), have before now short-circuited insulators or caused bare conductors to arc to the wall.

If such an arc as described in (3) does take place, it nearly always finds its way to other phases and practically short circuits the whole system. I have, unfortunately, had experience with all three kinds of animals, with very disastrous results both to ourselves and to the animals, especially to two mice, whose history is known to many engineers of the company. And lastly, there is always danger of somebody touching a live contact by accident.

The isolating switches also seen in Fig. 3 are all locked in such a manner that they cannot open accidentally when a short circuit takes place, a fault which is common to the old type of isolating switch and one that has caused serious troubles at many generating stations.

The insulated barriers seen in Fig. 3, besides preventing the isolating switches from being moved, are arranged to light up pilot lights automatically on the operating board, so that the attendant may know which way a generator is connected before it is started up. The front of this gallery is enclosed with a glass partition, the door of which is kept locked, and nobody can obtain access to the live terminals without first obtaining the key. An automatic arrangement is also in use which lights up the interior of the gallery as soon as the door is open, and draws the attention of the engineer in charge if anybody is at work inside. Signal lamps are also connected to each set of 'bus-bars showing whether they are alive or dead.

The lower gallery contains the three-phase oil switches, which are worked mechanically from the upper gallery. These switches have repeatedly opened short circuits direct across the generators during some experimental work which was carried out in connection with the railway equipment, without any injury to themselves, and without spilling any oil out of the oil tanks.

The second part of this article will deal with the engines, boilers, and condensing arrangements.

CORRESPONDENCE

CRUSE *v.* WILLANS & ROBINSON, LTD.

To the Editor of Electrical Engineering.

Sir,—Mention is made in your columns this week of this law suit, in which we, as defendants, have been unsuccessful. As inquiries have reached us regarding same, may we point out, to prevent misconception, that the action arose solely on account of work done as far back as 1906–1908 at the company's Queensferry Works, and is in no sense connected with the main works at Rugby. The Queensferry Works, it may be remembered, were built for the manufacture of boiler and kindred work, and were closed in 1908.

Victoria Works, Rugby. April 22nd, 1911.

Yours faithfully, For Willans & Robinson, Ltd., C. S. Essex, Secretary.

PRICE AND LIFE OF OSRAM LAMPS.

To the Editor of Electrical Engineering.

Sir,—In your journal of April 20th, under the heading of "The Price and Life of Osram Lamps," you mention several places where these lamps are being used for street lighting, and, as these are taken from information supplied by the General Electric Co., the impression may be created that they are solely responsible for the work. Perhaps, therefore, you will permit me to add that I have been responsible for nearly 75 per cent. of the places named. It might also interest you to know that I could name about eighty other places where I am either carrying out the same work or have already completed doing so.

Yours faithfully, Haydn T. Harrison.

11 Victoria Street, Westminster, S.W. April 20, 1911.

LIGHT RAILWAY COMMISSIONERS' REPORT

The report of the Light Railway Commissioners for 1910 shows that twelve Orders were submitted to and confirmed by the Board of Trade. These Orders authorised the construction of 13½ miles of light railway at an estimated cost of £76,680.

Once again the Commissioners draw attention to the necessity for amending the Light Railways Act of 1896. At the present time about 750 miles of line have been constructed under the Act, and nearly 1,200 miles have been authorised but not yet constructed. The main reason which accounts for failure to construct lines in country districts, and also for the notable reduction in the number of proposals for new lines, is to be found, says the report, in the fact that in its present form the Act does not adequately secure certain essential conditions, viz., cheap capital, cheap construction, and cheap work. When it is remembered that the chief difficulty in all light railway schemes has been to find capital, it will be seen, says the Commissioners, that the financial assistance of the State under the terms of the Act has not greatly contributed towards the construction of light railways for the reason that the extent of such assistance and the conditions under which it may be given have not been such as to enable the remainder of the capital to be raised on reasonable terms.

Reference is again made to a point mentioned in the last report, viz., lines on public roads mostly worked by electric power. It is provided in the Act of 1896 that special consideration shall be given by the Commissioners to the question whether proposals brought before them should in certain circumstances be submitted to Parliament, but no provision is made in the event of the Commissioners deciding to submit any scheme to Parliament, and no machinery is prescribed in the Act in this connection. The result is that proceedings taken under the Act in any such case become abortive, and the whole of the procedure becomes, to that extent, less effectual and less certain than it should be. In the opinion of the Commissioners this is one of the chief causes which is tending to bring applications for lines of this character (in many cases lines of much public usefulness) practically to an end.

The Commissioners have been asked to entertain applications for the installation of trolley omnibuses, but they are advised that, taken under the terms of the Light Railways Act, such applications cannot be dealt with.

Telephone Transfer.—It is stated that a Telephone Transfer Bill will be introduced into Parliament during the present session, dealing with the transfer of the National Telephone Company's undertaking to the Government.

Fire.—Owing to the boiling over of a can of varnish at the works of the London Electric Wiring Co., Leyton, on Thursday, considerable damage was done to the block of buildings known as the insulation and experimental works. Fortunately it was confined to this building, and did not spread to the other portion of the factory, which is a short distance away.

The Batti-Wallahs' Society.—The last smoking concert for this season will be held in the Council Chamber, Holborn Restaurant, at 7.45 p.m. on Tuesday, May 2nd. The chair will be taken by the new president, Mr. Slade Olver. An exceptionally strong programme has been arranged by the Entertainment Committee, and it is hoped that members will turn up in force.

Wireless Telegraph Notes.—The wireless telegraph station at Wick, Caithness, is now practically completed. The object in erecting a station at this spot is in order to obtain a more systematic control of the naval fleets operating in northern waters.

It has been decided to erect a wireless telegraph station at Spitzbergen, Norway.

Congress of Technology at Boston.—A congress, at which a number of Papers on applied science in relation to various branches of industry and public good, was held at Boston on April 10th and 11th, in commemoration of the jubilee of the Massachusetts Institute of Technology. Among the papers read was one by Mr. H. M. Hobart on "The Progress of Electric Propulsion in England." The president of the congress was Dr. Maclaurin, who, in his inaugural address, spoke of the progress of the Institute during the fifty years of its life and the influence of its work.

A Rapidly Completed Power Installation.—A notable illustration of the value of public electric power supply has just occurred at Messrs. Rennie & Company's Providence Mills, Stanningley, where, but for its aid, the machinery would now be standing idle. On Wednesday of last week the main engine gave way, and the machinery was brought to a standstill. Fortunately, the Yorkshire Electric Power Company's supply is available in Stanningley, and in twenty-four hours the supply was connected, and the first motor set to work. By Sunday night the whole of the machinery was converted to electrical driving, and now over 400 h.p. is taken from the public mains. This probably constitutes a record for this class of work.

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TRAIN TELEPHONY

At the invitation of Mr. H. von Kramer we attended the opening at Stratford-on-Avon on Thursday last, of what is stated to be the first Railophone installation for wireless inductive signalling to and from moving trains. Some months ago experiments were made on a short section of the London, Brighton & South Coast Railway by Mr. Von Kramer, and a company was formed under the name of Railophones, Ltd., to develop the system. By the courtesy of Mr. Harry Willmott, chairman of the Stratford-on-Avon and Midland Junction Railway Co., Mr. Von Kramer has been able to equip a ten-mile section of this railway between Stratford and Kineton, for the purpose of showing the possibilities of the system, but this installation also appears to be of an experimental nature.

On Thursday a temporary telephone box was fitted up in a marquee adjacent to the railway station at Stratford, and Miss Marie Corelli spoke an inaugural message into the telephone, which was received and replied to by the Mayor of Stratford from a telephone box on the train. On account of the fact that the patents covering the system have not yet been taken out in all countries, the company are averse from the publication of complete technical details, but the following notes will indicate the principles upon which the system is worked.

Speech is transmitted by electro-magnetic induction between a large coil of wire on the coach, and a stationary wire along the track. Thus, current variations in either the train coil or the stationary track circuit produce a varying magnetic field which induces currents in the other circuit and operates the receiver. Thus the coil on the train and the wire along the track may be looked upon as the two coils of a transformer of rather loose coupling, although one is on the train and the other along the track. The movement of one relatively to the other is of no account.

On the experimental track at Stratford-on-Avon, the stationary wire in the railway stations and at crossings is buried in the railway embankment on one side of the track, and consists of a bare iron wire placed in a wooden trough filled with bitumen, but along the open line it is suspended on short wooden poles, one foot high, close to the track. This wire is joined up with the rails which form the return wire, and thus complete the circuit with the telephone instruments in the signal box or any other desired position. One coach of the train is fitted with two large coils of insulated wire, hung horizontally from the bottom of the coach. One of these is connected with a telephone transmitter, and the other with a receiver. The transmitters used both on the train and in the signal box differ from the ordinary pattern only in having a somewhat lower resistance. The current employed in transmitting is about three amperes, in order that a sufficiently strong magnetic field may be produced.

As there are two coils on the coach, one for receiving and one for transmitting, the operator speaks and listens as with an ordinary telephone. In the case of the stationary telephone box, however, it is necessary, in the present experimental installation, to switch over from the transmitter to the receiver when it is desired to receive, as there is only one stationary circuit. One circuit cannot be used for both transmitting and receiving, as the receiver will not carry the heavy current required for transmitting.

The chief difficulty in developing the system has been the elimination of mutual disturbances with the ordinary telegraph wires along the railway track. Originally the coils on the train were arranged vertically, and in a longitudinal plane, the lower side of the coil only being active, while the remaining part extended over the roof, and was enclosed in a tube of brass or other non-magnetic metal. This method, however, has been abandoned, and the difficulties are now overcome by a special method of winding the coils, which has not yet been disclosed.

An important development of the system foreshadowed by Mr. Kramer consists in tuning the signals to and from different trains, so that a train will only pick up the impulses to which its apparatus is tuned. Experiments are also being conducted with a relay which will enable speaking and hearing to be performed with one track circuit without the inconvenience of being obliged to switch over from the transmitter to the receiver, and *vice versa*, in the stationary telephone box.

It was announced some months ago that the company had contracted to instal the system on the London, Brighton & South Coast Railway, over a distance of 30 miles in the middle of the route between London and Brighton, and to equip the express train known as the "Southern Belle" with the necessary apparatus, thus enabling passengers to send or receive messages during the journey from London to Brighton, but it does not seem that the system is yet sufficiently developed to be applied commercially in this way.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

REVOLUTION INDICATORS.—An illustrated booklet from the Union Electric Co. (Park Street, Southwark, S.E.), describes a series of electrical revolution indicators for marine work. These are on the Hartmann Kempf system, and depend on the resonance of a graduated row of tuned reeds in the field of a magnet excited by a small permanent magnet 24-pole alternator, driven by a chain from the main shaft. The frequency is thus proportional to the speed of the main engines and the scale against the reeds can be calibrated direct in r.p.m. of the main engines. In most of the instruments the dial is also provided with an indicating pointer, worked by a voltmeter connected to the same alternator, which also gives an approximate indication of the speed. Several indicators can be driven by the same alternator.

METAL FILAMENT LAMPS.—The latest price list of Westinghouse Auriga metal filament lamps from the British Westinghouse Electric & Manufacturing Co. gives notice of reductions in the prices of these lamps in the larger sizes, ranging from 65 to 600 candle-power. These lamps are manufactured from 8 to 1,000 c.p. and for circuits from 25 to 260 volts, and are British made.

CONTROLLERS.—A comprehensive catalogue of controllers, fuses, &c., has been issued by Messrs. Allen, West & Co., Ltd., of Lewes Road, Brighton, in the form of a number of sheets in a convenient file. It embraces porcelain handle fuses of the West self-aligning pattern, and a considerable selection of drum type controllers for series, shunt, and compound motors with and without braking positions, and power notches for lowering. Similar controllers for two- and three-phase motors, resistance grids and frames, and special heavy service controllers for steel works, collieries, &c.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ELECTRIC FANS.—The British Westinghouse Electric & Manufacturing Co. (Trafford Park, Manchester), are giving considerable attention to the study of ventilation, and have just issued a new list of electric fans, and in addition to supplying these pieces of apparatus, they are willing to place their experience in their application at the disposal of purchasers. Electric fans are of the utmost use when applied to real ventilation, that is to say, changing and not mere stirring up of the air, and as much care should be exercised in their application as in their selection. The list deals with continuous and alternating current fans, and the patterns include cabin fans, ceiling fans, exhaust and ventilating fans of the two-blade type, as well as the familiar desk and bracket fans.

INSTALLATION MATERIAL, &c.—Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.), have issued a new pocket edition of their catalogue. This contains the whole of the prices and particulars given in their full 400-page quarto list issued twelve months ago, with the exception that the fittings section has been curtailed slightly in view of a complete new fittings catalogue, which is now in course of preparation. But one or two new items have introduced. An idea of the completeness of the range can be obtained from the following list of the sections into which the catalogue is divided: Conduits, Flexible Wiring, Distribution Boards, Watertight Fittings, Wires and Cables, Accessories, Electric Bells, Porcelain Insulators, Lamps, Fans, Cooking, Heating, Signs, Meters, Instruments, Fixtures, Holophane, and Shades.

METAL FILAMENT LAMPS.—A leaflet from the Foster Engineering Co., Ltd., gives notice of reduction in the prices of the larger sizes of their metal filament lamps from 100 to 600 c.p. As is well known, these lamps are manufactured from start to finish at the Company's works at Wimbledon, and the Foster Co. are prepared to supply advertising literature overprinted with the names and addresses of contractors. We may mention that the Midland Railway has placed a twelve months' contract for Foster lamps.

The South African Institute of Electrical Engineers.—The report which was presented at the annual meeting on January 19th, 1911, records a total membership of 205, made up of 88 members, 79 associate members, 22 associates, and 16 students. A number of meetings have been held, the average attendance at which was 88. The following are the officers and council for the present year:—*President:* J. H. Rider. *Vice-Presidents:* Bernard Price, J. W. Kirkland. *Members of Council:* W. Elsdon-Dew, W. H. Perrow, L. B. Woodworth, A. G. F. Heather, F. H. Michell, W. C. Brown, F. W. Bentley, A. E. Gibbs, G. A. Webb. *Associate Members of Council:* J. S. Ross, G. H. B. Bernard, E. V. Perrow.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published April 20th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

7,657/10. **Improving Electrical and Mechanical Properties of Hard Copper Wire.** Elektrochemische Werke Ges. (Berlin). Up to 1 per cent. of calcium or molybdenum or smaller percentages of each are added to electrolytic copper instead of aluminium and magnesium as is now usual to produce hard wires for overhead lines. Whereas a usual requirement for such wire is a conductivity of 95 per cent. with a tensile strength of 40 to 46 kg. per sq. mm., a wire with 0·35 per cent. of calcium is stated to give on test 98 per cent. conductivity and a tensile strength of 54 kg. per sq. mm. Similarly, a wire with 0·05 per cent. of molybdenum is stated to give 96·2 per cent. conductivity and a tensile strength of 52·9 kg. per sq. mm. By adding 0·35 per cent. of both calcium and molybdenum to pure copper, a conductivity of 98 per cent. and a tensile strength of 52 kg. per sq. mm. are said to be obtained.

8,019/10. **Heavy-current Telephone Transmitter.** C. E. Egner and J. G. Holmstrom (Stockholm). In transmitters provided with a box of soluble material, such as paraffin wax, which, in melting, cools the granule chamber, metal rods are placed in the box extending upward from the bottom adjacent to the granule chamber, in order to conduct the heat into the soluble body. Two figures.

10,870/10. **Exhausting Lamp Bulbs.** F. Harrison (London). In order to exhaust completely the bulbs of incandescent lamps, and particularly those for pressures below 30 volts, red phosphorus or arsenic is inserted in the bulb or on the stem, and the bulb is first exhausted by a pump in the usual way. It is then placed in the electrostatic field or between the terminals of an induction coil or H.T. transformer, so that a bluish glow appears. At the same time a current greater than the normal is passed through the filament, and the phosphorus is heated by a flame until the blue glow disappears, whereupon the lamp is sealed off. One figure.

12,754/10. **Sealing-in Machine.** W. L. Pakenham and The "Z" Electric Lamp Manufacturing Co., Ltd. (London). This apparatus consists of a revolvable table carrying the lamp bulb and filament pedestal to be sealed, mounted on a support, so that it can be slid into or out of the zone of flame produced by a number of gas jets. When the bulb is brought into the flame the table is immediately rotated by a friction drive. A lever for adjusting the height of the pedestal is also provided. Four figures.

13,672/10. **Wiring Cable.** Siemens Bros. & Co. and W. Dieselhorst. With wiring cable of the kind which is provided with a metallic sheathing outside the insulation, trouble is often experienced when stripping off portions of the sheathing by reason of the insulation adhering to it. To obviate this, a wrapping of thin, non-adhesive material, such as paper strip, is provided between the sheathing and the insulation. Two figures.

15,425/10. **Accumulator Boxes.** G. E. B. Pritchett (Pritchetts & Gold, Ltd., London). Boxes for accumulators used for train-lighting, &c., where they are subject to vibration and concussion are made much deeper than the plates, and a very thick plate of teak or lead is supported horizontally just above the level of the electrolyte, while a large space is provided between the top of this plate and the top of the box. The electrolyte may penetrate through the narrow passages between the plate and the sides of the box, but is not projected out of the box. Five figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Moul, 13,528/10.

Electric Ignition: Vickers, Sons, & Maxim, Ltd. (*Elia*) [Submarine mines] 2,706/11.

Electrochemistry and Electrometallurgy: FitzGerald [Electric furnaces] 15,166/10; Consortium für Elektrotechnische Industrie Ges. [Production of indoxyl] 17,143/10; Nogier [Sterilising liquids by ultra-violet rays] 26,783/10.

Heating and Cooking: Bell [Heat conserving and heating and cooking apparatus] 2,829/10.

Incandescent Lamps: Krause [Metal filament lamps] 24,548/10.

Instruments and Meters: Hardingham (*Hartmann & Braun A.-G.*) [Measuring instruments] 19,093/10.

Storage Batteries: Marino [Separators] 30,602/09; Boult (*Smith*), 2,017/11.

Switchgear, Fuses, and Fittings: Conradi [Fuses] 7,823/10; Barry and Clarke [Rheostats] 8,274/10; Tucker [Switches] 8,375/10; Adams Manufacturing Co. (*Cutler Hammer Mfg. Co., U.S.A.*) [Motor controllers] 9,097/10; Trier [Switches] 9,153/10; Martyn [Wall-plugs] 13,274/10; Winterhalder [Automatic circuit-breakers] 15,482/10; Gill [Sheath for lamps] 18,821/10; Scott [Switches] 19,125/10; Dorman, Smith and Baggs [Fuses] 27,712/10; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Resistance units] 252/11; Baldwin [Bell circuits] 2,572/11.

Telephony and Telegraphy: Zwicky, Schwartz and Denholm [Signalling by light] 7,928/10; Hurd [Transcription of telegraphic messages] 10,745/10; Fessenden [Telephone transmitters and relays] 11,602/10; Goldstein [Central battery signalling system] 16,333/10.

Traction: Rothwell [Rail joints] 23,259/09 and 2,669/11; Jenkins and Brook [Air-brakes] 10,925/10; Quibell and Coghlan [Tramway rails] 27,723/10; Schilowsky [Mono-rail system] 29,892/10.

Miscellaneous: Arledter [Process for sizing paper electrically] 132/10; Hall [Coal-cutter] 8,987/10; Fries [Flux for soldering aluminium] 10,790/10; Oliver [Galvanising machines] 14,959/10; Money [Electromagnetic clutches] 15,422/10; Galvanostegie Ges. [Cleaning tubes before galvanising] 19,496/10; Siemens-Schuckertwerke Ges. [Percussion tools] 19,540/10; Bigge and Butt [X-ray apparatus] 25,670/10; Siemens Bros. Dynamo Works, Kieffer and Vernon [Liquid piston explosion engines for pumping] 27,753/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: Körting & Mathiesen A.-G. [A.-C. lamps] 6,336/11 and 6,783/11 Siemens-Schuckertwerke Ges., 7,501/11.

Electrometallurgy: Elektrostahl Ges. [Manufacture of iron and steel] 25,581/10.

Heating: Monnot, 8,023/11.

Incandescent Lamps: Weber, 1,210/11; Barollier [Sealing-in machine] 7,868/11.

Instruments: Strelow [Meters] 8,032/11, and [Measuring instruments] 8,033/11.

Switchgear: Allgemeine Elektricitäts Ges. [Voltage regulators] 7,668/11 and 8,150/11; Eilertsen [Rheostat for remote control] 8,156/11.

Telegraphy: Reisz and Strauss [Relay for undulatory currents] 2,111/11; De Bernochi [Transmitting pictures to a distance] 8,017/11.

Traction: T. Goldschmidt [Rail joints] 27,382/10; Schapire [Rail joints] 8,009/11.

Miscellaneous: Von Koch [Production of discharges in gases] 1,746/11; Goldstein [Temperature alarms] 7,670-1-2/11; Biermasz [Transmitting compass positions to a distance] 7,906/11; Rennert [Motor-controlled regulating devices for furnace dampers, valves, &c.] 8,151/11.

Opposition to Grant of Patent

5,934/10. **Arc Furnace for Treating Gases.** G. W. Johnson. (*Chemische Fabrik Griesheim-Elektron.*) Opposition has been entered to the grant of this patent. The specification describes a blowing device for directing the gases to be treated into the arc. Two streams of gas issue from longitudinal slits in two parallel tubes, and meet at an angle adjacent to the arc. It is claimed that the arc burns without any aureola, and that subsequent decomposition of the gases produced by the reaction is avoided.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: H. Bremer [Flame arc lamps with self-supporting carbons or carbons fed against metal stops] 420/00; F. W. E. Schuer [Enclosed lamp globe] 418/06.

Distribution Systems, &c.: Siemens Bros. & Co. (*Siemens-Schuckertwerke Ges.*) [Battery load-equalising plant] 376/06.

Dynamos, &c.: British Thomson-Houston Co. and B. Hopps [Control of generator in petrol-electric power transmission gear] 320/05.

Instruments, &c.: British Thomson-Houston Co. and F. Holden [Mercury meters] 515/06.

Storage Batteries: A. Müller [Casting grids with vulcanite or metallic backings] 273/03; C. Roderburg [Paste and grids] 415/03.

Switchgear, &c.: C. T. Briscoe, E. Jones, and T. S. Jones [Card-grips for lamp holders for preventing twisting of the conductors] 165/99; W. W. Lackie and W. T. Caldicwood [Fuses] 330/04.

Traction: C. Contal [Motor-suspension and gear of electric vehicles] 12,598/00; W. Griffiths and B. H. Bedell [Live stud detector for surface contact tramways] 351/04; Westinghouse Brake Co. [Air brakes] 307/05.

Miscellaneous: F. W. Hurd [Coal-cutter] 282/03.

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STREET LIGHTING IN THE BOROUGH OF HOLBORN

At the last meeting of the Holborn Borough Council just before Easter, the Town Clerk reported that in response to the invitation for new tenders for street lighting (see Electrical Engineering, February 16, p. 81) he had only received a joint tender from the Gas Light & Coke Co., and the Metropolitan Electric Supply Co., the latter company acting on behalf of the County of London Electric Supply Co., and the Charing Cross and West End Electricity Supply Co., apportioning the lighting of the borough between electricity and gas. The tender was for forty-eight lamps of approximately 1,500 c.p. each in High Holborn and New Oxford Street; twenty-eight lamps of approximately 1,800 c.p. in Kingsway and the High Holborn crossing at Southampton Row; twenty 600 c.p. lamps in Tottenham Court Road; four hundred and five 400 c.p. lamps in seventeen streets; forty-eight 300 c.p. lamps, thirty-seven 180 c.p. lamps, and 1,390 90 c.p. lamps in the remaining streets. The lighting would be roughly divided equally between gas and electricity. The total inclusive annual payment under this joint contract would be £6,950, the tender being for ten years, with the option to the Council to terminate it at shorter periods upon certain conditions.

This price, however, was on the basis of the penalty clause for non-maintenance of candle power being waived, but if this were insisted on the amount of the tender was to be increased by 10 per cent. Moreover, the companies were not willing to accept a clause in the specification with regard to adoption of subsequent improvements in burners, lamps, &c., unless the Council would agree to pay the extra cost of such improvements. It will be noted that the price of £6,950 per annum is considerably lower than the £7,527 originally tendered by the gas company, but it is higher than the price tendered in the first instance by the electricity companies, which was £6,602 per annum. It will be remembered that the gas company's tender was first recommended by the Works Committee for acceptance, but the Council refused to adopt the recommendation of accepting the higher tender of the two. Instead of accepting the tender for electric lighting forthwith, however, they called for fresh tenders and will now have to pay more for their lighting if the former tender for electric lighting is now withdrawn.

After a short discussion, it was decided to refer the joint tender to the Works Committee, which is to report to the Council in not less than a month's time. A suggestion that the Council should then consider the report of the Works Committee *in camerâ* met with approval, but a strenuous endeavour should be made to ensure public discussion of the matter when the time comes.

INDUSTRIAL BANKS AND THE ELECTRICAL INDUSTRY

There was a good attendance at the meeting arranged by the National Electrical Manufacturers' Association on Tuesday evening to hear the Paper by Mr. L. Joseph on "Foreign Compared with Home Industrial Finance." Mr. Joseph is not only connected with banking interests, but is also interested in the financial side of the electrical industry. He gave a rough outline of the financial organisation of industry in various countries, and strongly advocated the system of industrial banks which is so common in Germany and the Continent generally, and also in a somewhat different form in the United States. He denied that industrial credit involved bankers in undue risks, and pointed out that Continental industrial banks were equipped both financially and intellectually to cope with industrial requirements, with the result that co-operation between them had proved salutary to both. He attributed the rapid rise and progress of the German electrical industry to the assistance given by their bankers, manufacturing and other concerns being readily granted funds for extensions. He commented upon the fact that whereas in England the capital of industrial concerns was usually inflated through the necessary intervention of the company promoter, who considered his work at an end when he had provided the capital, no matter upon what terms, in Germany the bankers did not consider their function at an end with the issue of the capital, but insisted upon seeing that it was efficiently administered. Figures were given relating to the Siemens and Schuckert firms and the A.E.G. as unmistakable evidence of the good influence of bank assistance.

Mr. T. Rich, Mr. Myers, Mr. G. Hooghwinkel, Mr. H. Hirst (General Electric Co., Ltd.), Mr. Oppenheimer (International Electric Co.), Mr. Donovan, and Mr. W. L. Madgen (Brush Electrical Engineering Co.) took part in the discussion, and the majority of them strongly supported the opinions of Mr. Joseph.

These gentlemen deplored the fact that there are no responsible authorities for looking after industrial promotions in Great Britain, and the formation of industrial banks was suggested, it being put to Mr. H. W. Butler (Chairman of the National Electrical Manufacturers' Association) that some steps should be taken officially by that body in this direction. The circumstances of the promotion of the Victoria Falls power scheme were recounted as showing the advantage of the co-operation of banks with industry, the German electrical manufacturing firms having, with the assistance of their banks, obtained the contracts for this scheme, whilst a number of English bankers were only considering whether it would be worth their while to go into it. Similar schemes are said to be passing British firms in Central and South America and the Far East. Mr. H. W. Butler did not think that the English bankers were so much to blame, as at present they had sufficient employment for their funds to be able to return a 20 per cent. dividend to their shareholders, and naturally they were content. If the suggestion of industrial banks for the electrical industry were to be carried into effect it would be necessary for new institutions to be created rather than the existing banks should be made use of. Mr. W. L. Madgen, of the Brush Electrical Engineering Co., took exception to the general feeling of the meeting being in favour of the German system, and regretted that Mr. Joseph had omitted all mention of the large number of financial companies in this country which had been specially formed to deal with industrial enterprises. He was not quite sure whether the German banks existed for the benefit of the industries or the industries existed for the benefit of the banks. Mr. Oppenheimer was the only other speaker who differed from the author of the Paper in his whole-hearted advocacy of the German system.

LOCAL NOTES

Aberdeen: *Harbour Lighting.*—A new agreement is to be entered into between the Harbour Board and the Corporation for the lighting of the harbour. All public lighting by arc lamps is to be charged at £14 10s. per lamp per annum, including current, trimming, carbons, and ordinary repairs. Incandescent electric lighting is to be charged at a flat rate of 2·75d. per unit, and all current for power and heating is to be charged at the rates in force in the City for this purpose. The agreement is to be for a period of five years from Jan.1st, 1911. The Engineer of the Harbour Board expects that a saving of about £150 per annum will be made by the Board.

Brighton: *The District Tramways Bill.*—It is stated that the Brighton and District Tramways Bill is to be withdrawn for the present session. In a recent issue we reported that the Standing Orders Committee of the House of Commons had refused to pass certain sections of the proposed lines owing to the absence of the consent of various road authorities. The lines remaining represented only a small portion in the centre of the route between Brighton and Worthing, and the promoters do not think it worth their while to proceed with this.

Canada: *Combination of Electrical Companies.*—It is stated that the Toronto Electric Light Co., the Electrical Development Co., the Toronto Power Co., and the Toronto Railway Co., are to be amalgamated. The total capital of these concerns is $19,000,000, in addition to a bond issue of $17,500,000.

Dublin: *Plant Extension.*—Mr. P. C. Cowan, Chief Engineering Inspector, Local Government Board, held an inquiry at the City Hall on the 24th inst. concerning the application of the Corporation for a loan of £128,129 for extensions to the electricity works. He mentioned that he had received two objections to the loan. The Dublin Tramway Company objected to the loan being sanctioned on the following grounds:—They object to further expense on

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the extension of plant or otherwise in connection with the power station at the Pigeon House; the extension of further public lighting as proposed was wasteful and extravagant expenditure; they object to a loan of more than is necessary for the present requirements of the Corporation; it is unreasonable and inequitable to burden the city with loans for extensions which will not be required, as shown by the Corporation, in some cases before the year 1912, and in other cases 1913; on the further ground that the public electric lighting is carried on by the Corporation at a loss, is too expensive, it is not the best system and should not be continued, and that electricity can be otherwise obtained for the city at much less cost to the citizens. Sergeant O'Brien, for the Corporation, said that the Pigeon House Fort site had been selected on the advice of experts. Up to the present £620,742 had been sanctioned in connection with contracts, and of that sum £137,525 had been repaid. An extension was necessary having regard to the financial prospects

Leeds: *Tramway Profits.*—The sum of £51,888 are to be handed over to the relief of rates from the tramway profits for the past year.

London: *L.C.C. Tramways.*—The Wandsworth Council have been informed that the construction of the tramways from Putney Bridge along Putney High Street, and Putney Bridge Road to High Street, Wandsworth, will shortly be commenced.

Macclesfield: *Trolley Omnibuses.*—The Macclesfield and District Railless Traction and Electricity Supply Co have applied to Parliament for the insertion, in their Bill deposited in November, of an additional provision giving them powers to run trolley omnibuses along a number of other routes to those specified in their original application.

Malvern: *Railless Electric Traction.*—A meeting of ratepayers has passed a resolution calling upon the Council to support a Bill which proposes to instal a system of trolley omnibuses in Malvern.

Manchester: *Electricity Profits.*—The Electricity Committee have offered to base their contributions to the City Funds, commencing with 1911, at the rate of 1 per cent. on the outstanding indebtedness of the undertaking. On this basis the amount to be allocated this year will be £19,496, as against £15,000 last year. This sum is to be calculated after meeting instalments for sinking fund and interest charges.

Stoke-on-Trent: *Proposed Electricity Extensions.*—Notice has been given by a member of the Town Council that he will move at the next meeting that the resolution to expend £60,000 upon the re-arrangement of the electricity supply should be rescinded.

Swansea: *Proposed Purchase of Tramways.*—It is stated that the Swansea Improvements and Tramways Co. have indicated their willingness to agree to the purchase of their undertaking in 32½ years' time. Mr. J. M. McElroy, General Manager of the Manchester Corporation Tramways, has been appointed to advise the Corporation at a fee of £50 and travelling expenses.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Alloa.—Extensions are to be carried out at the generating station at an estimated cost of £3,400. The Town Council recently took over the undertaking from the British Electric Plant Co., and now propose to duplicate the plant.

Barking.—Tenders are invited by May 10th for extensions at the electricity works.

Barnes.—A combination de-oiling, softening, and feed-water heating plant is required for the electricity works. (See an advertisement on another page.)

Greenock.—It was stated at the last monthly meeting of the Corporation that it will soon be necessary to instal another turbo-alternator.

Ilford.—Tenders are invited by May 9th for a distributing switchboard, feeder cable and stoneware conduits. Particulars from Borough Electrical Engineer.

Mirfield.—Tenders are invited by April 29th for an electrically driven centrifugal pumping plant. Particulars from Engineer to Council.

New Zealand.—The Auckland Council invite tenders for complete boiler-house and engine-room equipments for their electrical power station. Copies of the specification may be seen at 73 Basinghall Street, London, and tenders should be sent to the Town Clerk, Auckland, by June 15th.

South Shields.—Tenders are invited by May 24th for 1,500 kw. steam turbine driving in tandem, a 1,000 kw. C.C. generator and 1,100 kw. A.C. alternator complete with switchgear and instruments. Particulars from Borough Electrical Engineer.

WIRING

Ashton-under-Lyne.—Elementary school at Droylsden. Architect, H. Littler, 16 Ribblesdale Place, Preston.

Bradford.—Rebuilding of Queen's Hotel, Listerhills Road.

Coatbridge.—Extensions to Woodside Iron and Steel Co.'s works.

Coventry.—Alterations and additions to Messrs. Thomas Bushill & Sons' premises, Little Park Street. Architects, G. & I. Steane, 22 Little Park Street.

Edinburgh.—Electric lighting of new school in Duncan Street. Specifications from Mr. J. A. Carfrae, 3 Queen Street, Edinburgh.

Extensions to Royal Scottish Museum.

Eton.—Town Hall and institute.

Halifax.—New church at King Cross.

Mansfield.—Extensions to Hospital.

Margate.—Electric lighting of concert pavilion and buildings at the Fort. Plans and specifications from F. W. Borg, Borough Surveyor, 13 Grosvenor Place, Margate.

Newport.—Monmouthshire County Training College at Caerleon.

Newton Abbot.—Extensions to Seale-Hayne College.

Southampton.—Additions to the Royal South Hants and Southampton Hospital.

Swansea.—Eighteen houses in Reginald Street, Mr. J. Thomas.

Wolverhampton.—Eighteen houses in Bruford Road, Mr. M. Westwood, Upper Villiers Street.

MISCELLANEOUS

Australia.—The Deputy Postmaster-General at Brisbane invites tenders by June 14th for the supply of telegraph and telephone material, including paper-insulated lead-covered cable, jointing sleeves, battery material, &c. Copies of the specifications may be seen at 72 Victoria Street, S.W., or 73 Basinghall Street, E.C.

Bolivia.—The Executive Authorities have, reports *The Board of Trade Journal*, been authorised to raise a loan of £50,000 for the installation of wireless telegraph stations.

Glasgow.—The arc lamps on the main routes to the Scottish Exhibition are to be changed over to flame arc lamps. In addition, all the street electric lighting in the City is to be brought up-to-date.

London: *Islington.*—Tenders are invited by May 4th for installation of fire alarms, &c., at the Guardians' School, Hornsey Road. Particulars from Guardians' Offices, St. John's Road, Upper Holloway.

Tenders are invited by the Commissioners of H.M. Works and Public Buildings for supply of carbon and metal filament lamps for one year from May 1st. Particulars from Storekeeper, H.M. Office of Works' Stores, 2 Lambeth Palace Road, S.E.

Tenders are also invited for supply of electric gas torches.

Malta.—A supply of arc lamp carbons is required at Valletta. Particulars from the Crown Agents to the Colonies, Whitehall Gardens, London.

Parliamentary Intelligence.—Liverpool Overhead Railway Bill was read a third time in the House of Commons on Thursday.

The Central London Railway Bill was read a third time in the House of Commons last week.

Manchester Local Section of the Institution of Electrical Engineers.—The annual report records the holding of eleven meetings during the session, an annual dinner, and conversazione. There are now 769 members of the Section (including 269 students), and the following Committee for the ensuing year was elected at the general meeting on March 28th. *Chairman,* W. Cramp. *Vice-Chairman,* J. Frith. *Members,* C. J. Beaver, A. A. Day, M. B. Field, G. Layton, Prof. E. W. Marchant, T. L. Miller, S. L. Pearce, Dr. E. Rosenburg, C. F. Smith, C. D. Taite, B. Welbourn, P. P. Wheelwright. *Past-Chairmen,* Miles Walker, S. J. Watson, and J. S. Peck. *Hon. Secretary and Treasurer,* H. W. Wilson. *Assistant Secretary and Treasurer,* A. L. Green. The Manchester Students' Section has held nine meetings, at which the average attendance was thirty-four. Messrs. P. Kent and W. A. Stephens have been awarded a Premium of £5 for their Paper on "High-tension Spark Discharges."

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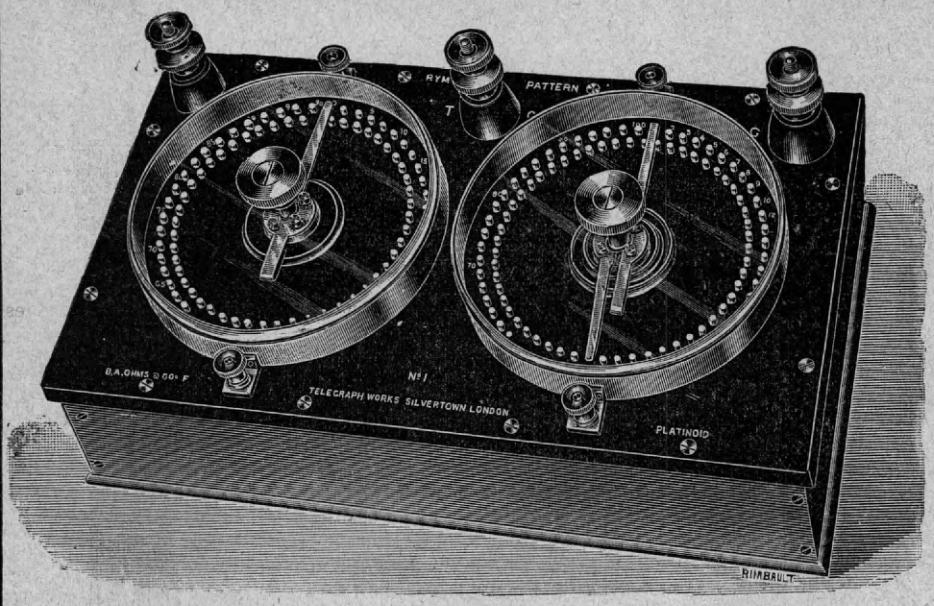
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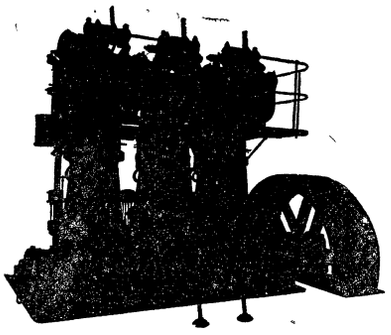
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TENDERS RECEIVED AND ACCEPTED

Atherton.—The Council has accepted the following tenders :—British Westinghouse Co., two 50 k.v.a., and two 85 k.v.a. transformers; Messrs. Ferranti, three switch panels; Messrs. W. Boydell & Sons, Ltd., three feeder pillars.

Edinburgh.—The Corporation have accepted tender of the Bastian Meter Co. for the supply of 5 ampere meters for the ensuing year.

Govan.—The contract for a 500 kw. rotary converter has been placed with the British Westinghouse Co.

Grimsby.—The tender of Messrs. Hobdell, Way & Co., has been accepted for the lagging of the boilers at the electricity works at £47 10s.

Leith Docks.—The contract for 250 cells, 1,200 ampere-hour capacity, Entz booster, and switchboard, has been placed with the Chloride Electrical Storage Co., Ltd.

London.—Messrs. Waygood have been commissioned to construct a special electric passenger lift for the use of his Majesty King George upon the occasion of his visit to the Festival of Empire at the Crystal Palace. The lift will communicate between the terrace of the Palace and the King's Pavilion, and the arrangements for the control of it will be in all respects similar to those on the London underground railways.

Stoke-on-Trent.—The following tenders have been accepted :—Two 600 kw. rotary converters for Burslem works, British Westinghouse Co., £2,490; two 300 kw. rotary converters for Longton works, and two 500 kw. motor generators for Stoke works, Bruce, Peebles & Co., £1,310 and £2,250 respectively.

Southend.—A contract has been given to the North-Eastern Steel Co., for 750 tons of rails required by the Tramways Committee, at £6 10s. per ton.

Swansea.—Messrs. Crompton & Co., Ltd., have received a contract from Messrs. Vivian & Sons, of Hafod, near Swansea, for the electrification of their copper rolling mills. The mills, which are continuous running, are to be driven by two 300 h.p. motors running at a speed of 150 r.p.m. The contract includes a 1,000 ampere storage battery with automatic reversible booster of the Chelmsford type. The battery is provided to deal with the peak loads of the motors, and thus give a steady load on the generating plant. The motors will drive the mills through Citroen double helical gear.

Telegraph Traffic.—An interesting Paper on "Imperial Telegraphs" was read by Mr. Charles Bright, F.R.S.E., at the Royal Colonial Institute on Tuesday, and was followed by a short discussion. Mr. Bright pointed to the desirability, from a strategic point of view, for further State-owned cables connecting the Colonies and Dependencies with the Mother-Country, and in particular a cable from Great Britain to Canada, supplemented by a land-line across the Dominion. He criticised the recent proposal for a cable from Scotland, *via* Iceland and Greenland, to Labrador, and suggested as an alternative one from the West Coast of Ireland to a point near Montreal, with intermediate stations at Cape Bauld (Newfoundland) and at Cape Whittle. Communication with South Africa, he pointed out, was obtained by a cable landing on foreign territory, and he proposed that one should be laid from Gibraltar to Bathurst, another from Bathurst to Halifax (Nova Scotia), and that a complete All-British chain should be completed, embracing Canada, the West Indies, South Africa, St. Helena, Sierra Leone, and Ascension.—On the 18th inst. we were advised that telegrams could not be accepted unti lfurther notice for Arizpe, Babicora, Banamichi, and Ures in Mexico, and on the same day the lines between Mossuril and Ternas Vellozo, Mozambique, were down.—On the 19th, the Zanzibar-Mobassa cable failed, as well as the lines between Quelimane and Mhassurge.—On the 21st inst., telegrams could not be accepted until further notice for Haimanguillo, Santonio, Cardenas, and Cunduacon, in the State of Tabasco, Mexico.—The El Arich and Hanekin routes were restored on the 21st, inst., but the Bagdad-Bassorah line was still down.—On the 24th inst., the Hanekin route was *hors de combat* again between Bagdad and Hanekin.—The Campagnie Française des Cables Télégraphiques has not yet restored its West Indian system to French and Dutch Guiana.—The cable between Hwandang and Menado is broken, and telegrams for the latter place have to be sent *via* Japan, and those for other places in the Dutch Indies *via* Singapore, Saigon, or Cocos.—It is reported that a working agreement is about to be entered into by Anglo-American, Direct United States, and Western Union Cable Companies.

OSRAM-LAMPS

APPOINTMENTS AND PERSONAL NOTES

A third-class clerk is required in the Wolwich Electricity Department. Commencing salary £95, rising to £140 per annum. Applications to Town Clerk by May 6th.

Mr. Ashton Bremner has been appointed assistant electrical engineer at Walsall to take charge of the electrical undertaking of the Corporation during the temporary absence of Mr. A. S. Barnard, the Borough Electrical Engineer, through illness.

At the recent examination for entrance scholarships held at Faraday House, the following awards were made :—Harry Ellis Smith, Dulwich College, to the Faraday Scholarship of fifty guineas per annum, tenable for three years; special prizes of twenty-five guineas each were also awarded to Alexander Bell, Royal School, Dungannon, and W. H. Chaplin, Christ's College, London.

The Belfast Electricity Committee require a sub-station attendant. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London E.C., inform us that the price of electrolytic wire bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 15s. to £57 5s. per ton (last week, £56 to £56 10s.).

Liquidation.—A meeting of the Sylverlyte Electric Lamp Co., Ltd., will be held at 46 Culverden Road, Balham, on May 27th, at 10.30 a.m., to receive the liquidator's account of the winding-up.

Dissolution of Partnership.—E. L. Pinching and W. H. Walton, electrical engineers, 52 Cannon Street, E.C., have dissolved partnership. The business will be continued by W. H. Walton under the old style.

Agency.—The Adams Manufacturing Co., Ltd., have concluded arrangements with Messrs. Heringa & Wuthrich, of Technisch Bureau, Haarlem, Holland, to act as their sole agents for Holland and Java.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Edmundsons' Electricity Corporation.—The *Stock Exchange Gazette* states that the directors are considering a scheme of capital reorganisation for the funding of the four and a half years arrears of preference dividend, the scheme being to capitalise the sum into a form of certificates redeemable out of profits after a moderate dividend has been paid on the ordinary shares. For some time past there has been a steady demand for the £5 preference shares of Edmundson's, and there is every indication of a continuance of the advance in the price which has been taking place recently.

Babcock & Wilcox.—At the annual meeting last week Mr. J. Dewrance, who presided, said that during the past year many improvements had been carried out at the Company's works which had enhanced the quality of their manufactures and reduced the cost. As the report showed, all these benefits had been given to their customers, as although the turnover was larger, the net profits were less than in previous years. This was, unfortunately, the trend of all industrial concerns, and it was what the shareholders must expect in the future.

Calcutta Tramways Co.—At the annual meeting last week Mr. E. C. Morgan, Chairman of the Company, stated that during the past year they had run about 40,000 more car-miles and carried a million and a half more passengers than in 1909, and that whilst traffic receipts had increased by £10,500, expenditure had been less. The new car shed has enabled the staff to deal with the maintenance of the cars in a more economical manner, and at the same time to vastly improve the appearance of the rolling stock. The most encouraging feature was that the directors' policy in carrying out the extensions in Calcutta itself, and also in Howrah, had been completely justified by the results.

British Westinghouse Co.—The report for 1910 is a very satisfactory one. Trading profits amounted to £112,538, and, after deducting £24,423 for depreciation on machinery plant, tools, &c., in addition to £5,550 for general depreciation, and meeting interest on all classes of debentures, there is a net profit of £12,436. From this is deducted the debit balance of £7,319 on the working for 1909, leaving £5,117 to be carried forward. During 1910 the increased demand previously shown by the export market continued, and also extended to the home market. The orders received during 1911 show a considerable increase over those for the corresponding period of 1910. Mention is made of the arbitration proceedings between the Company and the Underground Electric Railway Co. of London, which will involve the Westinghouse Co. in a considerable sum of money, and the directors have been advised to appeal against the arbitrators' award.

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WIRING CONTRACTORS.
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ELECTRICAL ENGINEERING

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Companies' Dividends, Reports, Meetings, &c.	244

SUMMARY

Our monthly Supplement on Electrical Engineering in Mines is included in this issue. It opens with an article on electric safety lamps for mines Some amendments proposed to the new Coal Mines Bill are given, and the most important electrical mining patents published in April are dealt with. Some new motor switch pillars are also described and illustrated.

The British Westinghouse Co. are suing the Electrical Co. for alleged infringement of the Bremer arc lamp patent. In addition to denying infringement, the Electrical Co. allege anticipation of the Bremer patent, and quote the Graham and Crosby specifications mentioned in the proceedings for infringement of the Bremer patent, in which the Westinghouse Co. were successful against Mr. Braulik. A point in the Appeal Court judgment in this action was that no lamp had ever been made according to the Graham specification, but a model has now been made, and evidence was called as to its satisfactory working. (Page 233.)

We are able to publish a few particulars of life tests of a well-known make of metal filament lamp. (Page 234.)

The application of Sir Oliver Lodge for an extension of his patent for "Improvements in Syntonized Telegraphy without Live Wires" was before Mr. Justice Parker last Friday. In granting an extension of seven years under certain claims in the specification, he complimented the patentee on his successful introduction of resonance for the first time. (Page 234.)

We are able to give the results of the official tests of a new 3,000 kw. turbo-alternator at Bristol which shows steam consumption down to 13·47 lbs. per kw.-hour. (Page 235.)

A road trial by the Automobile Club is in progress of a 3-ton lorry fitted with the Thomas transmission gear, which is partly electrical and partly mechanical. The gear provides about ten different torque ratios, and has many interesting points. (Page 236.)

A description is given of a new impulse disc and drum turbo-alternator recently installed at Bridlington. (Page 237.)

Among the specifications published by the Patent Office on Thursday last was one by P. Marino for storage battery separators of treated woven fabric which enable a very low internal resistance to be obtained.—R. A. Fessenden has patented a telephone relay with a brass-silicon contact, and H. E. Moul describes a feeding mechanism for flame arc lamps designed to obviate the trouble due to slag or deposit on the carbon tips.—An appeal has been lodged against the decision of the Comptroller to grant a patent to A. W. Leonard for an electrically-driven and illuminated advertising device.—A patent for an iron-nickel alloy for the leading-in wires of incandescent lamps expires on Thursday next, after the full life of fourteen years. (Page 238.)

A festival dinner in support of the Electrical Trades Benevolent Institution was held last week. Lord Justice Fletcher Moulton presided. Liberal donations were given, and we publish a complete list. Further contributions are earnestly solicited. (Page 239.)

Mr. A. M. Taylor read a Paper before Birmingham and London meetings of the Institution of Electrical Engineers last week on the use of storage batteries. He dealt with a number of aspects of battery working, deprecating the use of regulating cells, and putting forward a system of boosting, which he claimed would reduce the size of the boosters employed, and would give other advantages. In the London discussion Mr. B. M. Jenkin proposed a modified system in which the booster wires were eliminated at times of heavy discharge, and Mr. S. L. Pearce gave interesting

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figures of the savings effected at Manchester due to the large battery installed at Dickinson Street. Several other well-known central station engineers also spoke. (Page 240.)

THE Aberdeen Corporation are considering the introduction of trolley omnibuses.—Mr. Arthur Wright has agreed with the Brighton Corporation to accept £1,000 in settlement of his claims.—The Edinburgh Corporation have decided to transfer the profits from the electricity undertaking towards reducing the outstanding capital.—The Arbitrator in connection with the dispute between the Manchester Tramways Committee and their employees has decided against the men.—A new tramway brake is being experimented with in Halifax.—It is expected that the trolley omnibus system in Leeds will be opened in a few weeks. (Page 242.)

EXPENDITURE upon new generating plant is contemplated as follows:—Rochdale, £8,700; Finchley, £15,410; Dublin, £128,129; Worthing, £5,000; Eccles, £3,783; Belfast, £40,000; Bath, £7,500.—A 1,200 ampere-hour battery is to be installed at Barnstaple, and a 2,500 kw. set at Stalybridge.—The Hackney Council require 100,000 pairs of flame arc lamp carbons; twenty-four new tramway cars are required at Hull, and new mains at Stoke-on-Trent. The Wanganui (N.Z.) Council require a complete generating station for their new tramways.—Considerable extensions are to be made to the long-distance telephone system of British Columbia. (Page 243.)

AT the meeting of the British Westinghouse Co. last week it was stated that if the appeal against the arbitrator's award in connection with the Lot's Road turbines is unsuccessful, it may be necessary to write down the Company's capital. (Page 244.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, MAY 4TH.

National Electrical Manufacturers' Association.

2.30 p.m. Council Meeting at Balfour House, Finsbury Pavement, E.C.

Institution of Electrical Engineers.

8 p.m. "Practical Aspects of Printing Telegraphy," by Donald Murray.

TUESDAY, MAY 9TH.

Institution of Electrical Engineers: Glasgow Section.

8 p.m. At 207 Bath Street.

WEDNESDAY, MAY 10TH.

Junior Institution of Engineers.

7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment. "Notes on Illumination by Gas and Electricity," by F. J. Hawkins.

THURSDAY, MAY 11TH.

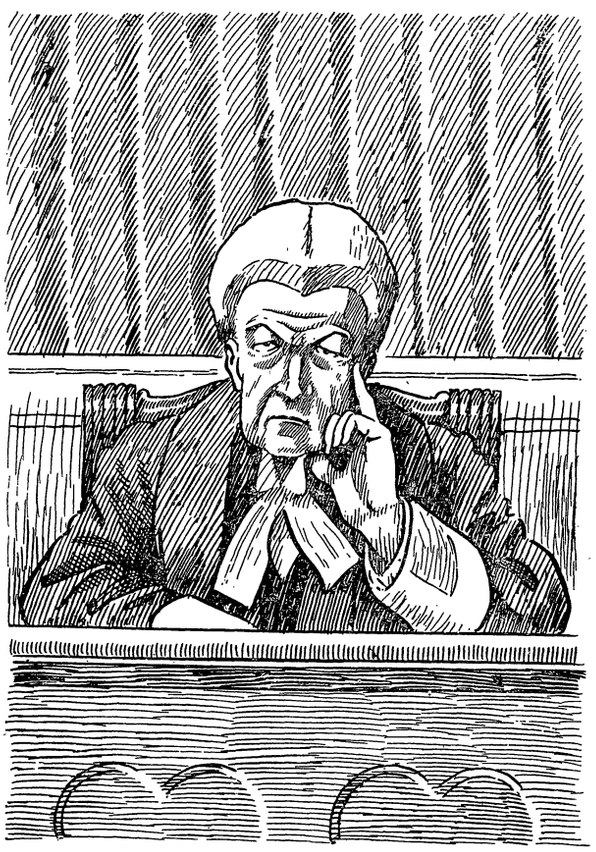
Institution of Electrical Engineers.

8 p.m. "The Driving of Winding Engines by Induction Motors," by H. J. S. Heather.

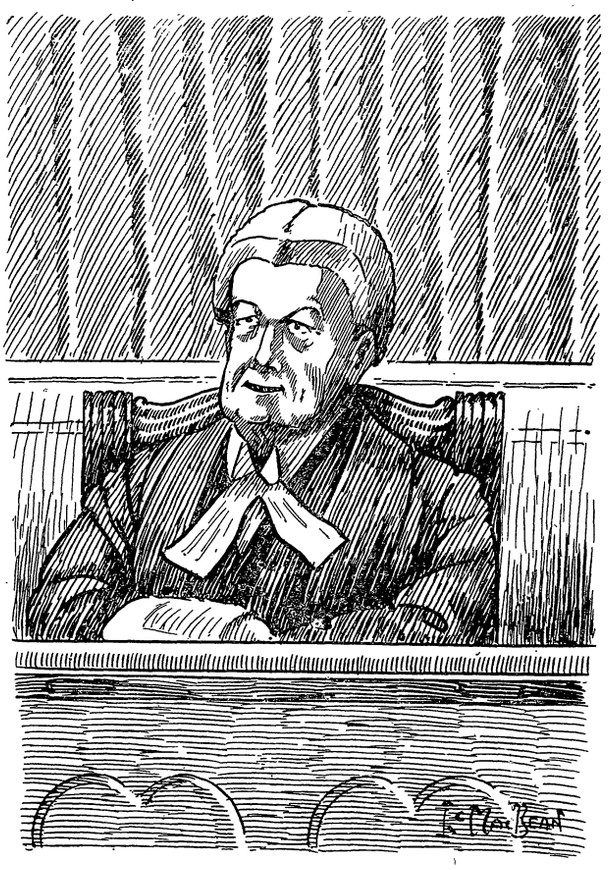
Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science.

Faraday House.—The seventh annual dinner of the Faraday House Old Students' Association took place at the Holborn Restaurant on Wednesday, April 26th. Mr. H. H. Perry, the President, was in the chair. Amongst the guests present were Mr. S. Z. de Ferranti, President of the Institution of Electrical Engineers; Professor J. D. Cormack, Mr. W. Duddell, F.R.S., Mr. J. S. Highfield, and Mr. Arthur Wright. Mr. S. Z. de Ferranti, in proposing the toast of "Faraday House and its Old Students," referred to the good work which had been done by Hammond College and its successor, Faraday House. Mr. Robert Hammond, in replying, reminded the company that although this was only the seventh annual dinner of the Old Students' Association, it was actually the twenty-sixth annual dinner of the old students. Mr. D. Wilson proposed the toast of "The Chairman," whilst "The Visitors" was given by Mr. A. F. Berry, and replied to by Mr. W. Duddell.



Expression on the face of a learned Judge of the Chancery Court after hearing Counsel's opening speech in a highly technical patent case.



Expression of relief on the face of the same Judge on being informed that a verbatim shorthand note would be taken.

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THE BREMER FLAME ARC LAMP PATENT

Action by the Westinghouse Co. Against the Electrical Co.

AN action of considerable interest in which the British Westinghouse Co. are proceeding against the Electrical Co. for alleged infringement of the Bremer flame arc lamp, patent No. 18,786 of 1902, commenced before Mr. Justice Swinfen Eady on Thursday.

In spite of the Appeal Court decision, which upheld the validity of the Bremer patent (ELECTRICAL ENGINEERING, Vol. VI., p. 122), the defendants not only deny infringement, but also contend that the patent is invalid owing to anticipation and want of subject-matter. The patents quoted as anticipations include most of those mentioned in the defence to the action against Mr. Braulik (ELECTRICAL ENGINEERING, Vol. V., p. 617), with some additional ones, making 8 British, 3 United States, 1 French, and 2 German. As in the action against Mr. Braulik, the United States specifications of Graham No. 268,218 of 1882 and Crosby No. 553,335 of 1896 are chiefly relied upon.

The Bremer patent, No. 18,786 of 1902, relates to the feeding of the carbons in arc lamps of the converging carbon pattern. The patent—as amended in December, 1907, when one of the claims was struck out and a disclaiming note added—describes mechanism for the purpose of obtaining a lateral movement of one or both carbons in addition to the downward feeding motion. Two alternative mechanisms are described in the specification, and the accompanying figures are reproduced below in Fig. 1. The first consists of an arm which bears against one carbon. An armature attached to the upper end is attracted by an electro-magnet connected in shunt across the arc, and this end also holds the detent, which engages with a star-wheel geared to the feeding-cord drum. If the arc lengthens, the armature is attracted to the magnet, and the swinging carbon pushed towards the other carbon, and this action is continued until the armature has moved to such a point that the star-wheel is released. Feeding then takes place. In the second mechanism, shown in the two right-hand figures, the swinging carbon is

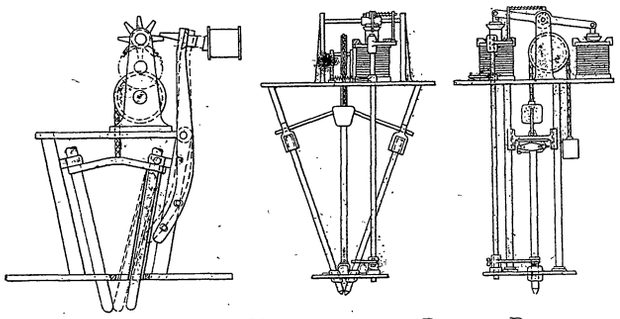


FIG. 1.—THE THREE FIGURES OF THE BREMER PATENT, No. 18,786/02.

moved by means of a loose collar near its burning end, this movement being controlled by a vertical shaft which is given a rotary motion by means of the differential action of the shunt and series coils.

The single claim attached to the specification is as follows:—

An arc lamp having downwardly pointing electrodes and provided with both downward and horizontal feed mechanism, so arranged that a certain amount of operation of the horizontal feed mechanism takes place before the downward feed mechanism is permitted to operate, subject to the disclaiming note.

The disclaiming note reads as follows:—The lamps to which my invention applies are of the type in which the current is supplied to the electrodes through electrode-holders, in which the upper ends of the electrodes are firmly clipped, and which are capable of being lowered simultaneously through the same distance, and about one of which the corresponding electrode can swing under the action of a device acting near its lower end, and I limit my claim to lamps of this description.

Mr. A. J. WALTER, K.C., opening the case for the Westinghouse Co., reminded the Judge that the patent had already been certified by the Court of Appeal in the previous case; yet the present defendants, the Electrical Co., were suggesting the same documents as anticipation of the patent as before, plus a large number of "eccentricities," unearthed from the Patent Office Library. He then reviewed the contents of the patent, and next exhibited a drawing (Fig. 2, opposite) of the alleged infringement—the "Sunshine" arc lamp sold by the Electrical Co. He explained that the carbons, which are inclined to one another, descend in a swinging frame which is pivoted top and bottom, and is caused to rock by the downward movement of an arm at the end of an oscillating lever. He contended that the mechanism contained every essential element of the Bremer specification—one of the carbons swung by a device acting at its lower end and the horizontal feed mechanism.

Mr. JAMES SWINBURNE, F.R.S., was the only witness put in by the plaintiffs. He said, in answer to questions put by Mr. Walter, that the special point in the Bremer patent was the downward feed of the carbon, that is to say, they were fed axially; there was no draw-back, and the end of one carbon was moved horizontally in either direction by the mechanism, and the two movements were so connected that an excessive horizontal movement resulted in a subsequent vertical feed, but a horizontal movement of the tips away from each other did not produce a reverse vertical movement. He endorsed the statements made by Mr. Walter as to the points of similarity between the defendants' lamps and that described in the Bremer patent, and said that, in his view, the modifications were mere additions, and not alterations in the principle of the lamp as invented by Bremer. Mr. Swinburne was then cross-examined at great length by Mr. Bousfield, the cross-examination being only concluded on Friday afternoon.

Mr. W. R. BOUSFIELD, K.C., then addressed the Court on behalf of the Electrical Co. on Friday. He said that much was made of the conditions necessary for introducing regularity in the burning of arc lamps with inclined carbons, but the electrical problem was precisely the same as with vertical carbons. The whole solution of this difficulty was to be found in lamps designed long before 1889; in the early 'eighties, he

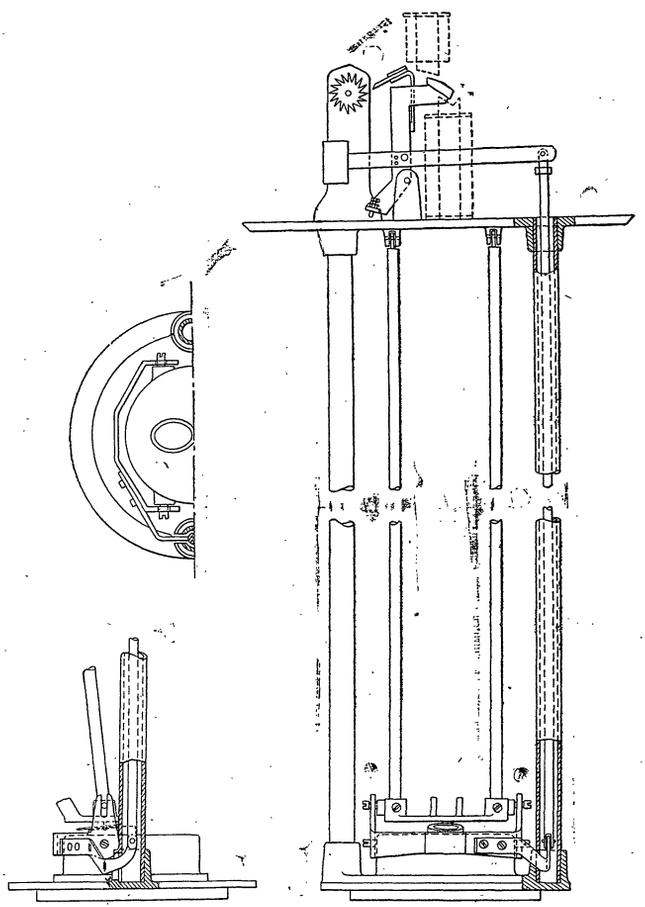


FIG. 2.—DRAWING OF THE ALLEGED INFRINGEMENT.

contended, vertical carbon lamps were made with this retractile motion, and the details were all given in lectures before the Society of Arts by Prof. S. P. Thompson in 1889. Bremer had merely applied an existing idea to an inclined carbon lamp, and despite the decision of the Court of Appeal he denied that this constituted invention. Mr. Bousfield's next point was that the drawings in the Bremer specification were admittedly unintelligible, and that a lamp having the advantages claimed in the specification could not be made from them. As a sample of the lamp made under the Bremer patent, the Westinghouse Co. had produced an Excello lamp, sold in this country by the Union Electric Co., which was quite different to the lamp described in the Bremer specification, and also different to the lamp of the Electrical Co. The alleged infringing lamp had a pivoted frame and not pivoted carbons, so that, no matter how much the carbon was burned, the movement at the end

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of the carbon was precisely the same. Mr. Swinburne, in his cross-examination, had admitted that there was an advantage in this, viz., that the relation of the striking of the arc to the play of the armature of the magnet was always the same whatever the length of the carbon, although he had thought this advantage was neutralised by the fact that the whole of the frame was moved as well as the carbons.

Dealing in detail with the claims of the Bremer patent, Mr. Bousfield argued that the disclaiming note in the specification given above excluded from infringement any equivalent of an electrode-holder in which the electrodes are firmly clipped. In order to be able to get a monopoly for a retractile motion and horizontal strike of inclined carbons, a patentee must have invented and disclosed to the world one practicable way of carrying out the idea. But Bremer had not done this. He had merely taken one well-known thing and applied it to another well-known thing. Referring to the specifications of Graham and Crosby, he said that models had been made by simply following out the directions of the specifications, and the floating horizontal feed effect was obtained, and they could not be put on one side merely because a floating feed was not specifically mentioned by Graham and Crosby. The idea was outlined in these specifications, and the experiments had shown that in following out the instructions a lamp was obtained which was indistinguishable from the Bremer lamp in this respect.

Mr. Bousfield concluded his speech on Monday. He alleged that the Westinghouse lamps made precisely in accordance with the Bremer patent of 1902 were failures, and had to be withdrawn, and that the existing lamps were not made according to the specification. The design of the magnets had had to be changed in order to get any sort of success. In the figures of the Bremer specification the carbons were suspended in such a way that they rocked upon the suspension, and this had to be changed. Mr. Swinburne had also admitted that taking the Bremer specification, a workman could not construct a successful lamp, but would have to start over again.

Prof. J. D. CORMACK, Professor of Engineering at University College, and also at the London University, said he could find no specific mention of floating in the 1902 Bremer patent. The arrangements shown in Fig. 1 were the worst to obtain floating, whilst the other diagrams in the patent also had features which would prevent successful floating. He produced models made from the directions contained in the Graham and Crosby specifications, and demonstrated that they did get a floating feed horizontally. In the case against Mr. Braulik it had been argued that no lamps had been made in accordance with these specifications, and that therefore there was no evidence that they would work. Two models were shown of the Graham lamp, both of which had been run for 3½ hours, whilst the Crosby lamp had run for three-quarters of an hour. The latter did not run so satisfactorily as the Graham, but with all three models there was a horizontal swing before the downward feed.

Professor Cormack was cross-examined by Mr. Walter on Tuesday. He expressed the emphatic opinion that there was no advance on common knowledge at the time of Bremer's specification in any respect. He admitted that lamps made according to the Graham and Crosby specifications had not been put on the market, and also that in order to make the models from these specifications work satisfactorily slight modifications had had to be made. He further agreed with Mr. Walter that the Electrical Co.'s lamp contained every single element in the combination described in Bremer's patent, but the carbons swung with the frame instead of being pivoted on a frame. This he regarded as a distinct improvement, as it effected a much better regulation.

At the conclusion of Professor Cormack's evidence Mr. Bousfield caused some amusement by putting in the witness box Mr. J. Hunter Gray, one of the junior counsel for the Westinghouse Co. in this case, but who had appeared as junior counsel with Mr. Bousfield against the Westinghouse Co. in the application for revocation of the Bremer patent brought by Mr. Braulik. Mr. Gray was called to prove that an affidavit by Mr. Belfield, at that time in charge of the Westinghouse Patent Bureau, had been used in evidence in that case. It was a technical legal point, but was necessary in order that Mr. Bousfield could bring in as part of his case the fact that lamps originally made according to the Bremer specification had had to be withdrawn from the market owing to their unreliability, and that the present lamps on the market are made in a manner totally different from that described in the specification.

Professor S. P. Thompson, F.R.S., confirmed the main facts spoken to by Professor Cormack, and said that from the early 'eighties the majority of arc lamps had a retractile strike, and that by 1900 no less than nine-tenths of the arc lamps of the market were fitted with this movement. Even the old Brockie-Pell lamp was fitted in this way, and could easily have been made to burn flame carbons with slight modifications to secure better ventilation. A good deal of invention would be necessary to produce a satisfactory flame arc lamp if a workman were given the Bremer specification and drawings without any further instructions.

The cross-examination of Professor Thompson took place yesterday (Wednesday), and the case was still proceeding when we went to press.

THE LIFE OF METAL FILAMENT LAMPS

WITH reference to a letter in our correspondence columns on p. 175, of ELECTRICAL ENGINEERING of April 6th, taking up the subject of some recent tests of metal filament lamps of various makes carried out by the Westminster Electrical Testing Laboratory as they affected the Cryselco lamp, we have received an interesting communication from Mr. J. J. Fletcher, manager of the Osram lamp department of the General Electric Co. He remarks that as none of the Osram lamps tested had failed at the end of 2,000 hours, they had the test carried out for a further thousand hours—making 3,000 hours—and as no lamps had failed at the end of this period the test was prolonged for a further 1,000 hours—making 4,000 hours in all. One lamp failed at 3,600 hours, and the remaining three lamps were intact at the end of 4,000 hours. He comments with regard to the Cryselco tests that two lamps failed at 1,250 and 1,440 hours respectively.

Mr. Fletcher sends us some particulars of the tests of the four Osram lamps. At the commencement the average British c.p. was 21.4, and the average consumption 1·49 watts per c.p., while at the finish these figures had become 18·7 c.p. and 1·695 watts per c.p. The behaviour of the four lamps was remarkably close. During the continuance of the tests one lamp was broken in removal from the rack after 3,600 hours, but at the end of 4,000 hours the average c.p. was 18·5, and the consumption 1·72 watts per c.p.

THE LODGE WIRELESS PATENT

ON Friday last Mr. Justice Parker gave judgment in the petition of the Lodge-Muirhead Wireless & General Telegraphy Syndicate, Ltd., for an extension of the term of Patent No. 11,575 of 1897, granted to Sir Oliver Lodge. The arguments and evidence in favour of the petition were reported in our issues of April 6th and 13th.

The Judge complimented the patentee on being the first to make use of the principle of resonance, and the consequent possibility of securing that selectivity which was indispensable for practical purposes.

These methods are set forth in claims 1 and 2 of the specification.

The Judge, in taking into consideration the time and money required to put such a system on a commercial basis, and the fact that it had taken years of experimenting to obtain a satisfactory coherer, considered that the patentee had been inadequately remunerated. He thought that under Section 18 of the Patents Act, he would be justified in extending the patent on some of its claiming clauses only, and he would therefore grant an extension of seven years from the expiration of the existing patent, to be confined to claims 1, 2, 6, 7, 9, 10, and 11 of the existing patent. This grant was given on condition that the patentee should grant licences to those desiring to make use of the protected invention on terms to be arranged by a qualified representative of the Board of Trade.

Clause 11 is generally for the specific arrangement described and illustrated in the specification, and the other clauses extended are as follows :—

1. In a system of Hertzian wave telegraphy, the combination with a pair of capacity areas (of which one may be the earth) of a self-inductance coil inserted between them electrically, for the purpose of prolonging any electrical oscillations excited in the system and constituting such a system a radiator of definite frequency or pitch.

2. In a system of Hertzian wave telegraphy, the combination with a pair of capacity areas (of which one may be the earth) of a self-inductance coil inserted between them electrically for the purpose of prolonging any electrical oscillations excited in the system, and thereby enabling a distant radiator to act cumulatively if of corresponding period; thus constituting the system a resonator or absorber of definite frequency or pitch.

6. In combination, a pair of capacity areas connected by a coil of wire serving as a radiator in a system of Hertzian wave telegraphy, means for syntonising such radiator and means for charging it by aerial disruption or impulsive rush.

7. In a system of Hertzian wave telegraphy, the combination of a pair of capacity areas such as h h^1 [shown in various shapes in the drawings], means for syntonising such capacity areas, a receiving circuit completed through one or both of such capacity areas or their adjuncts, and means for bridging over the discharge gap between such capacity areas when they are to be used as a receiver whereby such capacity areas are rendered adaptable for use at will either as a radiator or resonator.

9. In a system of syntonic Hertzian wave telegraphy the combination with the self-inductance coil of the receiver of a secondary coil surrounding the same, which secondary coil forms part of the coherer circuit substantially as and for the purpose set forth.

10. The combination, in the receiving circuit of a system of Hertzian wave telegraphy, of an adjustable or replaceable self-inductance coil, connecting the capacity areas, a coherer, a battery, a telegraphic receiving instrument or a telephone with or without a shunt across the coils thereof substantially as and for the purpose set forth.

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

ELECTRIC SAFETY LAMPS

IN the exhaustive report by Prof. Redmayne on the disastrous explosion and underground fire which occurred in the Wellington Pit of the Whitehaven Colliery about a year ago, there was an interesting Note by Mr. Robert Nelson (H.M. Electrical Inspector of Mines) which has not yet received the notice it deserves, although the report has been published several weeks. It will be remembered that the most accepted theory as to the cause of the explosion and fire was that fire-damp was ignited by a safety lamp, which may or may not have been defective, and that it was carried on by means of coal dust. The explosion occurred in the neighbourhood of a "goaf," and it is suggested that a heavy fall of roof might drive a large volume of collected gas out with such force that the gauze of the lamp afforded no protection. Prof. Redmayne recommends that men working in the neighbourhood of those goaves the roof of which consists of a thick bed of hard rock, as was the case here, should be provided with electric lamps in place of the usual oil safety-lamps.

Mr. Nelson, in the Note to which we have alluded, points out that the only fundamental objection to electric safety-lamps is that they will not, unless they are fitted with a cumbrous and delicate attachment, detect the presence of explosive gas. Any other defects in electric safety-lamps are purely of a constructional nature, and can be overcome with more or less ease by applying latter-day knowledge and experience; in fact, it is safe to prophesy that the electric lamp will have superseded the Davy lamp completely in six or seven years' time, and that independent devices will be employed for the detection of fire-damp.

Of these constructional defects, Mr. Nelson particularly mentions the switching arrangements. These should, of course, not be outside the box, and if properly constructed and placed within the lantern in a gas-tight case there can be no danger from the spark or break. With primary batteries, Mr. Nelson points out that switches may be dispensed with. The cell or cells can be half full of the electrolyte, and the plates extend only half-way down, and to light the lamp the box is simply inverted to allow the liquid to surround the plates. This principle is used in the lamps supplied by the Float Lamp Co. and the Chromolyte Syndicate. Another device suggested by Mr. Nelson is the use of a dry battery loose in the box, with contacts on it which come up against contacts connected to the lamp terminals within the box when the latter is turned one way up, and fall away from them by the weight of the battery when the box is inverted. A second defect which Mr. Nelson alludes to is that most of the electric lamps on the market give a "sort of search-light effect" and poor general lighting, but this is also easily remediable by a modification in construction and the choice of a suitable lens and reflector.

Of secondary battery lamps, the Oldham and Sussmann lamps seem to be most used, and the Bristol and Lithanode lamps are also employed to some extent.

Too much has been made of the possibility of a broken lamp igniting gas. As Mr. Nelson points out, the lamp is invariably protected by an outer glass, and the liability of damage or breakage to the actual lamp is certainly less than the corresponding risk attaching to a safety lamp, the glass of which may be subjected to unusual heat, and if the latter is cracked or broken the lamp immediately becomes dangerous. In fact, the electric lamp is by far the safer of the two, for the glass of a Davy lamp may become cracked by the lamp being left tilted; or, again, the lamp may have been left burning in a gaseous mixture until the gauze becomes red hot, and the gauze and glass are easily broken by a blow from a pick. Those engaged in mining work know that, immediately after an accident, electric lamps are called for and are used rather than oil lamps.

Coming to the question of practicability in regular service, the problem has now a far different aspect to formerly by the introduction of the metal filament lamp. The question of electrical efficiency is of the very greatest importance indirectly, although the cost of energy may be practically negligible, for as the metal filament lamp takes one-third of the power of the carbon lamp for the same light, the batteries can have one-third the capacity, and therefore little more than one-third the weight of the older ones. Moreover, there is no difficulty in constructing two-volt metal filament lamps, so that single-cell secondary batteries can be employed instead of two-cell, which means the possibility of a far better mechanical construction, greater durability, and lower maintenance costs.

The colliery in this country that has done most in connection with electric lamps is the Merton Colliery, in which the Sussmann secondary battery lamp has, we believe, been in use for some fifteen years. During this prolonged trial the lamp has been gradually improved, and there is little reason to doubt that the example will now be widely followed.

We invite correspondence from makers of electric safety lamps, and from the officials of the collieries in which these lamps are employed.

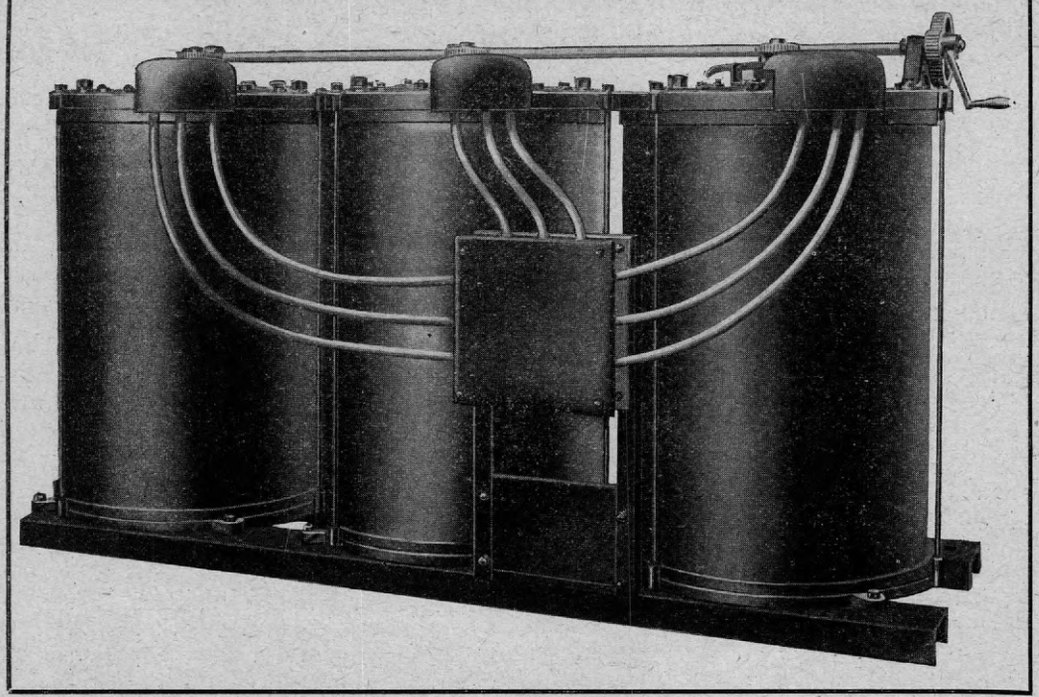
ABSENCE OF SEALING CHAMBER SUSPECTED OF CAUSING A FIRE

ON April 19th a fire occurred in a downcast shaft of the Brookhill Pit of the Pinxton Colliery Co., Derbyshire. Fortunately, the 400 men who were in the pit at the time were able to get to the surface in safety, and the fire was extinguished by rescue teams from Pinxton and Mansfield. We regret to say, that there is a well-founded suspicion that the fire was caused by a burn-out near the end of a cable supplying a pump motor. The outbreak was in a pump house, and we understand that the 3-core cable—a paper-insulated lead-covered cable working at 400 volts pressure—was connected up without there being any sealing chamber at its end, the hydroscopic paper insulation on the cores being protected from moisture in the atmosphere by a covering of tape only.

What appear to be the surrounding circumstances of this accident—heralded in the press and elsewhere as another instance of the danger attendant upon the use of electricity below ground—have been made quite familiar by experience, namely, neglect of an elementary precaution in the installation of the plant, added to failure of those in charge to realise the point or points of weakness in the plant under their care.

It is the neglect of such details, that is frequently the cause of accidents which bring electricity into disrepute for the time being in colliery practice, and, although in this case it cannot be definitely ascertained how the fire was caused, we have no hesitation in publishing the formation which we have obtained for the benefit of those, happily diminishing in numbers, who permit work to be done in collieries that is, to say the least, not in accordance with the best practice.

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THE COAL MINES BILL

A LARGE number of amendments to the Coal Mines Bill have been placed on the paper by Mr. Markham (Member for Mansfield, Notts). Several of these relate to electrical working. One of them requires that the "electrician" appointed to supervise the electrical apparatus shall be over twenty-one, and, if necessary, shall be provided with assistants. His duties, according to another amendment, would be defined as follows:—

The electrician shall be in daily attendance at the mine. He shall be responsible for the fulfilment of the following duties, which shall be carried out by him, or by an assistant, or assistants, duly appointed under Sub-section 3 of this section:—The thorough examination of all apparatus (including the testing of earth conductors and metallic coverings for continuity) as often as may be necessary to prevent danger. The examination and testing of all new apparatus, and of all apparatus removed from one position in the mine to another, before it is put into service in the new position. The electrician shall keep at the mine a log book, made up of daily log sheets kept in the prescribed form. The said log books shall be produced at any time to an inspector of mines. Should there be any fault, or leakage, of current in any circuit, the part affected shall be made dead without delay, and shall remain so until the fault has been remedied. Inflammable or explosive material shall not be stored in any room, compartment, or box containing apparatus, or in the vicinity of such apparatus. Where electricity is used for signalling, the pressure in any one circuit shall not exced 25 volts. A proper plan, on the same scale as that kept at the mine in fulfilment of the requirements of this Act, shall be kept in the office at the mine, showing the position and size of all fixed apparatus in the mine. The said plan shall be corrected as often as may be necessary to keep it reasonably up to date, and it shall be produced to an inspector of mines at any time. Haulage by electric locomotives on the overhead trolley wire system is prohibited in any part of a coal mine.

The Bill was discussed on Thursday last by a conference between the Executive Committee of the Mining Association of Great Britain, representing the coal-owners, and the Executive Committee of the Miners Federation, representing the miners. The proceedings were private, but it is understood that the prevention of danger due to the use of electricity in mines was one of the matters discussed. At the general conference of the Miners Federation on the same day it was decided that the whole question of the use of electricity in mines be referred to the Executive Committee and they be asked to draft an amending clause to be submitted to a subsequent conference.

ELECTRICAL MINING PATENTS OF APRIL

AMONG the patents published during the past month and of interest to electrical mining engineers was one (No. 9,740 of 1910) by the Float Electric Co., Ltd., and W. J. L. Sandy for a miner's electric safety lamp. The case has a flanged lid which is forced into position, until it is held by catches, by means of a press against the force of a powerful spring under the lid. The miner cannot, therefore, tamper with the lamp as a special press is needed both to open and close the case.

Specification No. 12,360 of 1910, by G. S. Bragge of Burton-on-Trent, describes a machine, which may be electrically driven, for sprinkling stone dust or other material on the floors, walls or roofs of roads or galleries in coal mines for the purpose of reducing the danger of explosions.

Specification No. 15,098 of 1910, by M. Hart of London, communicated from F. W. Bawden, of Johannesburg, describes a tool for the electric ignition of safety fuses used in blasting. It consists of a pair of pliers with double jaws. One pair of jaws has spikes which perforate the fuse and meet in the powder, while the other two have contacts which complete the circuit through the spikes where the spark ignites the powder.

An Electrical Mining Alarm.—The *Electrical Record* (Melbourne) describes an appliance which is being tested in Australia to give signals in case of small movements of roof, &c., in mines. A tripod stand has a telescopic extension terminating in a fork, which can be arranged to press against the roof. The top part is flexible, and is pressed upwards by springs, and carries a cross arm provided with contacts at each end, set to be just not touching those on a similar cross arm on the section, within which the top section slides; thus any slight movement of the roof closes one or other of the pairs of contacts, and works bells or other signals.

[*Continued on page* XXXVI.

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OFFICIAL TESTS OF A 3000-K.W. TURBO-ALTERNATOR AT BRISTOL

AS the question of steam turbine efficiencies is very much to the fore, the results of the official tests of the first of the two new 3,000-kw. impulse type three-phase turbines built by the British Westinghouse Company, Ltd., for the Bristol Corporation Electricity Department may prove of interest as showing the efficiencies obtained on turbines of this description.

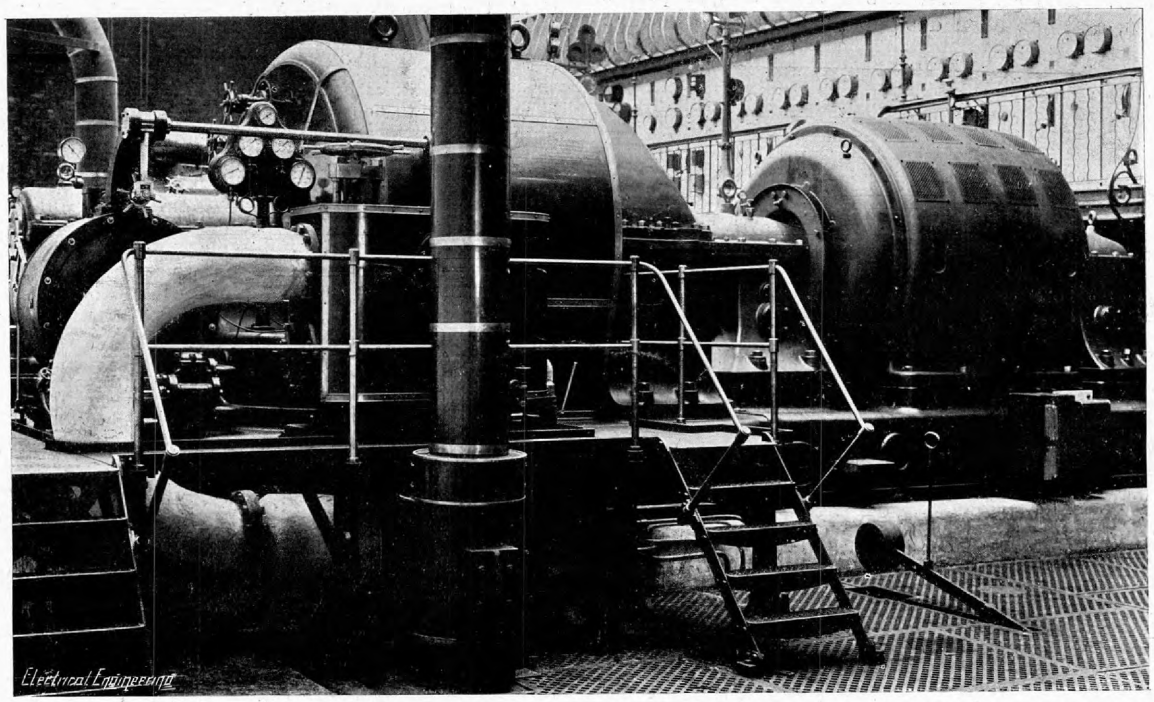


FIG. 1.—GENERAL VIEW OF 3,000-KW. WESTINGHOUSE TURBO-ALTERNATOR AT BRISTOL.

The specified conditions of test are as follows :—Normal output of turbine, 3,000 kw., three-phase, 50 periods, 6,000 to 6,600 volts. Steam pressure, 200 lbs. above atmosphere. Superheat 200° F. Vacuum, 28 in. in relation to 30 in. barometer. Speed, 1,500 r.p.m The sets are designed for an overload of 25 per cent. for two hours, or 50 per cent. for short periods. A photograph of the set is reproduced in Fig. 1. The turbine is of the design described in the ELECTRICAL ENGINEERING, April 20th, p. 205, where a detailed cross section of a similar machine was given. This type of turbine enables the use of very high steam pressures and temperatures without risk of injury to either blading or casing, as only the nozzle boxes—which are two in number—are subjected to maximum pressure and temperature. The steam expands in the nozzles from 200 lbs. per sq. in. (total temperature 590° F.) to about 45 lbs. per sq. in. pressure (the temperature being reduced to

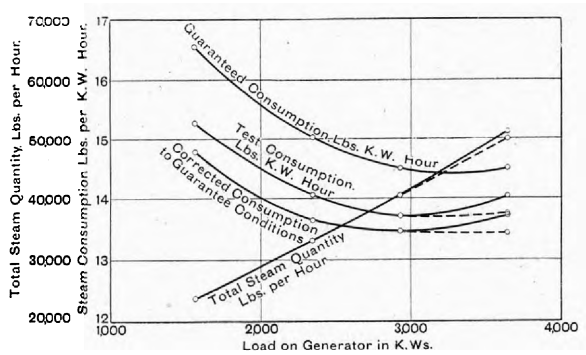


FIG. 2.—STEAM CONSUMPTION CURVES.

350° F.), the superheat and pressure being converted into kinetic energy, which is absorbed efficiently in the velocity wheel. The casing is thus subjected to comparatively low pressures and temperatures, so that no trouble is experienced due to distortion and expansion of the casing of the shaft. In addition to the nozzles capable of carrying full load, separate nozzles are provided for 25 per cent. overload and full load non-condensing. Thus, the consumption at 25 per cent. overload is even slightly better than at full load, since no steam is by-passed into a lower stage of the turbine.

The official tests were carried out at Avonbank Electricity Works, Bristol, on March 18th and 19th, 1911, by the British Westinghouse Company, in the presence of Mr. H. Faraday Proctor and other officials of the Bristol Corporation. Steam consumption tests were taken at ½, ¾, full load, and 25 per cent. over load, each for a duration of one hour, and all instruments used were specially calibrated immediately before and after the test. The following are the results obtained :—

Approximate Load	½	¾	full	1¼
Output	1563 kw.	2344·5 kw.	2930 kw.	3645 kw.
Speed	1505	1490	1500	1501
Steam Pressures...	192·5	189·2	195·4	193·6
Steam Temperature	556	560	568·1	565
Steam Superheat	171·2	176·6	182·1	179·7
Vacuum (30in. Barometer)	28·42	28·47	28·18	27·78
Circulating Water Inlet	41° F.	41°	43°	41°
Circulating Water Outlet	59°	61°	64°	66°
Energy for Air and Circulating Pumps ...	45 kw.	46 kw.	48 kw.	46 kw.
Steam Consumption. Total ...	23,887 lbs.	33,015 lbs.	40,200 lbs.	51,171 lbs.
Steam Consumption, lbs. per kw. hour	15·28	14·08	13·72	14·03
Ditto, corrected for 200 lbs. pressure 200° F. superheat (Vacuum as during test)	14·78	13·64	13·47	13·71

The corrections allowed for variations in the steam pressure and temperature as from the specified conditions are 1 per cent for 10 lbs. pressure, and 0·9 per cent. for 10° F. superheat. No corrections have been made for vacuum as contractor has benefit of more than 28 in. with Bar. 30 in. Fig. 2 shows the result of the tests in diagrammatic form. Due to an error when the overload test was made, the by-pass valve for running the turbine non-condensing was open instead of the valve provided for 25 per cent. overload. The dotted lines in the diagram show the results which would have resulted under proper conditions. The generator is separately excited from a 100-volt exciting system, the field absorbing from 276 amperes at 51 volts at half load, to 291 amperes at 55 volts at 25 per cent. overload.

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THE THOMAS TRANSMISSION

A 3,000-MILES road trial is being carried out by the Royal Automobile Club of a lorry to carry a load of three tons, fitted with a form of transmission gear which is partly electrical and partly mechanical. The gear presents several unique points of interest, and has been designed by Mr. G. Thomas.



FIG. 1.—VIEW OF TEST VEHICLE.

The lorry was entered for the trial by The Thomas Transmission, Ltd. (14 Leonard Place, Kensington), and apart from the nature of the vehicle itself the trial is of interest as being the first time a heavy commercial vehicle has been subjected to a test of this kind by the R.A.C. The route is exceptionally hilly, and the trial consists of continuous trips day and night from Cooper's Green, near Uckfield, to Bromley Common, about thirty-seven miles, viâ Tonbridge and Sevenoaks. The most serious incline is River Hill, parts of which are said to be 1 in 6½. A photograph of the vehicle, which weighs about 7 tons 15 cwt. with passengers and load, is given in Fig. 1.

Before describing the actual vehicle, we must explain the general principle of the transmission gear, which is shown diagrammatically in Fig. 2. The arrangement of the parts in a touring car chassis is seen in Fig. 3. The engine drives a casing D forming the flywheel, which contains a double system of epicyclic gearing arranged as shown, with one central pinion W keyed to the inner shaft H, which is the actual propeller shaft, and the other, W_1, of smaller diameter, mounted on the sleeve K. Each pair of surrounding "planet" pinions are keyed to the same spindles. Two identical electrical machines, acting as we shall see sometimes as dynamos and sometimes as motors, have their armatures mounted respectively on K and H, and their fields fixed to the chassis. These machines are series wound, and are connected permanently in series. There are two paths of power between the engine and the road wheels—a direct mechanical path from W along the shaft H, and an electrical path through the two electrical machines BB_1 and CC_1. If W is larger than W_1, then for a certain rotation of the casing, W_1 will tend to rotate backwards and W forwards, at speeds depending upon their relative resistances to motion. If the speed of D is constant, the speed of H will vary with the speed of K, and since the speed of K depends on its resistance to motion and therefore on the load on the machine BB_1, the speed of H can be varied by the variation of power transmitted electrically.

The actual series of operations is as follows:—The casing D is rotated by the engine at a speed controlled by the throttle. Before starting, W_1 will rotate freely backwards and W remain stationary. To start the vehicle current is taken from BB_1 to CC_1—this has a double effect on the load shaft H. The current

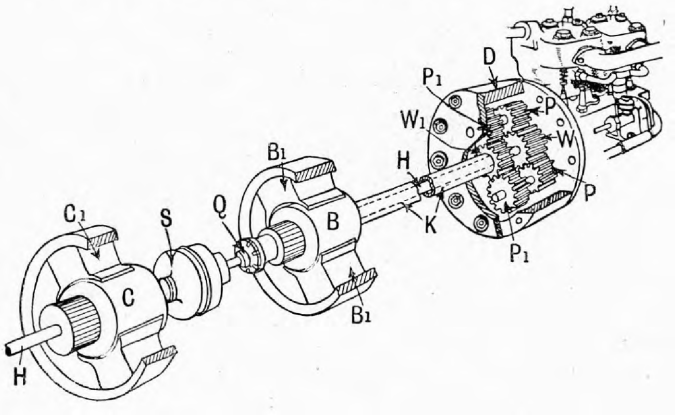


FIG. 2.—DIAGRAM SHOWING PRINCIPLE OF THE THOMAS TRANSMISSION SYSTEM.

transmitted to CC_1 exerts a large starting torque on H and the loading of BB_1 with this current decreases the speed of K, and therefore causes W to rotate. In this manner a large starting torque is exerted on the road wheels. As BB_1 is gradually decreased in speed by controlling the relative fields of the machines, the vehicle increases in speed until K practically comes to rest. Up to this point BB_1 has been acting as dynamo and CC_1 as motor. If now K is forced to rotate against and in the same direction as the engine it is evident that H can still further be increased in speed. This operation is performed by transmitting power from CC_1 to BB_1—both machines now changing their functions. K increases in speed more rapidly than H, due to the gear ratio, until finally they are both travelling at the same speed. The coupling Q is then engaged, with the result that the current in the electric circuit dies down to zero.

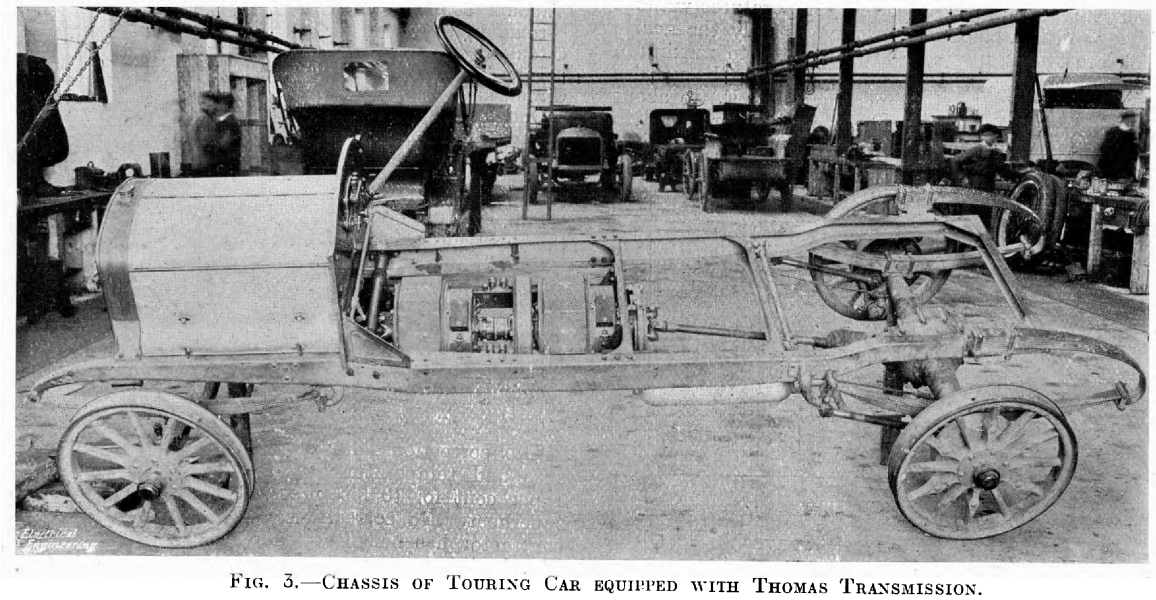


FIG. 3.—CHASSIS OF TOURING CAR EQUIPPED WITH THOMAS TRANSMISSION.

All electrical losses are thus eliminated and a direct drive is obtained from the engine to the road wheels as a top speed. The control is effected by a single lever working a controller which regulates the relation of the field strength of the two machines by suitable diverting resistances, and also in its top speed position controls the engagement of the jaw clutch Q. It has, in addition to 10 intermediate electrical positions or

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"speeds," the top speed position, a position for converting one of the machines to shunt connections, and inserting suitable resistances for charging the small battery which is carried, and a position in which this battery drives one of the machines as a motor to start the engine from the driver's seat, and a reverse position, reversing the connections of one machine and letting the other drive it backwards with the jaw clutch in and the cone clutch (which is controlled by a pedal) out.

One of the main points of the system is the possibility of so many graded variations of torque ratio, providing very nearly the equivalent of a continuously variable gear ratio. The engine can consequently be run always under the best conditions, resulting in the possibility of using a smaller engine than would otherwise be required, and a great gain in petrol consumption. The efficiency is much higher than in those systems where the whole of the power is transmitted electrically, as the electrical losses are only a percentage of that part of the power transmitted electrically. The electrical efficiency is highest at the half-way point, where one machine is stationary, and then amounts to about 94 per cent. On the lowest speed running notch it is about 80 per cent., and on the highest electrical notch about 86 per cent. The current in the machines is practically constant, and there is no possibility of an armature burning out through being overloaded. The weight of the equipment is certainly heavier than that of the ordinary gear-box, but this is more than counterbalanced by the efficient conditions under which the engine works, as has been shown by hill-climbing tests with cars with identical chassis, one with an ordinary gear-box and one with this system, the latter proving 20 per cent. faster. Again, a smaller engine can be used, and it can be given higher compression, as it can run at practically constant speed, and it must not be forgotten that a complete electric lighting equipment is incidentally provided. The size of the electrical machines is determined by the torque range required, and in machines for hilly roads these are not larger than motors for one-third the continuous output of the engine.

The particular vehicle being tested by the R.A.C. is adapted from a standard 36/40-h.p. Leyland chassis, with engine 4¾ ins. bore. The motors, which are thoroughly dust-tight, weigh from 5 to 6 cwt. each. They have six poles each, and were made to Mr. Thomas's designs by Messrs. Mawdsley's, Ltd. (Dursley, Glos.), and, using entirely single-turn coils, are very free from sparking. The controller was made by Cowans, Ltd., and weighs about ½ cwt. It is fully enclosed, with all contacts and resistances under oil. A 180-ampere hour 12-volt Tudor battery is carried for starting the engine and supplying the lamps. During the trial this has been put on charge only on downhill stretches, but has been able to run the lights for 8 hours every night. The total weight is 7 tons 15 cwt., including chassis, accessories, passengers, and 3 tons 7 cwt. of sand. Previous tests in Lancashire have shown a petrol consumption of 9·7 tons per gallon fully loaded, but the result of this trial will not be as good, as the road is exceptionally hilly, and the R.A.C. observers do not allow the speed ever to exceed 12 m.p.h.

The system has been applied to touring cars, and we can speak from experience of the excellent running of one of these, and an experimental railway coach equipped on the same principle is now being tested. Space forbids us to enter in further particulars, but in conclusion we wish to express our thanks to Mr. G. Thomas and to Mr. Thompson, of the Thomas Transmission, Ltd., for their courtesy in demonstrating the system to us, and their hospitality on the occasion of our visit to Sevenoaks to see the trial vehicle and a lighter car equipped with the transmission.

AN IMPULSE-DISC AND DRUM MIXED PRESSURE TURBO SET AT BRIDLINGTON

AMONG recent tendencies in turbine design, one of the most important is the combined impulse and reaction turbine. A fine example is presented in the machine which Messrs. Willans & Robinson, Ltd., of Rugby, who have adopted this design as their standard for all high pressure and mixed pressure work, and are supplying them in increasing numbers to colliery installations, have supplied to the power station of the Bridlington Corporation, to the specification of Mr. A. J. Beckett, the Borough Electrical Engineer.

It consists of a wheel carrying the high pressure impulse blading and a drum on which is mounted the low pressure reaction blading. Two inlets are provided, one for the high steam, and one for low pressure steam, and the admission is controlled in both cases by throttle valves. The governing arrangements are remarkably simple, as both throttles are actuated direct by the centrifugal governor.

The generator is of the standard continuous-current type made by Siemens Brothers Dynamo Works, fitted with ventilated commutator, and having a normal output of 300 kw. at 440 to 500 volts, when running at a speed of 2,700 r.p.m. The full output can be obtained when the turbine is supplied with exhaust steam from the existing engines, or any mixture of exhaust and live steam. No live steam is admitted until after all the exhaust steam available is being utilised. The turbine will also give its full load, 25 per cent. overload, and a non-condensing output of 250 kw. on live steam.

Although the plant has not been installed for more than a short period, very satisfactory economies are being obtained with the combined plant as compared with the engine-driven sets alone. When running on high pressure steam, the results are much better than when the engines alone were run condensing. In changing over from high to low pressure, the speed variation does not exceed 1 to 2 per cent. as a maximum. Other points worth noticing are the absence of vibration and the excellence of the bearing design and oil cooling arrangements.

We are informed that Messrs. Willans & Robinson, Ltd., have installed a large number of similar machines which are giving equally good results. Among those working at collieries may be mentioned the mixed pressure sets at the Blairhall Colliery, Fife, the Rothervale Collieries, near Sheffield, and the Tredegar Coal & Iron Co.'s Collieries in South Wales; also the plain exhaust set at the Pleasley Colliery, near Nottingham.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ALUMINIUM v. COPPER CABLES.—The British Aluminium Co., Ltd. (109 Queen Victoria Street, E.C.), have sent us a table giving the aluminium equivalents and standard sizes of low-tension paper-insulated lead-covered cables—calculated in accordance with the standards of the Engineering Standards Committee for all sizes from the equivalents of 0·025 to 1 sq. in. copper. The table gives dielectric and lead thicknesses and weights, and should be of considerable service to those considering the question of using aluminium cables, and it may be taken as an appendix to the articles published in our issues of November 24th and February 9th last. The company also send a curve showing the saving arrived at by using aluminium cable at about present prices of aluminium and copper, and ask us to say that they will be pleased to send copies of both the table and curve to any of our readers who may be interested.

TELEPHONES AND BELLS.—The Sterling Telephone & Electric Co., Ltd. (200 Upper Thames Street, E.C.), have sent us the revised edition of their abridged catalogue, dealing with equipments of all kinds for telephones, including their wonderful "Primax System" of intercommunication, designed to reduce cross-talk to a minimum.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

METALLIC DIMMERS.—A pamphlet from the Adams Manufacturing Co., Ltd., Bedford, deals with their Igranic Metallic Theatre Dimmers. They consist of a resistance divided up into a number of small steps, so that the lamps can be made to glow or fade gradually. They are worked by means of a lever working on a rigid rod drive. Any combination of lamps can be worked by a method of interlocking by means of a master lever, connection being made by half a turn of the lever. We understand the company have obtained a contract for a complete installation of these dimmers for one of the largest theatres in St. Petersburg.

INSTALLATION ACCESSORIES.—Two catalogues have reached us from Messrs. Siemens Bros. Dynamo Works, Ltd. (Supply Department, 39 Upper Thames Street, E.C.), chiefly illustrating various types of tumbler switches and lampholders. Included in these are the latest forms of the Watkin switch. Another feature is an insulated switch lampholder, for which a patent is being applied, consisting of a fireproof insulating case enclosing the porcelain interior of a switch lampholder. The illustrations, which number some 150, show the following sections very clearly: Ceiling roses, porcelain connectors, electric heaters, fuse-boards, cut-outs, the Fuller electric geyser, various wall plugs, and insulators.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—Member: H. B. White. Associate Members: R. Ayton, J. H. Bell, W. Bowen, G. B. Burrows, J. Carnie, W. W. Crompton, E. P. Elwin, E. Henkhe, W. J. Henry, C. H. Hird, W. Hodson, R. S. Hubbell, E. Hughes, A. Hutcheson, S. B. Iyengar, A. W. Maley, F. M. Ward, R. H. Wilkinson. Associate: H. C. Townsend. Students: A. H. Barrett, E. F. Boynton, D. D. Campbell, S. A. Campbell, K. C. Mittra, E. Potter, R. W. Shackell.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published April 27th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

30,602/09. **Accumulator Separators.** P. MARINO (London). Separators for storage batteries in which the plates are packed closely together consist of woven fabric of animal or vegetable fibre (wool or cotton) treated to strengthen it and protect it from the action of the electrolyte by immersing the material in an alkaline silicate bath and then in a bath of dilute sulphuric acid, finally coating it with a thin film of gutta-percha, india-rubber or celluloid. The fabric retains its porosity, and enables a very low internal cell resistance to be reached.

2,829/10. **Heating and Cooking.** G. G. BELL (London). This specification describes a combined electric water-heater, oven, and heat-conserving apparatus, consisting of a large mass of material of high specific heat and a good heat conductor with an electric heating element embedded in it, and a hollow space in the mass to form an oven. Two figures.

9,097/10. **Lift Controller.** ADAMS MANUFACTURING CO., LTD. (*Cutler Hammer Manufacturing Co., U.S.A.*). A controller for lift and other motors provided with an automatic device to slow down the motor before the circuit is opened, is further provided with a device to disconnect the motor from the supply automatically if the slow-down mechanism fails to work, thus ensuring that the motor will have sufficient time to come to rest before the limit of travel of the lift is reached. One diagram.

10,790/10. **Flux for Soldering Aluminium.** W. FRIES (Berlin). A flux for soldering aluminium consists of a mixture of 90 parts of chloride or hypochlorite of zinc and 10 parts of common salt, and an addition of from 2 to 20 per cent. of iron oxide. The specification describes the method of using the flux, which removes the film of oxide, enabling the solder to unite with the metal.

11,602/10. **Telephone Relay.** R. A. FESSENDEN (*Brant Rock, U.S.A.*). The weak received currents pass through the coils of a receiver on the diaphragm of which is a silicon button in contact with a brass pin. This contact is in a local circuit containing a battery and an ordinary telephone receiver. Two figures.

13,528/10. **Arc Lamp.** H. E. MOUL (London). A feeding mechanism for flame arc lamps of the converging carbon pattern, allows one carbon to feed gradually, but the other at intervals, so that it drops suddenly and rubs off any slag or deposit from the tips. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: JANDUS ARC LAMP & ELECTRIC CO. and JONES, 15,807/10; MICHOTTE, 28,888/10; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Vapour devices] 3,268/11.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: VON PINDTERSHOFEN [Cables] 14,496/10.

Dynamos, Motors and Transformers: LAYTON [Generating systems] 12,261/10; WARBURTON [Combined reciprocating engines and turbo-generator plant with motors for driving ships, &c.] 18,307/10; SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens-Schuckertwerke Ges.*) [Polyphase induction generators] 23,634/10; SIEMENS BROS. DYNAMO WORKS, LTD., KIEFFER and KLOSS [Ventilation of machines] 2,317/11.

Electric Ignition: LAMPLOUGH [Sparking-plug] 12,856/10; R. BOSCH, 20,968/10; RENO and BLOIS [Distributor] 21,949/10.

Electrochemistry and Electrometallurgy: COWPER-COLES [Electro-deposition of iron] 9,082/10; WALKER and SEAMAN [Electroplating] 9,129/10; HENRI, HEILBRONNER and VON RECKLINGHAUSEN [Sterilisation of liquids] 14,127/10; REID [Regulating electrodes of furnaces] 19,805/10; HEIL [Primary cells] 207/11.

Incandescent Lamps: BRITISH THOMSON-HOUSTON CO. and GRAY, 8,984/10; GRIGGAL and BRITISH VITRITE WORKS, LTD. [Manufacture of lamp bases] 8,988/10; MALACHOWSKI [Manufacture of lamps] 10,041/10.

Storage Batteries: JOHN and BERRY [Non-spillable vents] 17,308/10.

Switchgear, Fuses, and Fittings: HIRST and BROOK [Motor starters] 5,765/10; BOOTH [Connection of incandescent lamps in series] 8,371/10; SMITH and LARSEN [Motor controllers] 15,343/10; BULLIMORE and A. C. COSSER, LTD. [H.-T. condenser] 15,873/10; BERRY and MARKHAM [Insulating parts of switches] 22,380/10; CROSHER [Connecting wires to lamp-holders] 1,614/11.

Telephony and Telegraphy: COLWILL [Sound-proof telephone box] 9,326/10; SOC. DES TELEGRAPHES MULTIPLEX (SYSTEME E. MERCADIER) [Mono-telephonic relays] 29,271/10.

Traction: ANGUS [Preventing collisions] 756/10; HADFIELD [Tramway points] 8,834/10; SEFTON-JONES (*Soc. pour l'Exploitation des Brevets d'Aiguillage Samaia*) [Tramway points] 8,863/10 and 27,487/10.

Miscellaneous: BRIGHTMAN [Automatic temperature control] 1,943/10; REILLY [Electric alarm and lock for tills, &c.] 8,743-4/10; BROWN, BOVERI ET CIE. [Operation of pumps and compressors] 9,201/10; BRITISH INSULATED & HELSBY CABLES, LTD., and BUCHER [Jointing sheet-metal articles] 11,003/10; LAXTON [Combined fire alarm and bell push] 14,985/10; BENTLEY [Electric clocks] 19,044/10; LUCAS and EDWARDS [Electric horns] 22,482/10; FREUND [Electrically controlled bell-ringing mechanism] 30,397/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distributing Systems, &c.: SOC. VEDOVELLI PRIESTLEY ET CIE. [Suspension chain for H.-T. transmission wires] 27,174/10; HULTMAN [Cable drums and channels] 5,812/11.

Dynamos, &c.: ALEXANDERSON [Control of A.-C. motors] 8,149/11.

Incandescent Lamps: SCHILLING [Cementing process for lamp filaments] 23,640/10.

Instruments: H. ARON ELEKTRICITÄTS-ZAHLER FABRIK GES. [Prepayment meters] 3,450/11.

Telegraphy: GOLDSCHMIDT [Wireless telegraphy] 8,387/11.

Opposition to Grant of Patents

6,700/10. **Blowers.** W. MULHOLLAND. The grant of this patent is opposed. The specification describes a particular construction and arrangement of the blades of centrifugal fans with axial suction and circumferential discharge, which is claimed to obviate the partial vacuum behind the blades and to increase the efficiency of the blower.

28,210/09. **Advertising Sign.** A. W. LEONARD. An appeal has been lodged against the decision of the Comptroller-General granting this patent. The patent covers an electrically-driven and illuminated advertising device in which transparent advertisements are exhibited successively through apertures in a box.

Extension of Term

11,575 of May 10th, 1897. **Wireless Telegraphy.** SIR OLIVER LODGE. This patent would, in the ordinary course, expire on Wednesday next, but its term of life has been extended for another seven years. Mr. Justice Parker's judgment granting this extension is given on another page.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:

11,695 of May 11th, 1897. **Iron-nickel Alloy.** J. C. MEWBURN (*Soc. Anon. de Commentry-Fourch-ambault*). This patent covers an alloy of iron containing 37 per cent. of nickel, which does not expand when heated. It is used for leading-in wires in incandescent lamps, for parts of fire-alarms and of instruments, and for other purposes.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, &c.: G. W. MASCORD [Electric driving of printing machinery, &c.] 727/04; G. E. GAIFFE [Magneto generator for therapeutic purposes] 890/06; C. A. PARSONS [Cooling of armatures and transformers] 1,068/06.

Electric Ignition: F. R. SIMMS, 909/02; ELECTRIC IGNITION CO. and F. H. HALL [Sparking-plug] 735/06.

Instruments, &c.: V. FEENY (*Allgemeine Elektricitäts Ges.*) [A.-C. induction meter] 683/00.

Switchgear, &c.: W. H. BOWLEY [Jointing flexible metallic tubing to conduit fittings] 632/03; BRITISH THOMSON-HOUSTON CO. and E. B WEDMORE [Overload and reverse current relays] 718/05; P. H. THOMAS [Mercury-vapour rectifier] 222/06.

Traction: F. C. NEWELL [Wheel brakes operated by magnetic track brakes] 998/01; W. and T. W. PHILIPSON [Brakes] 928/03; W. WARNER [Rail-joints] 1,009/03; F. L. CLARK [Air brakes] 901/04; A. NEELEMANS [Electric signalling system] 1,095/04.

Miscellaneous: H. H. CUMMINGS [Electric aim recording shooting apparatus] 745/03; S. C. DAVIDSON (SIROCCO ENGINEERING WORKS) [Electric fan equipments for mine and tunnel ventilation] 926/04; H. PFEIFFER [Submarine boat amusement device as at the "White City"] 1,098/04; H. CRUSE [Steam superheaters] 548/05.

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THE ELECTRICAL TRADES BENEVOLENT INSTITUTION

A STRONG appeal was made for donations and subscriptions at the Festival Dinner of the Electrical Trades Benevolent Institution on Wednesday last week. Lord Justice Fletcher Moulton, K.C., F.R.S., presided, and was supported by the majority of the members of the Committee of Management and a number of subscribers to the fund and others.

Lord Justice FLETCHER MOULTON explained that he took the chair in the absence abroad of Sir William H. Preece. His own entry into the scientific world had been due to Sir William Preece, who had come to him in an endeavour to find something more convincing than an affidavit of seventeen men to prove that a telephone was a telegraph. He next had to represent the whole of the electrical industry in connection with the first Electric Lighting Bill (1882), and referred to the niggardly action of the municipalities at that time in crippling the industry by the purchase clause in that Act. In fact, he had had to do with the industry since it was an isolated patch of human thought until it had got to a position in which it seemed as if it would do all the higher class of work of the world. The industry required trained men, almost as many officers as men, and between the officers and artisans were the intermediate class who, if they were not scientific men were scientific workmen. It was these largely that the fund would be destined to help. The best charity included individual examination of cases, and this personal element was one of the features which was practised by the Electrical Trades Benevolent Institution, and enabled it to do good work.

Mr. HUGO HIRST enlarged further on the function of the Benevolent Institution in the important work of giving temporary relief until employment should be found. The fund was particularly intended to assist the staffs of firms who were neither capitalists, nor working men who could rely on their unions for support. Ninety per cent. of those in adversity had not themselves to blame, for there were frequently rapid changes in ways and methods in an industry such as ours which only those financially strong could withstand. To such, temporary relief meant the possibility of a fresh start. He suggested that members of the staffs of firms should be encouraged to collect subscriptions to the fund by prizes being offered for the best results.

Mr. A. J. WALTER, K.C., followed with an eloquent appeal.

At the close of the dinner it was announced that the contributions collected had been £520, of which no less than £240 had been subscribed at the dinner.

The following is a complete list of donations and subscriptions received or promised at the dinner. Subscriptions are marked with an asterisk.

Further contributions received will be announced in our columns.

	£	s.	d.
Rt. Hon. Lord Justice Fletcher Moulton ...	10	10	0
Bazire, A.	1	1	0
Kingsbury, J. E.	1	1	0
Buck & Hickman, Ltd. ...	1	1	0
Sterling Telephone & Electric Co.	3	3	0
Burney, Guy	2	2	0*
Handcock & Dykes ...	1	1	0*
Webb, J. W.	1	1	0
London Electric Firm, The	2	2	0
Peel, C.		10	6*
Wilkinson, H. D. ...	1	1	0*
Steinitz, J. J.	1	1	0*
Siddeley, H. C.	1	1	0*
Levinger, Max	1	1	0*
Hextall, G. B.	1	1	0*
Oberlander, Otto	1	1	0*
Armorduct Manufacturing Co.	2	2	0*
Schmahl, W.	2	2	0*
Goddard, J. T.	1	1	0
Spicer & Pegler	1	1	0
McDougall, Ltd.	1	1	0
Thurnauer, L.	1	1	0
Tasker, W. Howard ...	1	1	0
Wolf, A.	1	0	0
Barfield, E. P.	1	1	0
Thomson, W. C.	1	1	0
Raworth, J. S.	2	2	0
Eck, Justus	2	0	0
Nalder, F. H.	1	1	0
Garcke, Emile	5	5	0
Hart Accumulator Co., Ltd.	10	10	0
Boulton, G. & Sons ...		10	6
Locke, Lancaster & Sons, Ltd.	1	1	0
Spies Bros. & Co. ...	1	1	0
Hurst, A. & Co.	1	1	0
Wallach Bros., Ltd. ...	1	1	0
Holmes, F. J.	1	1	0
Brundle, F. H.		10	6
Hay, G.	1	1	0
Worrell & Baynes ...		10	6
Esdaile & Co., Ltd. ...	1	1	0
Meyer, M. L.		10	6
Clark, E. J.	1	1	0
Tasker, W. H.		10	6
Blackwood, J. A. ...	2	2	0
Cooper, W. R.	2	2	0
Walter, Arthur J. ...	5	5	0
Howe, J. W.		10	6
Greene, F. A.	1	1	0
Harris, A. F.		10	6
Hecht, J. S.	1	1	0
Pell, W. M. D.	1	1	0
Jandus Arc Lamp & Electric Co., Ltd. ...	2	2	0
Gibson, J. D.	1	1	0*
Longbottom, B.	2	2	0*
Berry, H. H.	1	1	0*
Attwood, Reginald G. ...		5	0
Benest, F. E.	1	1	0
Bevan, Edward		5	0
Raphael, F. C.	1	11	6
Sanderson, O. F. ...		10	0
Jacobs, C. M.		10	6
Benjamin, H. L.	2	2	0
Samuelson, F.	1	1	0
Pirelli, Ltd.	2	2	0
Krausse & Auerbach ...	1	1	0
Hughman, R. W.	1	1	0*
Zettel, Theo		10	6
Sheppard, E. G. ...		10	6
New, Max	1	1	0
Davenport, Walter ...	1	1	0
Rich, Theodore		10	6
Bright, Chas.	1	1	0
Ruthven-Murray, E. T. ...	1	1	0
General Electric Co., Ltd.	31	10	0
Osram Lamp Works, Ltd.	26	5	0
Robertson Electric Lamps, Ltd.	15	15	0
Aron Electricity Meter, Ltd.	10	10	0
Peel-Conner Telephone Works, Ltd.	5	5	0
Hirst, Hugo	10	10	0
Byng, E. G.	10	10	0
British Thomson-Houston Co., Ltd.	21	0	0
N. J. Fenner & H. B. Alder & Co.		5	0
Sun Electrical Co., Ltd.	5	5	0
"Electrical Review" ...	10	10	0

The following had been received previously during 1911.

	£	s.	d.
Byng, Gustav, Trustees of the late	100	0	0
Pilkington Bros., Ltd. ...		10	6*
General Electric Co. ...	10	0	0
International Trades Exhibition, Ltd.	5	5	0
Ferranti, Ltd.	5	5	0*
Bishop, O. H.	1	1	0*
Ruberoid Co., Ltd. ...	1	0	0*
Kapp, Gisbert, Dr. ...	1	1	0*
Samuelson, A. G. B. ...	2	2	0*
Hunt & Co., R., Ltd. ...	1	1	0*
Golden, R. E.		10	6
Home & Rowland ...	1	1	0
Stolzenberg Patent File Co.	1	1	0
Baughan, A. H.		10	6
Moul, H. E.	1	1	0
Facsimile Letter Printing Co., Ltd.		10	6
Cantie Switch Manufacturing Co.	1	1	0
Willcox, W. H., & Co., Ltd.	2	2	0*
Marshall, E.		10	6*
Reynolds, T., & Co., Ltd.		10	6
Waddie, T., & Co., Ltd.		10	6
Redmayne, L.		10	6
Crampton & Sons, Ltd. ...		10	6*
Hardy & Padmore, Ltd.		10	6
Thacker, F. C.		10	6
Barkham, C.		10	6
Wedekind, J. E.		10	6
Conradty, C.	3	0	0
Sloan Electrical Co. ...	2	2	0
Unwin Bros., Ltd. ...	1	1	0
Glaholm & Robson, Ltd.		5	0
Turners & Manville, Ltd.	1	1	0*
Champion, H. C.		5	0
Chaplin, H., & Co. ...	1	1	0
Gabriel Lamp Co. ...		10	6
Leftwich & Co.		10	6
Cook, A. G. H.		5	0
Voigt & Haeffner	2	0	0
"Anonymous"		10	0
Korting & Mathieson, Ltd.	2	0	0
Wearing, A. B.		2	6
Hartmann & Braun, Ltd.	2	0	0
Hall, J.		10	6
Courtenay, J. Irving ...	5	5	0
Ward & Goldstone ...	5	0	0
Barry, Sir J. Wolfe ...	1	1	0*
Trotter, A. P.	1	1	0
Pilkington Bros., Ltd. ...	1	1	0
O'Meara, Major W. A. J.	2	2	0
Wallis-Jones, R. J. ...	1	1	0
Anderson, A. Bruce ...	2	2	0
Ireland, A. J.	1	1	0
Traun, Dr. Heinr, & Sons	2	2	0
Devonshire, J.	2	2	0
Parsons, Hon. C. A. ...	1	1	0
Courtenay, Sir J. Irving	5	5	0
British Ever-Ready Electrical Co., Ltd. ...	5	5	0
Tegetmeier, C. G. ...	1	1	0
Lycett, J. A.	1	1	0
Blackburn, Starling & Co., Ltd.	2	2	0
Leaf, H. M.	1	1	0
Lund, P., Humphries & Co., Ltd.		5	0
Thompson, W. P., & Co.	1	1	0
Spencer, Sir Ernest ...	1	1	0
Espir, Fernand	1	1	0*
Straus & Co.	1	1	0*
Rich, Theodore		10	6*
Clothier, H. W.		10	6*
Lind & Co.	1	1	0*
D. P. Battery Co. ...		10	6
Griffiths Bros. & Co. ...	1	1	0
Mosers, Ltd.		10	0
Harris, W. G.		10	6
Indestructible Cable Co.	1	1	0
Preece, A. H.	1	0	0
Preece, Cardew & Snell ...	2	2	0
Geipel, Wm.	5	5	0
Morrison, Alexander ...		10	0
Garbe, Lahmeyer & Co.	2	0	0
Wood, L. A. S.		5	0
Bates, W. A.		2	6
Edgcumbe, Kenelm ...		10	6
Arculus, Alfred, & Co. ...	1	1	0
Burman, R. H.		10	6
Ellis, Simpson & Saunders	1	1	0
Wilkins & Wright ...	1	1	0
Assersohn, D.		10	6
Manifold Printing Co., Ltd.	1	1	0
Berridge, Geo., & Co. ...	2	2	0
Becker, R.		10	6
Waterhouse, L. M. ...	1	1	0*
Carless, Capel & Lennard	1	1	0
Continental Tyre Co. ...	1	1	0
Crapper & Co.		10	6
Escare & Denelle ...		10	6
Price & Co.	1	1	0
Rawlings Bros., Ltd. ...	2	2	0
Wiggins & Co.		10	6
Northcote, C. S.	1	1	0
Bagley & Co., Ltd. ...		10	6
Mehne, J. G.	2	0	0
Jaeger Bros.	1	1	0
Falk, Stadelmann & Co., Ltd.	5	0	0
Digby, T. J.	5	5	0
Stubbs, A. J.	1	1	0*
Bonnella, D. H., & Son, Ltd.	1	1	0
White, S. D.	1	1	0
Taylor, Tunnicliff & Co., Ltd.	1	1	0
Charles & Dible	1	1	0
Sykes, Geo.	1	1	0
Charles, W. J.	1	1	0
Madgen, W. L.	1	1	0
Howley, R. J.	1	1	0
Farmiloe, T. & W., Ltd.	1	1	0
Grothe & Son, A. ...		10	6
McGeoch & Co., Wm., Ltd.	2	2	0
Canning & Co., W. ...	1	1	0
Straus & Co., G.		10	6
Broadbent, F.		10	6
Dennis, R.		7	6
Cohen, A.		5	0
Catchpole, J. W.		10	6
Stewart, A.	1	1	0
Whittaker & Co.		10	6
Kolle, H. W.	2	2	0
Baker, G. T.	1	1	0*
Croggon & Co.	1	1	0*
Reid, E. J.	1	1	0*
Saxonia Electrical Wire Co., Ltd.		10	6
British Traders' Association	2	2	0*
Hawes, F. B. O.	1	1	0*

The Vandervell System of Motor-car Lighting.—Messrs. C. A. Vandervell & Co. (Warple Way, Acton Vale) write informing us that in view of the rather bad luck experienced in one or two details during the recent 4,000 miles trial by the Royal Automobile Club of one of their complete motor-car lighting outfits, they have determined to enter a similar outfit for another 4,000 miles R.A.C. trial, including not only the road test carried out in the former trial, but also subsequent tests upon Brooklands track to secure the necessary data as to the output of the dynamo at various engine and car speeds. Photometric tests of the headlights and complete lamp equipment will also be made. We understand that over 1,000 of these sets have been installed upon various makes of car, and that satisfaction has been expressed with their running.

Telegraph Traffic.—The lines between Inhassunge and Vicente, and between Quelimane and Villa Bocage were restored on the 25th ult. On the 26th the Via Hanekin route was in normal condition, and on this day the line between Tangier and Mogador was down, telegrams for the latter place being sent by post from Casablanca. On April 27th telegrams addressed to Chihuahua and Sinaloa in Mexico, were subject to very heavy delay, while on April 29th lines between Mossuril and Fernando Vellozo were restored, but those between Quelimane and Chinde, and Quelimane and Villa Bocage remain down. The Bagdad Bassorah line was down on 1st inst., and the Tangier-Mogador line was repaired, but there is still delay on the line. The Bagdad-Bassorah line was working again on the 2nd inst. The French Company has succeeded in once more repairing the Martinique-Paramaribo cable, and the ship is at present engaged on the Paramaribo-Cayenne section. The Direct United States Cable Company has had some trouble with the Newfoundland-Nova Scotia cable, but it has now been overcome.

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THE USE OF LARGE STORAGE BATTERIES

A PAPER by Mr. A. M. Taylor, entitled "Battery Economics and Battery Discharge Arrangements," was discussed by the Birmingham Local Section of the Institution of Electrical Engineers on Wednesday, April 26th, and at the London meeting of the Institution on Thursday, April 27th.

The author dealt first with the effect of rapid discharge rates on the total ampere hour capacity and terminal E.M.F.'s of batteries, and gave the curves reproduced in Figs. 1 and 2, based above the one-hour rate on tests of English batteries and heavier discharges than this on tests on American cells.

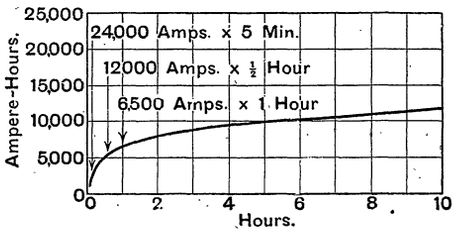


FIG. 1.—CURVE TO SHOW VARIATION OF CAPACITY WITH DISCHARGE RATE.

Passing on to methods of controlling discharge, he condemned the system of relying entirely on regulating cells, as is done to a very large extent on the Continent and in America, and showed by an ingeniously arranged diagram how in a 500 volt battery with sufficient regulating cells to enable a 5-minute discharge rate to be attained that 57 of the cells do not become properly charged unless the battery be charged very slowly, and that some of the cells are practically never discharged, especially if the battery, although equipped for occasional heavy discharges, is normally used at the one hour rate. In the case of booster control there is also considerable expense incurred if these heavy discharge rates are to be attained, as the voltage of the boosters, combined with the heavy currents, means considerable kilowatt capacity. In some stations, however, it is considered good enough to throw the batteries direct on the bus-bars under emergency conditions, but in this case either the batteries will never give the discharge they are capable of giving, or that the bus-bar pressure must fall tremendously. The author, however, proposes a method whereby the cost of a booster equipment suitable for quarter-hour discharges need not exceed that now incurred for the one hour rate.

The system which he advocates is the triple series arrangement shown diagrammatically in Fig. 3. A motor is employed to drive two double-wound booster armatures, each having two commutators, giving four booster armature windings, which can be coupled in series or parallel; the fourth, however, would be used as a spare. Comparisons are gone into at some length of this system, arranged with a static balancer, against the ordinary booster-balancer system and extra cells with regulating switches, showing considerable advantage for the author's proposals as regards estimated cost of equipment.

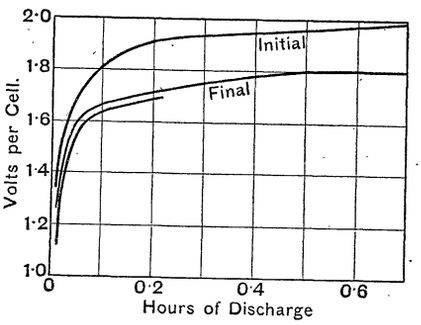


FIG. 2.—TERMINAL VOLTAGE ON DISCHARGE FOR HIGH DISCHARGE RATES.

In Fig. 4 the author shows an arrangement which, it appears to him, might with advantage be employed in cases where the battery has to be used with a regular load of known amount daily, and more particularly where the cells can be either charged from traction bus-bars or preferably where rotary converters of the split-pole type (or of the alternating-current booster type), having a large range in their voltage, are available. Where desired, existing rotary converters can be adapted for this purpose quite easily and at a low cost.

In this scheme the number of cells is so chosen that the maximum, or peak, output occurs at such a period of the discharge of the battery that practically no boost is at that time required for the latter (see central point of the 510-volt bus-bar line of Fig. 4). For, say, one-quarter of an hour on either side of this point the boosters are worked with their armatures in parallel and are thus able to deal

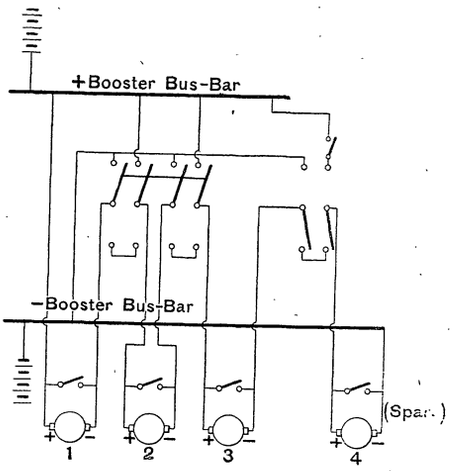


FIG. 3.—TRIPLE SERIES ARRANGEMENT OF BOOSTERS.

easily with the 6,650 amperes. During the earlier and later portion of the peak, however, the current being then much less, the booster armatures are put in series with each other. A few regulating cells, as indicated, may be employed if desired, and these could be cut as shown, should the discharge rate require to be reduced in the early part of the discharge beyond that shown by the curve.

If traction bus-bars were available, or a rotary converter could be modified to give sufficient voltage range for the charging of the cells (assisted by the battery boosters), the output of the battery boosters could be reduced to 66·5 kw. If the boosters only were employed for charging, their capacity would have to be 198 kw., against 730 kw. for the ordinary arrangement. The fourth or reserve armature would be used during charging, and special switchgear would enable the

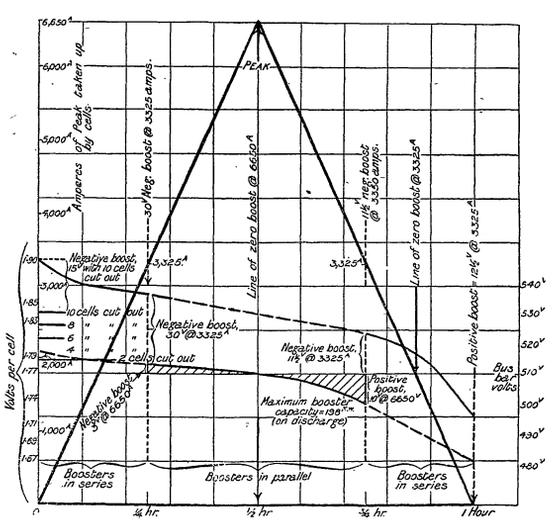


FIG. 4.—BOOST ARRANGEMENTS FOR A SPECIAL CASE.

changes between series and parallel to be made without breaking the circuit.

Mr. Taylor then passed on to the employment of storage batteries purely for stand-by purposes in view of breakdowns of generating plant, and mentioned some large batteries put down for this purpose in America, but did not on the whole commend the practice. With regard to the question of automatic or non-automatic boosters, he favoured batteries installed to deal with time peaks being equipped with hand

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regulated boosters, but suggested the use of a smaller battery, which might be of the nature of a buffer battery to take up the "instantaneous" peaks by means of an automatic booster, and so keep the bus-bar pressure constant, while the main battery would be regulated by hand in such a manner as to enable boilers and engines to be shut down to the maximum possible extent.

The latter part of the Paper contained an investigation of the possible saving in a concrete case by the introduction of accumulators in place of additional steam or gas generating plant. Estimates were worked out in some detail for a peak load of 1,450 kw., and it was seen that on a one-hour basis and with coal at 8s. per ton, the total annual cost with the batteries was only £2,752 as against £5,576 when delivering the power direct to the bus-bars without cells by means of rotary converters. The cost of the energy wasted in the cells and boosters in the case of the gas plant was only 0·04d. per unit, and in the case of the steam plant with coal at 8s. per ton only 0·07d. per unit delivered to bus-bars. With coal at 12s. per ton, and with steam plant, the cost of the energy wasted in the cells and boosters is 0·11d. per unit. The higher the fixed charges and the lower the running cost of the generating plant, the better does the battery show up as a substitute for it. It would seem, therefore, that even, however, where coal is dear, Mr. Taylor claims that there is generally a sufficient saving in stand-by losses, on boilers and engines, which can be entirely shut down to make the value of the coal so saved fully equal to that lost in the inefficiency of the battery.

The author points out that the development of the split-pole rotary converter in the United States has resulted in extended use of batteries for load equalisation on alternating circuits, and he remarked incidentally that he had devised a rectifier capable of withstanding particularly heavy overloads. He also proposed to make use of accumulator sub-stations for improving the power factor of alternating current systems by causing them to discharge through over-excited rotary converters.

A further section of the paper deals with an alternative proposal to batteries as a means of dealing with peak loads, put forward by H. G. Stott of America, employing exhaust turbo-generators and boilers with enlarged fire-grates, but the author goes into some figures to show that better economy could have been obtained with batteries. Extensive tabulated particulars of recent Continental and American battery installation are given in an appendix.

Discussion.

The discussion was opened by Mr. B. M. Jenkin (Messrs. Kennedy and Jenkin), who expressed great interest in the author's proposal for reducing the size of the boosters. A feature of this arrangement was the use of a few more cells than usual. He would suggest that the matter be carried still further, and enough cells be provided to give the emergency discharge rate straight on the bars. In these circumstances, the whole resources of the battery should be used to help the load, and no part of it expended on booster losses. The author's proposals as to switching arrangements were unnecessarily complicated, and he thought that the use of double commutator armatures in single fields was out of the question, as the voltage of each must be capable of being regulated independently. The absence of boosters during emergency discharge would also be an advantage from the switching point of view. The author was a little inconsistent in his general condemnation of regulating cells and his adoption of them in his proposed system. The system Mr. Jenkin advocated was to put sufficient regulating cells on a battery to give the emergency discharge rate and to put the booster in parallel with the regulating cells. On normal discharge the booster would be used as a "bucking" booster in series with the battery, and by means of a local circuit arrangements would be made to give the necessary extra charges to the regulating cells. The booster could be kept quite small, and would be automatically cut out on heavy overloads. This method had not yet been tried, but he fully intended to put it into practice as soon as he had an opportunity.

Mr. C. E. C. Shawfield (Borough Electrical Engineer, Wolverhampton) did not see much point in putting in heavy discharge batteries for standby purposes. Circumstances which entailed a battery being discharged at a five-minute rate would involve trouble lasting longer, and the battery would only defer the inevitable shut-down for a few minutes. A one-hour rate was in his opinion the heaviest that paid. Regarding the controversy between regulating cells and boosters, on the Continent boosters were almost unknown except to a limited extent for charging. He had seen, in Berlin, wonderfully perfect automatic regulating switches which did not appear to cost any more than booster equipments, and, of course, the efficiency of the system was much higher without boosters. Batteries were used to a startling extent in Berlin, and were of sufficient capacity to take the whole load of the city for as much as two hours. He thought their adoption was due partly to the desire for boiler house economies owing to the high price of coal, but mainly to the heavy penalties, as much as £100 per minute, imposed by the authorities for interruptions of supply. He was interested in Mr. Taylor's remarks about Exide cells, but hardly saw where they came in if they were suited to emergency work, but not to regular work. He thought that Mr. Taylor had taken much too high figures for standing charges in his comparisons between batteries and extra generating plant.

Mr. S. L. Pearce (Chief Electrical Engineer, Manchester Corporation) thought that some figures of the result of the first complete year's working of the large battery at the Dickinson Street station, Manchester, would be of interest. This battery had been originally installed to be charged from the traction bars and to be discharged on the lighting load. Its capacity was 3,000 kw. at the one-hour rate, and the boosters would be driven from either set of bars. The battery could, however, be used entirely on the lighting system, and, as a matter of fact, the most economical result had been obtained in this way. The interconnection of the large Stuart Street station with those at Dickinson and Bloom Streets, provided great flexibility. Thus at the dinner-hour, when the heavy power-load from Stuart Street fell off, its resources could be utilised in giving the battery a very considerable amount of charge. He reckoned the savings due to the introduction of the battery for the first completed year to be as follows: The cost of coal per unit generated had been reduced from 3·33d. to 2·29d., which represented no less than £3,348 in coal alone for the year. Other savings amounted to 0·064d. per unit, and brought the figure up to £7,762 for the year. Deducting all capital and maintenance charges, the net saving left was £3,041. They must, however, add to this the capital charges saved in adopting the battery instead of extra steam plant, and taking the capital cost of steam plant as £13 per kw., and the battery as £8 per kw., this came out, on an 8½ per cent. basis, at £1,950, so that, finally, the saving due to the use of the battery would be written down as about £5,000, which was not far off Mr. Taylor's estimates. The steam-plant load factor had been brought up from 32 to about 47 per cent., and the over-all efficiency of the battery had come out as high as 71 per cent. Its discharge rates were 8,400 amperes for one hour, 13,000 amperes for half-hour, and 17,000 amperes for five minutes. High discharge rates were largely a question of switching, and he marvelled how the 40,000-ampere emergency currents in the large American batteries could be satisfactorily dealt with. He agreed with the author that it was not advisable to put down these large batteries solely as stand-bys. The Manchester boosters were fully able to carry the maximum current at maximum boost when connected three in parallel, and there was no complication in the change over switchgear. Finally, he said that the use of central-station batteries was usually handicapped by the fact that the Local Government Board only allowed a period of seven years for battery loans, which was out of all proportion to the maintenance guarantees now given by battery makers at 8 per cent. for fifteen years.

Mr. A. H. Seabrook (Electrical Engineer to the Marylebone Borough Council) said that in common with many of the central station engineers, he had been driven to think seriously upon batteries by Mr. Taylor's persistent advocation of them. At Marylebone an additional load of some 3,000 kw., mostly in the Oxford Street district, about 3,000 yards from the generating station, would have to be provided for in the near future. He had estimated the cost of steam extensions suitable for the case at £5,700, and of a 4,000-kw. battery for a one-hour rate discharge at only £2,600. The economy obtained by batteries had been fully brought home to him by the small battery they already had at Marylebone. He joined with Mr. Pearce in the protest against the loan period allowed by the Local Government Board for batteries, but was amazed at his 71 per cent. efficiency; his own little battery only gave something like 54 per cent. He did not think that regulating cells should be passed over so lightly. He had himself bought sufficient extra cells to do away with the boosters at times of heavy discharge. End cells were, in his opinion, more reliable than boosters, and the cost of switchgear could be reduced by making the switches cut in more than one cell at a time. He had experimented in that direction, and found that a step of three cells gave no appreciable flicker of the lights.

Mr. Leonard Andrews (Key Engineering Co.) rose to disclaim some figures in Mr. Taylor's detailed comparisons which were said to be taken from the Paper by himself and Mr. Porter. He went into the matter in some detail to show how Mr. Taylor, in working on his figures, had made deductions which were not quite warrantable in that for one thing they exaggerated the difference in cost of labour and attendance. He finally admitted, however, that even if Mr. Taylor's figures were modified to suit his views there would still be a margin left in Mr. Taylor's favour.

Mr. Taylor replied briefly, reserving his full reply for the *Journal*. Mr. Jenkin had, he thought, exaggerated the complication of the switchgear he proposed, and Mr. Shawfield had rather over-estimated the proportion of the losses in the booster and in the battery itself. His desire in reducing the size of booster was not so much to save money as to enable

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it to be spent in spares. The weak point of the Manchester installation was, in his opinion, the absence of spare booster plant. He suggested that with his own scheme Mr. Pearce's savings would have been even greater. He heartily agreed with the protest against the loan period of the Local Government Board. He was not sure that the method at Manchester of giving the battery two charges a day was quite the best procedure, looking at the life of battery plates as a function of the total number of charges and discharges they received. This was what made the Exide cell unsuitable for regular use, as although it could be used for very high rates it would not stand so high a total number of charges and discharges.

DISCUSSION AT BIRMINGHAM.

The discussion was opened by Mr. W. FENNELL (Wednesbury Corporation), who said that only wealthy undertakings could afford to purchase their batteries out of revenue and that 5 per cent. for sinking fund was insufficient to obtain the L.G.B. sanction to a loan. He agreed that there should be as little booster output at the peak as possible, but that spare boosters should be provided. He considered that for small stations regulating cells were preferable to boosters, and suggested that the regulating cells might be of different type to the main battery, as the demand upon them is for much shorter periods than upon the latter.

Mr. F. FORREST (Birmingham Corporation) held that there would be difficulty in keeping the connection to neutral when the battery used as a balancer was cut out. In the author's table of capital costs 50 per cent. should be added for spare battery and steam plant, as it is bad practice to regularly take more than two-thirds of the charge out of the battery, but the author appeared to run it right down. He considered that if batteries were used for very heavy peak loads on A.C. systems with rotaries the latter would flash over. It is unwise to expect too much from Exide cells, as he understood that they will not stand more than 50 discharges.

Mr. F. BROWN (Walsall Electrical Co.) asked what the life of a battery in regular and constant work would be. He mentioned how he had tried recently to obtain one of the latest Edison batteries, but the company stated they were unable to supply at present.

Mr. A. T. BARTLETT (General Electric Co.) thought that the figure of £3·89 per kw. for fixed charges for steam plant, given in Mr. Taylor's comparison, was altogether too high.

Mr. TAYLOR, in reply, said that the correct figures for interest and sinking fund was a vexed question, but that the L.G.B. rate for batteries was unduly high. The charges for boosters are important, but not so much so with his system, as he keeps down the capacity of the boosters and therefore the costs. If regulating cells are used for very large batteries the contacts and connections must be very heavy. He saw no difficulty in keeping the connection to neutral when the battery used as a balancer was cut out. As to batteries with rotaries on an A.C. system, he held that they would take the six minutes discharge rates satisfactorily, as it only meant four times the one-hour rating. Ordinary rotaries take 3·5 times full load without flashing over. The number of discharges of which the Exide cell is capable is 300, not 50. These cells would only have to deal with the emergency peak, and not the ordinary peak, and would therefore be discharged only 20 or 30 times per annum, giving a life of 10 years. Ordinary batteries can be discharged 3,000 times during their life.

LOCAL NOTES

Aberdeen: *Trolley Omnibuses.*—The Tramways Committee have under consideration the question of providing some form of locomotion for the Footdee district, and it is not improbable that a deputation will visit Leeds to inspect the system of trolley omnibuses which will shortly be working there.

Blackburn: *Electricity and Tramway Profits.*—The net profit upon the electricity undertaking for the past year, after meeting capital charges, was £697, against £1,387 in the previous year. There was a loss of £181 upon the tramway undertaking, compared with a profit in the previous year of £453.

Brighton: *Consulting Engineer's Fees.*—Mr. Arthur Wright, who recently resigned his position as consulting engineer to the Corporation, has agreed to accept £1,000 in settlement of the amount due to him by way of commission upon profits of the undertaking, under the terms of his agreement.

Dundee: *Electricity Staff Social Club.*—Notwithstanding the somewhat mediocre results which in some cases have attended the institution of social clubs, Dundee Electricity Department bids fair to be a particular exception in such matters. The formation of a club and club-room suggested itself to the members of the staff some little time ago. The idea was enthusiastically received, and Tuesday night saw the opening of a splendidly fitted club-room, where members of the staff can enjoy their leisure hours when "off shift." Mr. Chas. Lamb, as Vice-President of the club, performed the opening ceremony, while speeches were also given by Mr. H. Richardson, the genial manager of the department, to whom the members of the staff are indebted for many facilities in connection with the scheme, and Messrs. D. H. Bishop and J. H. Wright.

Dunfermline: *Tramway Extensions.*—The Dunfermline and District Tramways Co. are being urged to push forward with the extensions of their lines in a westerly direction.

East Kent: *Electric Lighting.*—The Dover Rural District Council have given consent to the Sandwich, Deal and Walmer Electric Lighting Co., to run mains along the Dover and Deal road.

Edinburgh: *Electricity Profits.*—The Electric Light Committee recommend the Council to apply the surplus of £7,300 from the 1909–10 accounts to the reduction of the capital debt upon the undertaking. Every year there is considerable controversy as to whether the profits from the undertaking shall be dealt with in this manner or transferred to relief of rates.

Grimsby: *Electricity for Domestic Purposes.*—The Corporation have approved of a recommendation by the Electricity Committee to reduce the charge for electricity for domestic purposes to 1d. per unit.

Halifax: *New Tramway Brake.*—A new brake, which has been invented by Mr. C. J. Spencer, the tramway manager, is now undergoing trials.

Leeds: *Trolley Omnibuses.*—It is expected that the Corporation system of trolley omnibuses will be in operation this month, the cars being expected within a fortnight.

Manchester: *Tramways Committee and the Employees.*—The Arbitrator who was appointed by the Board of Trade to consider the dispute between the Tramways Committee and the tramway employees mainly on the question of hours, has now given his award. He decides that no case has been made out for a reduction of the working hours from nine to eight per day without a diminution in the weekly wages or the curtailment of any of the other privileges which the men now enjoy.

New South Wales: *Electric Tramways.*—The revenue from the New South Wales tramways for the quarter to March 31st amounted to £353,000, an increase of £43,000 compared with the corresponding quarter of last year, whilst the expenditure, viz., £262,000, was increased by £26,000.

Pinner: *Maximum Price in Lighting Order.*—The Hendon Rural Council suggested to the Harrow Electric Light Power Co. that a lower maximum price should be inserted in the Provisional Order which the Company is seeking for the Pinner district than the usual allowed by the Board of Trade. The Company offered 7d. per unit, but this did not meet with the approval of the Council. When, however, the matter came before the Board of Trade the latter decided that under no circumstances could they insert a lower figure than the usual maximum of 8d. per unit. The Rural Council also desired to have a purchase clause inserted in the Order, but the Board of Trade refused this also on the ground that it was not thought desirable for a Rural Council to have purchase powers over an undertaking relating only to a portion of their area.

Preston: *Tramway Profits.*—After meeting capital charges, there was a net profit of £4,369 upon the working of the tramways during the past year.

Rotherham: *Electricity Profits.*—After meeting capital charges, the accounts of the Electricity Department for 1910–11 show a net revenue of £7,848.

Russia: *New Electrical Undertakings.*—According to the *Financial News* an English syndicate some time ago submitted to the Russian Government a scheme for the establishment of electrical works in the Caucasus to supply light and power to numerous industrial undertakings in the district. The Syndicate also proposed further works in connection with an electric railway. It is now stated that the Commission which was appointed to inquire into the proposals will report in favour of the English syndicate.

Stoke-on-Trent: *Electricity Works Extensions.*—There seems to be a good deal of opposition on the part of the ratepayers in the new Federated County Borough to the proposed expenditure of £60,000 upon remodelling the system of electricity supply. At the last meeting of the Council, however, a resolution not to go forward with the proposal was defeated.

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TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Barnstaple.—Mr. Albert Gay, Borough Electrical Engineer at Islington, who has been advising the Council with regard to extensions, recommends the installation of a 1,120 ampere-hour battery.

Bath.—An expenditure of £7,500 to be incurred on new generating plant.

Belfast.—The extensions to the power house authorised in 1909 are nearing completion, and the City Electrical Engineer reports that it is necessary to anticipate the requirements for the next two years. He recommends that additional plant and machinery, mains, services, and meters should be provided at an estimated cost of £40,000.

Blackburn.—The Corporation propose to apply to the Local Government Board for sanction to borrow £45,170 for the purposes of extension to the Corporation Electricity Works.

Brazil.—Fresh tenders are to be invited for a telephone system between Rio de Janeiro and Sao Paulo.

Burnley.—A Local Government Board inquiry was held last week into an application by the Corporation for sanction to borrow £9,023 for the extension of plant at the electricity generating station.

Dublin.—A Local Government Board inquiry was held last week concerning a loan of £128,129 for extensions to the electrical undertaking. Considerable controversy has been taking place in regard to this proposed loan, the Tramways Company being especially concerned in it. Arguments have been put forward that extensions of the Pigeon House Fort Power House would be uneconomical, and that the best plans would be to erect a new power house more centrally situated. Mr. S. L. Pearce, Chief Electrical Engineer to the Manchester Corporation, gave evidence on behalf of the Corporation, and strongly supported Mr. Mark Ruddle's recommendations to add plant at the Pigeon House Fort Station rather than to shut down these works and build a new station. He saw no reason why extensions should not be carried out at Pigeon House Fort to the extent of 12,000 kw. capacity. The inquiry was resumed on Tuesday.

Eccles.—A Local Government Board inquiry was held last week concerning a loan of £3,783 for new plant at the electricity works.

Finchley.—A loan of £15,410 has been sanctioned.

Govan.—Extensions to the generating plant at the Electricity Works are to be put in hand.

New Zealand.—Tenders are invited by the Wanganui Borough Council for a complete generating plant for their tramway system. Tenders to the Town Clerk, Borough Council Offices, St. Hill Street, Wanganui, by June 12th. Copy of the specification can be seen at 73 Basinghall Street, E.C.

Stalybridge.—The Works Sub-Committee have under consideration the installation of an additional 2,500 kw. turbo-generator at the electricity works.

Worthing.—An expenditure of £5,000 is contemplated upon new generating plant. Mr. J. F. C. Snell has presented a report upon the proposed extensions, in which he recommends the installation of two Diesel engine sets.

Rochdale.—The Electricity Committee have decided to carry out extensions at the electricity works, at an estimated cost of £8,700.

WIRING

Aberdeen.—Additions to works of Messrs. Alexander Pirie & Son. Architects, Messrs. Jenkins & Marr.

Ayr.—Alterations at Newton Academy.

Blackburn.—Public Hall on Blakey Moor; also reconstruction of present Town Hall.

Chelmsford.—Alterations and additions to Friars Council School. Architect, Mr. W. H. Pertwee, Chelmsford.

Coventry.—New municipal buildings.

Glasgow.—Extensions to works of Messrs. Redpath, Brown & Co., Ltd.—Additions to schools in Ropework Lane.—Block of shops and offices at Hyndland Road. Architects, Messrs. J. M'Kellar, Davies & Gunn.—Electric theatre at 421 Sauchiehall Street.

Gloucester.—Tenders are to be invited for lighting the Corn Exchange by electricity.

Eastbourne.—New post office. Builders, Messrs. J. & M. Patrick, Wandsworth Common, S.W.

Edinburgh.—Freemasons' Hall, George Street.

Manchester.—Theatre in Great Bridgwater Street.

Newcastle-on-Tyne.—Art School at Armstrong College.

Plymouth.—Conversion of Free Library into Municipal Offices.

Tipperary.—Electric lighting of workhouse premises.

MISCELLANEOUS

British Columbia.—It is reported that the Dominion Government propose to considerably extend the long-distance telephone service in British Columbia.

Eccles.—The Corporation has decided to adopt electric lighting in certain public streets. Application is to be made to the Local Government Board for the necessary loan.

Hull.—The tramway manager reports that twenty-four new cars will be required within a very short time.

London: *Hackney.*—Tenders are to be invited for 100,000 pairs of yellow flame arc lamp carbons.

TENDERS RECEIVED AND ACCEPTED

Accrington.—The tender of Messrs. W. T. Glover & Co., at £4,333, for the supply of extra high-tension mains has been accepted. The same firm has got the contract for a twelve months' supply of electric cables. The tender of the British Thomson-Houston Co., at £428, for the supply of high-tension sub-station switchgear has also been accepted.

Bridgwater.—The tender of the Bridgwater and District Electric Supply Co. has been accepted for the electric lighting of the Blake Gardens. There was keen competition for this work between Gas and Electric Lighting Companies.

London: *Hackney.*—The following tenders have been received for two water-tube boilers:—Messrs. Hawkesley, Wild & Co., £3,083; Messrs. Clarke, Chapman & Co., £2,644; Messrs. Babcock & Wilcox, £2,570; Howden Boiler Co., £2,500. The tender of Messrs. Babcock & Wilcox is recommended for acceptance. The heating surface is 4,226 square feet, and the grate area 80 square feet.

Nine tenders have been received for a turbine feed pump, varying from £131 to £258. That of Messrs. Hayward, Tyler & Co., at £165, is recommended for acceptance. The tender of Messrs. Babcock & Wilcox, at £445, is recommended for the reconstruction of a portion of the coal-conveying plant at the electricity works.

Liverpool.—The Mersey Docks and Harbour Board has accepted the tender of Edison & Swan United Electric Light Co., Ltd., for a motor generator.

Mansfield.—The tender of Messrs. Bellis & Morcom, Ltd., for engines, has been accepted at £1,460, and that of the British Thomson-Houston Co., Ltd., for dynamos, at £915.

Stoke-on-Trent.—The tender of Messrs. James Howden & Co., at £8,905, for two 1,500 kw. turbo-generator sets has been accepted. There were twelve tenders for this plant.

Worthing.—The tender of The Hart Accumulator Co. has been accepted, at £864, for the replating of the storage battery.

OSRAM·LAMPS

Railway Rates on Electrical Goods.—In November last the General Electric Co. were fined by the Aston Petty Sessions for misdirection in consigning stator parts as "bearers." The action was taken at the instance of the Midland Railway Co., by whose line the goods were consigned from Birmingham to Bedford, the alternator being to the order of the Bedford Corporation. According to the general railway classification of goods, "bearers" are chargeable at 9s. 2d. per ton, whilst electrical appliances are chargeable at 22s. 9d. per ton. The General Electric Co. contended that the function of the stator is to carry or bear the laminations and coils, and that in the absence of definition in the classification by the railway company they were entitled to consign the goods as "bearers." Before a Divisional Court in London last week, consisting of the Lord Chief Justice and Justices Pickford and Lush, the General Electric Co. appealed against the fine of the Aston Petty Sessions, but the Court held the view that the magistrates were right, and dismissed the appeal with costs.

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APPOINTMENTS AND PERSONAL NOTES

The salary of Mr. Wilson, Mains Superintendent in the Maidstone Electricity Department, is to be increased from £120 to £130 per annum.

It is stated that Mr. L. Birks will be chief assistant to Mr. E. Parry, who has recently been appointed Electrical Engineer to the New Zealand Government.

The Hackney Electricity Committee recommends that the salary of Mr. J. R. Bowden, Distributing Engineer, to be increased from £325 to £400 per annum, by annual increments of £12 10s. Mr. Bowden will take the title of Deputy Engineer.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic copper bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 5s. to £56 15s. per ton (last week, £56 15s. to £57 5s.).

Bankruptcies.—A petition has been filed in the Canterbury Bankruptcy Court by A. C. Wampach, electrical engineer, Formby Lodge, Seabrook Road, Hythe.

Unica Gearing.—Messrs. Rodgers Bros. (Baker Street, Brighton) have acquired the business of Messrs. J. B. Hamilton & Co., Ltd., of gear specialists and general engineers. The sole agent for the Unica gears which Messrs. Rodgers will now manufacture will be Mr. P. F. Brittain (110 Cannon Street, E.C.).

Vickers, Sons & Maxim.—The name of this company has been changed to Vickers, Limited.

Change of Address.—The St. Helens Cable & Rubber Co., Ltd., have altered the address of their Newcastle office and stores to 8 Charlotte Square, Cross Street. An attractive coloured card announces the fact.

Meter Approved.—The Board of Trade have approved of Messrs. Chamberlain & Hookham's patent continuous current meter combined with Lackie's patent demand indicator, and also means provided for fixing same.

"Witching Waves" in the Roadway.—Under this heading, the *Evening News* of Wednesday, last week, described a disturbance on the mains of the Charing Cross, West End, and City Electricity Supply Co., which occurred early in the afternoon. Although not of a very startling character from an electrical point of view, the occurrence must certainly have appeared mysterious and sensational to the general public. A short had occurred in a distributing box in Cannon Street, and the bitumen in it had smouldered, emitting quantities of smoke, not only from between the box and its cover—the pit of which had been rendered bad owing to the swelling of the wood pavement blocks in the roadway—but also between crevices in the blocks, so that smoke actually rose all over the road. On opening the box and part of the road, the smoke escaped fairly thickly for some time. The interruption to supply was quite local and not at all of a serious nature, and traffic in the street, which had had to be diverted, was resumed in about an hour.

"The Chief."—Several generations of Ferranti staff met on Saturday last at the Trocadero to entertain Mr. Ferranti, and to present to him a memento in the shape of a silver inkstand. Those who went through the works in the old days, at the Grosvenor Gallery, Deptford, Charterhouse Square, or Hollinwood, all knew Mr. Ferranti as "the Chief," and apparently the present generation at Hollinwood still retain the old title, for when the toast of the evening was proposed by Mr. C. P. Sparks, Mr. Ferranti was universally hailed as "the Chief." Those who have worked with Mr. Ferranti have all been imbued with some of his enthusiasm, and have always had unlimited confidence in his genius. That enthusiasm, his magnetic personality, and charm of manner are responsible for drawing all to him. The speeches at the dinner partook mostly of reminiscences and anecdotes. "The Chief" took us back to the good old days when cables to carry unheard-of pressures had to be evolved from nothing but a fertile brain, and when men had to risk their lives to demonstrate the safety of a system of transmission. He told something of the evolution of the Ferranti meter, and the special winding of the Ferranti alternator, the Grosvenor Gallery plant and the fire, when high hopes disappeared in a flash, and the whole plant had to be reconstructed with apparently high hopes as the only asset, and so on, down to the present day and even into the future. Mr. Ferranti himself suggested the publication of a volume of such reminiscences, and this would indeed make interesting reading in the history of the electrical industry. About ninety old Ferrantians foregathered at the dinner; old friends met old friends, and an extremely pleasant evening was spent.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

City of Santos Improvements Co.—At the meeting last week it was stated that a contract has been entered into for the complete electrification of the tramway system in Santos. Messrs. Mordey & Dawbarn have been entrusted with the preparation of the scheme, and Mr. Dawbarn has recently left for Santos in order to discuss details with H. M. Sayers, the company's resident engineer.

City of Birmingham Tramways Co.—Mr. Emile Garcke presided at the annual meeting in London on Monday. The accounts for 1910 enable the payment of a 10 per cent. dividend upon the ordinary shares, and the transfer to reserve of £36,513. The Chairman reminded the shareholders that after June 30th their profits will undergo a serious diminution, as of the 18 miles at present worked in Birmingham, more than half pass into the hands of the Corporation on that date, and of the remaining mileage six miles are in Aston, and are being worked without profit. Nevertheless, the position of the company as a revenue earning undertaking will remain satisfactory owing to the return from their investments, and the Chairman thought the prospects of continuing to pay 10 per cent. on the ordinary shares were good.

British Westinghouse Co.—At the annual meeting on Monday the Chairman of the company, Mr. J. A. Bryce, M.P., after referring to the satisfactory result of the year's working, which has enabled the Board to transform a debit balance of £7,319 from 1909, into a credit balance of £5,117 for 1910, in addition to making provision for substantial reserves, referred to the arbitration award in connection with the turbines at the Lot's Road power house. If the result of the appeal against this award was unsuccessful, a very serious loss would have to be faced, and would probably mean the occasion for writing down the capital. He impressed upon the shareholders that the contract over which this dispute has arisen was made at the very commencement of the company, and that no blame attaches to the presnt Board. Very satisfactory results, he continued, have been obtained with the Rateau steam turbines, which were making a reputation for reliability in running.

Electrical Distribution of Yorkshire.—A dividend at the rate of 2½ per cent. for 1910 is recommended, and after placing £400 to reserve a sum of £109 is carried forward. In order to provide the necessary capital for laying mains in Castleford, Hipperholme, and Sowerbridge, the directors have made arrangements with the Yorkshire Electric Power Co. for temporary borrowings.

Brisbane Electric Tramways Investment Co.—A final dividend, making 8 per cent. for 1910, is recommended on the ordinary shares. Whilst the total receipts have increased by £23,302, the expenses have only gone up by £10,740. During the year there was a large expansion in the sale of electrical energy for power purposes. Many newly erected wharves and wool stores have now been fitted for electrical operation. With reference to the suggestions that have been made that the local authorities in Queensland have power at any time after 1920 to purchase the company's undertaking at constructional value less depreciation, the Board have obtained the opinion of Sir Robert Finlay, K.C., and two other lawyers, which is to the effect that any purchase by the local authorities must be upon going concern value.

Oldham Ashton & Hyde Electric Tramway Co.—There was a net profit of £6,824 for 1910, and after placing £1,250 to reserve a final dividend making 6 per cent. for the year is recommended, carrying forward £151.

Merthyr Electric Traction & Lighting Co.—The accounts for 1910 show a net profit of £5,070. The sum of £1,000 is placed to reserve, and a dividend at the rate of 6 per cent. is declared on the ordinary shares, carrying forward £457.

Arbroath Electric Lighting & Power Co.—There was a net profit of £1,601 for 1910, and, after meeting interest charges, a balance of £1,097 is carried forward.

British Columbia Electric Railway Co.—Interim dividend at the rate of 8 per cent. per annum on deferred ordinary stock for the December half-year.

South Metropolitan Electric Tramways & Lighting Co.—The full dividend on the 6 per cent. preference shares for the year to December, 1909, is declared, placing £2,500 to depreciation and reserve, 2,000 to renewals, and carrying forward £339.

River Plate Electricity Co.—A dividend of 10 per cent. on ordinary shares for 1910, carrying £14,000 to reserve, and £5,880 forward.

Batti-Wallah Society.—The last smoking-concert of the season was held in the Council Chamber, Holborn Restaurant, on Tuesday, May 2nd. Mr. Slade-Olver, the new President of the Society, took the chair, and with the assistance of the genial and energetic entertainment secretary, Mr. Robinson, kept things going with great verve throughout the evening. An exceptionally good musical programme was provided, and according to general consensus of opinion of those present, the smoker was the most enjoyable of the year. Those members who did not attend have every reason to regret their non-attendance.

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SUMMARY

A new edition of the Institution of Electrical Engineers' Wiring Rules has just been issued. Among the alterations are increases in the permissible current density and voltage drop in conductors, modifications in the rules relating to surface wiring, and a long section on the earthed concentric system applicable to "Stannos" wiring. A summary and critical review of the new rules appears on page 247.

The action by the British Westinghouse Co. against the Electrical Co. for alleged infringement of the Bremer flame arc lamp patent concluded on Thursday. Judgment was reserved. (Page 248.)

The full programme of the Brighton Convention of the I.M.E.A. is now issued. Papers will be read on "Electricity Supply Viewed from the Municipal Committee's Standpoint," "Modern Wiring Practice," and "Internal Combustion Engines in Power Stations," and discussions will take place upon "Purchase of Fuel" and "Street and Shop-front Lighting." (Page 248.)

We publish this week the second half of Mr. G. W. Partridge's article on the single-phase plant supplying the London, Brighton, & South Coast Railway. Particular interest attaches to the governors employed, the use of Temperley-Cockburn steam-extracting pipes in the water-tube boilers, and a rotary strainer for the condensing water from the river. (Page 249.)

Short illustrated articles deal with a new automatic starter on the contactor principle for squirrel cage motors and the use of metal filament lamps for church lighting. (Page 251.)

Our monthly article on New Electrical Supplies and Accessories contains illustrated descriptions of a new metal filament candle lamp, a temporary wiring lampholder, an illuminated shaving-mirror, a spring shade-carrier, making removal of the shade very easy, a semi-automatic door switch, a new design of ironclad switch, and a tumbler switch with automatic overload release. Other novelties mentioned include a choking coil dimming switch and a motor control pillar. (Page 252.)

The section of the London, Brighton, & South Coast Railway from Victoria to the Crystal Palace is to be opened for traffic under electric traction to-day. (Page 253.)

A paper on light and illumination dealing more particularly with interior lighting, by Mr. Haydn T. Harrison, and one on the effect of wall-papers on illumination, by Mr. P. J. Waldram, were discussed at a recent meeting of the Illuminating Engineering Society. (Page 254.)

Mr. Donald Murray read a long Paper at last Thursday's meeting of the Institution of Electrical Engineers on the practical aspects of printing telegraphy, in which he reviewed generally the field for printing telegraphs dealing in some detail with the practical difficulties to be overcome, and described the latest forms of his apparatus, including the Murray automatic printing instruments and the new Murray multiplex

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system. The discussion dealt more with the traffic than the engineering side of the problem. (Page 255.)

THE Corporation of the City of London have issued a short series of recommendations regarding temporary wiring for illuminations. (Page 256.)

THE Hindhead Electricity Works was almost destroyed by fire on Wednesday last week, but supply had already been partially resumed on Friday. (Page 256.)

MR. A. M. TAYLOR contributes a long letter, forming a reply to the discussion on his recent Paper before the Institution of Electrical Engineers on the use of batteries, and the correspondence on life tests of metal filament lamps is continued. (Page 257.)

BEFORE the Junior Institution of Engineers yesterday Mr. F. J. Hawkins read a Paper on illumination, dealing with the points to be observed to obtain the maximum distribution of light with the minimum glare effect. (Page 257.)

AMONG the specifications published by the Patent Office on Thursday last was one by J. E. Criggal and the British Vitrite Works, Ltd., describing a method for manufacturing lamp caps. The British Thomson-Houston Co. and J. Gray have introduced a method of making drawn tungsten filaments. W. & R. Bullimore and A. C. Crosser describe a means of preventing breakdowns by sparking in condensers. A. Heil has produced a new primary battery. A patent for improvements in railway signalling expires on Thursday next, after the full life of fourteen years. A grant has been allowed to A. F. Berry, in spite of opposition, for a patent for heating and cooking apparatus. Opposition has been entered to the grant of a patent to J. Keith for centrifugal fans. (Page 258.)

THE legal expenses in connection with the bank overdrafts at West Ham amount to a penny rate.—The price to be paid by the West Hartlepool Corporation for two sections of the local tramways is £12,096, against £22,000 claimed.—The conduit tramway system in Bournemouth has now been entirely converted to overhead, and the cars are running.—Sums of £40,000 and £15,000 respectively will be paid over to relief of rates out of the profits of the Birmingham tramways and electricity departments. (Page 259.)

PLANT extensions are contemplated as follows:—Blackburn, £45,170; Colwyn Bay, £2,700; Leicester, £17,000; South Shields, £8,960; Newcastle-under-Lyme, £5,000; and Stockton, £6,750. The storage battery at Worthing is to be replated; mains extensions are to be carried out at Colne (£1,000); a supply of cable is required at Manchester; and electric supply schemes are under consideration at Donaghadee and Armagh. The sum of £14,650 is to be spent on tramway extensions at Burnley. (Page 259.)

ARRANGEMENTS FOR THE WEEK

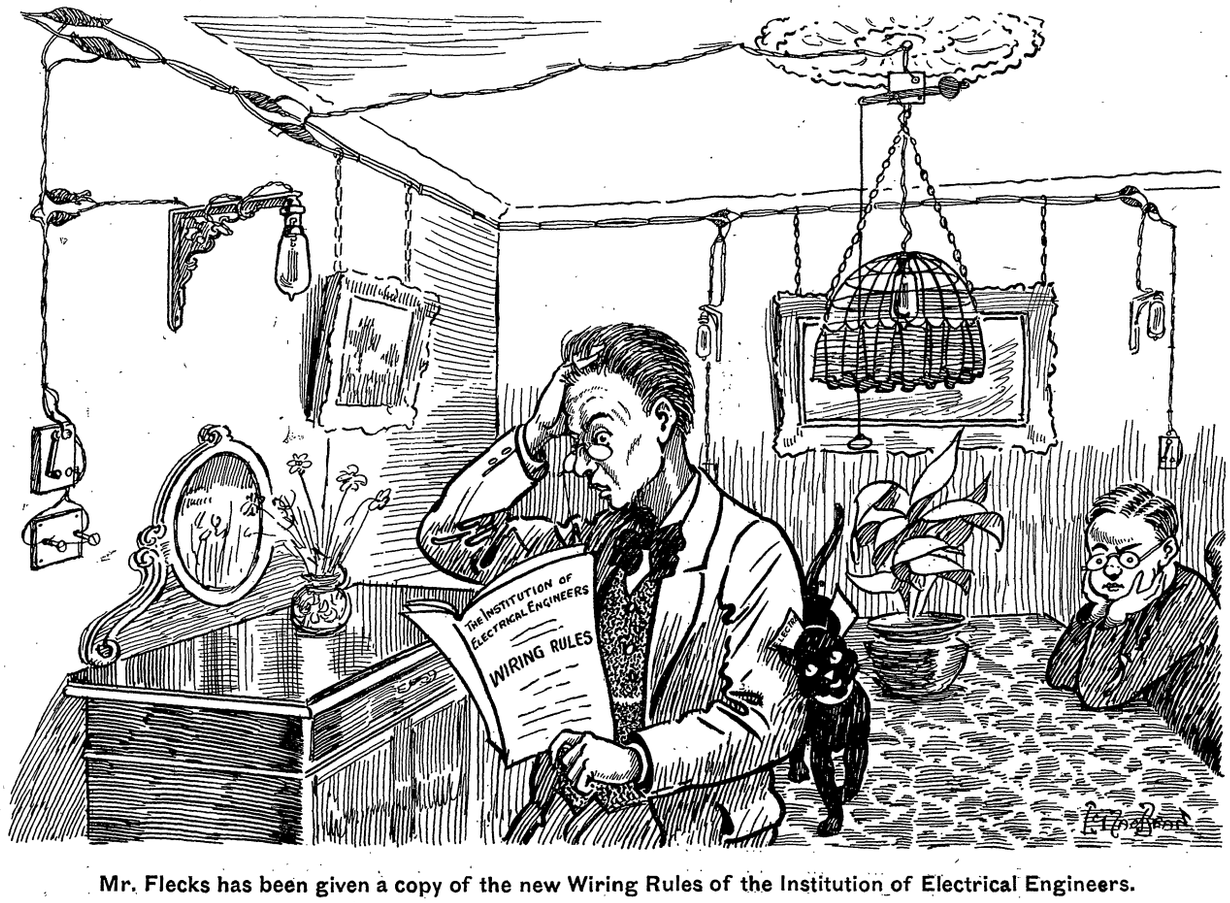
(TO-DAY) THURSDAY, MAY 11TH.
Institution of Electrical Engineers.
8 p.m. "The Driving of Winding Engines by Induction Motors," by H. J. S. Heather.
Institution of Electrical Engineers: Dublin Section.
8 p.m. At Royal College of Science.

SATURDAY, MAY 13TH.
Birmingham and District Electric Club.
7 p.m. At Colonnade Hotel, New Street. "Exhaust Steam Utilisation for Generating Electricity," by V. E. Walters.

TUESDAY, MAY 16TH.
Institution of Electrical Engineers: Glasgow Section.
8 p.m. At 207 Bath Street. Annual General Meeting (postponed from May 9th).

WEDNESDAY, MAY 17TH.
Institution of Electrical Engineers: Yorkshire Section.
7 p.m. At Leeds University. Annual General Meeting.

THURSDAY, MAY 18TH.
Institution of Electrical Engineers.
8 p.m. "Automatic Telephone Systems," by W. Aitken.



Mr. Flecks has been given a copy of the new Wiring Rules of the Institution of Electrical Engineers.

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THE NEW WIRING RULES OF THE INSTITUTION OF ELECTRICAL ENGINEERS

THE Institution of Electrical Engineers, before finally adopting the new edition of its wiring rules which has just been issued (the 6th edition), would have done well to have adopted the practice of some Government Departments, and to have issued them at first only tentatively in draft in order to invite general discussion and criticism; in fact, a discussion on the draft rules at an ordinary meeting of the Institution would have been desirable.

It is true that the Electrical Contractors' Association and other Associations were represented on the Committee, but this is not the equivalent of inviting comment from the whole electrical public, as the representatives of each society constitute only a minority by themselves. That the rules before being issued to the public were sent to the fire insurance companies and to the supply authorities for their approval, and 49 fire offices and 232 supply authorities have accepted them, may perhaps be thought sufficient evidence of their being what is required, but although in general they form an excellent definition of the best practice in wiring work, yet there are a few details to which exception may justly be taken, and some precautions which may be regarded as unnecessary.

There is, however, one important alteration in the opposite direction, namely, the permissible use of a far higher current density in conductors than has hitherto been thought expedient. For instance, if the drop of pressure is not too great, a 3/22 wire may be loaded up to 7·2 amperes—equivalent to a current density of no less than 4,000 amperes per sq. in. However, as the table of conductors is based on experiments made by the National Physical Laboratory, we must not find fault with it, but such current densities are certainly high. A few of the other changes are in the direction of allowing more leniency, but, as we have said, there are some details in which excessive precaution has certainly been observed.

The chief alterations are as follows:—

One of the first alterations is the omission of what is sometimes called the "six-foot" rule, applying to cases in which a building is connected on both sides of a three-wire network. In the old rules, it was specifically stated that the wiring must be so arranged that a person cannot simultaneously touch two points respectively in contact with the outer conductors, but the new rules simply say that the two pairs of terminals shall be arranged so as to minimise the danger of shock, and that the wiring from them, including that behind the distribution boards, shall be kept distinct throughout in separate circuits. The old rule, although stricter, was certainly better.

The increased maximum current density allowed in conductors has already been alluded to. Formerly it was stated that in calculating the size of circuits, every point must be assumed to require at least 60 watts, but this has now been omitted, as it should be, as the larger proportion of metal filament lamps now in use are of smaller wattage.

Doubtless in view of the less sensitiveness of the metal filament lamps to drop in pressure, the permissible drop has now been increased from 2 per cent. to 2 per cent. plus one volt, so that, for instance, on a 200 volt system, a 5 volt drop would be allowed, and on a 100 volt system a 2 volt drop. We recommend wiring contractors not to go to this extreme limit, for at times of peak load the central station will probably avail itself of the full 4 per cent. drop allowed by the Board of Trade regulations, so that on a 100-volt circuit the voltage might be 7 volts down on the furthest point of the house wiring, and on a 200-volt circuit 13 volts down.

For power and heating circuits, conductors need not be dimensioned to keep down the voltage drop, but it is simply specified that their temperature must not rise 20° F. in the case of rubber cables, or 50° F. in the case of paper or fibre cables; the maximum current for this rise is given in the conductor table at the end. In this table we regret to see that the sizes of flex are no longer included. This would have been a convenience especially with regard to the larger sized flex used for radiators, and the information would have been of far more use to the wiring contractor than a prolonged table to embrace all sizes of conductors up to one sq. in. section. The table will, however, be very useful, as it gives, besides the maximum permissible currents for any conductors, the length of the circuit for one volt drop at maximum current, conductor resistances, radial thicknesses, &c. Radial thicknesses for paper cable below 7/18 are still omitted, however, and we are surprised to note that the low insulation of from 70 to 140 megohms per mile is still specified as the minimum for cables of this class. The latter, we think, is a serious mistake, for a well-insulated lead-covered paper cable has a far higher insulation resistance, and it is quite conceivable that a fault in the lead might not bring the insulation down below 140 megohms after 24 hours' immersion in water.

The test for dielectric strength was formerly at 2,000 volts and has now been decreased to 1,000 volts, and the specification of frequency and wave form has now been omitted.

A modification has been made in the salutary rule that rubber conductors for drawing into conduit should be braided, and now the braid is not insisted on if the tubes have a polished internal surface. We think this is wrong, as the place where wires are cut in the drawing-in is at the ends of the tubes. The extra money spent on internally polished tubes would be far better expended in braiding on the cable.

Flexibles may be insulated either with pure or vulcanised rubber, but pure rubber is recommended for pendants.

Although we agree that the use of the standard specifications of the Engineering Standards Committee should be recommended, yet they certainly ought not to be made compulsory in general rules of this class. For instance, the rule relating to metal conduits reads as if the only conduits permitted other than brass or copper ones are those in accordance with the above specification, although we cannot think that it is the intention of the Institution to bar heavier material or galvanised barrel. Again, lampholders "must" be in accordance with E.S.C. standards.

A rule has been added that the ends of the conduits must either terminate at metal outlet boxes, or must socket into boxes, preferably of incombustible material. We must take it that teak blocks are meant, as this wood is practically incombustible. The free ends of the tube must be bushed excepting where wooden bellmouths are used.

As in previous rules, casing is not allowed to be buried in plaster or cement.

Flexible is allowed to be fixed on insulators on the surface of walls, but must not be carried unprotected within four feet of the floor level, and must not pass through floors. The supports must not be more than 3 ft. apart, and there must be no joints except in junction boxes. The rule has been retained to the effect that flexibles must be connected to ordinary wires only by screw terminals in boxes or ceiling roses, and not by soldering, and that flexibles entering from fittings and passing into ceilings must be enclosed in conduits terminating in metal junction boxes. The first part of this rule is frequently disregarded, even by some of the best wiremen.

Ordinary unarmoured conductors, that is to say, not flexibles, may be run on the surface, but need not be fixed on insulators. They must be spaced from the wall, and metal staples must not be used with them. Armoured conductors may, of course, be fixed right on the wall and with metal staples if desired, and they must be earthed.

It is not made quite clear whether wiring of the Stannos class would rank as armoured wiring, but there can obviously be no objection to its being fixed right on to the surface of the wall; there must be hundreds of miles of this class of wiring so erected. As to whether it may be buried in plaster there is room to doubt, especially as the rules do not even make it clear that ordinary armoured cable may be employed in this manner.

A long section is devoted to earthed concentric systems, from which it is evident that "Stannos" wiring is absolutely accepted for this purpose. The voltage drop allowed for lighting is the same as for ordinary wiring, and a drop of 7 volts on the bare outer conductor is allowed on heating circuits. The metal parts of fittings must be connected to the outer conductor. Fuse boards on these systems must either be in metal cases or have metal backing, to which the outer conductors are bonded.

All joints must be soldered except where flexibles are connected to ordinary wires, and it is specified that conductors larger than 7/18 must be soldered to proper lugs for connection. The latter rule was also in the last edition, but, needless to say, is not always observed.

The specification for ordinary distribution boards in the previous edition of the rules was unnecessarily severe, and was certainly not always followed, but it has been retained. The bases are to be of incombustible and insulating material, and if the cases are of wood, they must be protected with fire-resisting material, a minimum clearance of 1½ in. is to be provided, and the distance from the glass front of the case to

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the fuse is not to exceed 1 in. In a well-known type of distribution board very largely used all over the country, and giving no trouble, there is a bare ½ in. between the sides of the cover and the terminals of the fuse carrier, and the wood cover is not lined with asbestos. Teak is, of course, employed for these distributing board cases in the best practice, and if this is done, we fail to see that they should be deemed dangerous.

The rule for the rating of fuses is that the conductor which the fuse protects must not rise in temperature above the limits already specified, provided that the fuse shall blow at 200 per cent. overload in circuits up to 10 amperes and 100 per cent. overload on larger circuits. On the other hand, no smaller fuses are insisted on than those blowing at 9 amperes, which are destined to protect ordinary three-ampere circuits. Contractors should be warned, however, that the Phœnix Fire Office does not allow such heavy fuses, and that the majority of the supply authorities would endeavour to insist on a lower rating for their main fuses than 100 to 200 per cent. overload.

The regulations for switches have been slightly altered. The old rules state that switches should be tested with pressures and currents 50 per cent. in excess of those for which they are rated. In the new rules, "must" is substituted for "should," which imposes a very unnecessary obligation on the manufacturer, for it cannot be expected that the contractor will test in this manner every switch that is to be used. The metal covers of switches for pressures above 125 volts are to be lined with insulating material on circuits of over 6 amperes; the old rule was 5 amperes, probably the new rule will be as frequently disregarded as the old one. Where switches are liable to come in contact with goods, they must be protected by an open-fronted box or other suitable guard.

Wall sockets and plugs are now called "plug connectors" instead of simply "connectors," as in previous editions of the rules. It is certainly less confusing, but why object to the names wall sockets and plugs. The old rule so frequently disregarded is retained to the effect that every wall socket must be independently controlled by a fixed switch on the live side. It is added, however, that a combined switch and wall socket complies with this rule, but apparently the Committee has forgotten that a large number of a useful form of combined switches and wall sockets are now used, in which the wall socket is always live, and independent of the switch. The rules recommend that portable fittings should not be supplied with switches, and suggest that, where switches are used on them, at least one lamp of a group must be controlled only by the fixed switch on the live side of the wall socket.

In the case of switch lampholders it is specified that they must be controlled, preferably in groups of not more than ten, by a master switch, and that one of the lamps controlled by this switch shall not have a key holder. All these rules will be found very troublesome in practice if they are followed, for these are all matters which the consumer wishes to decide for himself.

Another rule relating to portable hand lamps is that the lamp holder must not be in metallic connection with the guard or other exposed metal work. This is the Home Office rule for damp or metal floors, and, if it need not apply in the case of dry floors in factories, we fail to see why it should be imposed in the case of an ordinary house, for it prohibits the use of a metal shade on the shade carrier of a hand lamp.

As hitherto, portable heaters must be independently controlled by a wall switch, whether there are switches on the heater or not. A good rule has been added, but one which, we fear, will be disregarded, that at least one section of the heater must be controlled solely by the wall switch.

It is specified that D.C. motors over ½ h.p. must be fitted with a regulating switch with no-volt release; we presume a starting switch is meant, and that a regulating switch is not insisted on.

Portable accumulators with celluloid cases must be so arranged and placed during recharging, that if they become ignited the fire cannot spread.

The rules are published at the price of 6d. (post free, 7d.), bound up with the Home Office regulations for factories, and those of the Board of Trade Regulations which relate to the use of pressures from 250 to 650 volts for motors, &c., in buildings, but in this edition the rules for electricity in mines are not included, presumably because they are at present under revision by the Home Office.

Telegraph Traffic.—The cable between Zanzibar and Mombasa was restored on the 2nd inst. Communication between Gaza and El Arich failed on the 3rd, but was put right on the 4th. The Eastern Telegraph Company's cable between Kwandang and Menado has been in working order again since the 5th inst. Telegrams for offices of the Mexican Government are subject to very great delay, and the lines to all offices in the States of Sinaloa, Sonora, Chihuahua, Durango, Guerrero, and Morelas, excepting Cuernavaca and Puente de Ixtla, in the State of Morelos, are interrupted. Cable steamers on the Western Atlantic coast have been very idle lately, some of them not leaving port at all during March.

THE BREMER ARC LAMP PATENT

THE action by the British Westinghouse Electric & Manufacturing Co., Ltd., against the Electrical Co., Ltd., for alleged infringement of the Bremer flame arc lamp patent No. 18,786 of 1902 concluded on Thursday, and Mr. Justice Swinfen Eady reserved judgment. We dealt in our last issue with the whole of the case for the Westinghouse Co., and also that for the Electrical Co. down to Wednesday, when Prof. Silvanus P. Thompson, F.R.S., was giving evidence. The cross-examination of Prof. Thompson was directed to showing that no new facts had been brought out by him as compared with his evidence for Mr. Braulik in the action against him by the Westinghouse Co., but, in reply, stress was laid upon the point already made by Mr. Bousfield, K.C., that no Graham model had been made for the purpose of the previous action.

Mr. Bousfield, K.C., then replied for the Electrical Co., and was followed by Mr. Russell Clarke for the British Westinghouse Co.

THE I.M.E.A. CONVENTION

THE full programme of the Brighton Convention of the Incorporated Municipal Electrical Association, which will be held from Tuesday, June 27th, to Friday, June 30th, is now to hand.

The Mayor of Brighton will welcome the Association at the Royal Pavilion at 10 a.m. on Tuesday, June 27th, after which Mr. J. Christie, Engineer and Manager of the Brighton Corporation Electricity Department, will deliver his Presidential Address. The following two papers will then be read and discussed:—(1) "Electricity Supply viewed from the Municipal Committee's Standpoint," by Councillor H. Leese, Stoke-on-Trent; (2) "Modern Wiring Practice," by Mr. W. J. Beauchamp, Chief Electrical Engineer, Tunbridge Wells. In the afternoon visits will be paid to the Southwick Power House of the Brighton Corporation, and the works of the Brighton & Hove General Gas Company. In the evening there will be a Reception and Conversazione at the Royal Pavilion by invitation of the Mayor and Mayoress of Brighton.

The meeting on Wednesday, June 28th, will be held at the Municipal College, Portsmouth, and only one Paper is down for reading, viz., "Internal Combustion Engines in Power Stations," by Mr. H. L. Howard, Chief Electrical Engineer, Barking, and Mr. R. M. Carr, Chief Electrical Engineer, Leek. A visit will be paid in the afternoon to H.M. Dockyard Power House, and a ship of the "Dreadnought" class and the Portsmouth Corporation Lighting and Tramway Power Houses will also be open for inspection. At 5.30 p.m. a cruise will be made through Portsmouth Harbour to Ryde and Cowes.

On Thursday, June 29th, no Papers will be read, but discussions will take place at the Royal Pavilion, Brighton, on (1) "Purchase of Fuel," to be opened by Mr. C. E. C. Shawfield, Chief Electrical Engineer, Wolverhampton; (2) "Street and Shop Front Lighting," to be opened by Mr. A. H. Seabrook, Chief Electrical Engineer, Marylebone. A visit will be paid in the afternoon to the Brighton Corporation Electricity Department Sub-Station in Church Street, and the electrically driven locomotive workshops of the L.B. & S.C. Railway. The annual dinner will be held in the evening at the Dome.

The Annual General Meeting will be held at the Royal Pavilion on Friday morning, June 30th, for the election of officers for 1911–12, place of meeting, &c.

In addition to the visits mentioned above, the following will be open for inspection during the Convention:—Brighton Corporation Car Sheds and Workshops, Lewes Road; Reason Manufacturing Co.'s Works, Lewes Road; Volk's Electric Railway, and the Electrobus charging garage of the Brighton, Hove & Preston United Omnibus Co., Montague Street.

For the first time ladies are invited to the Annual Dinner, and the Council hope that all members will support them in their efforts to make this function a success.

All communications regarding the Convention should be made to The Secretary, Mr. C. McArthur Butler, 28 Bedford Square, London, W.C., but owing to the Coronation holidays in London, no communications can be dealt with between June 21st and the opening of the Convention on June 27th. It is requested that tickets be applied for not later than June 14th.

The Forthcoming Olympia Exhibition.—We are informed that a number of panels, each 32 ft. by 3 ft. 6 in., round the gallery, are available for the exhibition of electric signs, at the nominal rental of £10 per panel. These spaces will be very prominent, and in addition to serving as an exhibit for signs or decorations, would also constitute a valuable advertisement to the firms securing them.

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THE SINGLE-PHASE PLANT SUPPLYING THE LONDON, BRIGHTON AND SOUTH COAST RAILWAY

By G. W. Partridge, M.Inst.C.E.

(*Engineer-in-Chief to the London Electric Supply Corporation.*)

PART II.—THE MECHANICAL PLANT.

The Engines.

THE engines are of the Ferranti vertical cross compound type, with alternators arranged between the H.P. and L.P. columns, the rotors being both keyed to the shaft and bolted to the 70-ton fly-wheels. The cylinders are 31 inches and 62 inches diameter respectively, by 30 inch stroke.

The valve gear is arranged with a variable cut-off, operated by means of a scroll, which alters the throw of the cams, and is adjustable by hand from the outside of the gear box. In addition to the hand operation, an automatic feature has recently been designed and fitted by the Corporation whereby the cut-off is electrically and automatically worked by means of a solenoid, which is energised in series with the main field windings of the alternator, so that when the field current is automatically increased by the Tirrill regulator, due to a heavy load being thrown on, the action of the solenoid is simultaneously and correspondingly strengthened, and this, operating on the valve gear by a suitable arrangement of levers, causes the cut-off point to be carried later in the stroke. On the load falling off, the cut-off is automatically readjusted to light-load conditions by means of a powerful spring.

By this means a very fair over-all steam economy is obtained, notwithstanding the unfavourable varying load conditions.

With a load subject to such heavy momentary fluctuations, it will be readily understood that the question of good and reliable governing is a very important one, both for voltage regulation purposes and also from a safety point of view. After careful consideration it was decided to fit these engines with the Chorlton-Whitehead isochronous governors. These were specially designed by Mr. Whitehead for the severe conditions obtained, and are the largest and most powerful governors of this type which he has hitherto made.

The balls and springs are entirely enclosed in a neatly finished circular cast-iron housing case, filled with oil, which revolves with the balls, being driven through gearing by means of a Hans Renold chain from the main shaft.

By an ingenious arrangement of oil dashpots and compound springs, the adjustments, which in an ordinary governor have to be done by hand for speed correction between no load and full load, are in the case of the Whitehead governor carried out entirely automatically, the engine speed between no load and full load on a steady rise being practically constant without any hand adjustment, and the momentary variations on an instantaneous throwing on and off of a load of 2,000 kw. with the cut-off properly adjusted, not exceeding 7 per cent., returning to normal within three seconds.

That the selection of this governor has been thoroughly justified will be readily seen from an inspection of the excellent results shown on the speed and corresponding load charts given in Fig. 5.

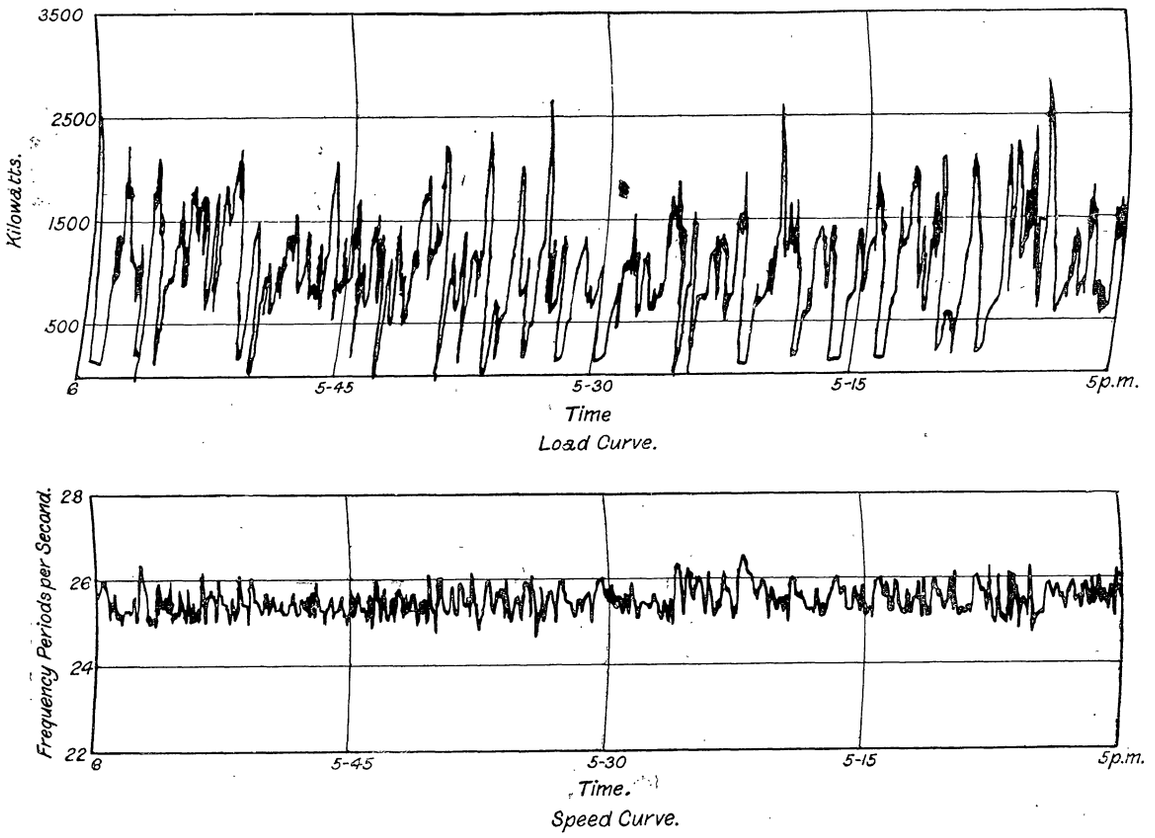


FIG. 5.—LOAD AND SPEED CURVES FROM 5 TO 6 P.M. ON APRIL 12TH, 1911, TO SHOW THE CLOSE GOVERNING.

Boilers.

The steam for the railway plant is obtained from the same boiler system which serves the lighting side of the station, all the boilers and steam mains being connected in parallel.

The boiler plant consists of seventeen boilers of the Babcock & Wilcox land type, arranged in three batteries, and twelve Davey-Paxman dry-back "Economic" in two batteries of six each. Of the the Babcock boilers, five are arranged in one battery and have a heating surface of 4,250 sq. ft. each, and the remainder 3,500 sq. ft. each. The larger boilers and one battery of the smaller size are fitted with chain grate stokers.

The steam from the mechanically stoked boilers is passed through a separately fired superheater of the Stirling Company's make, which is provided with a small boiler section in front of the superheater element, so as to enable economical surface conditions to be obtained without any risk of damaging the steam-filled tubes.

It may be of interest to point out that since the five large

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Babcock boilers were installed we have fitted them with the Temperley-Cockburn system of steam-extracting pipes.

This consists of an arrangement of internal pipes about 1 in. diameter by 8 ft. long, fitted longitudinally in the four bottom rows of boiler tubes at the furnace end, each set of four pipes being connected together inside the front staggered header box to a vertical ascension pipe, which passes up through the front connecting nipples into the steam space of the boiler drum.

The longitudinal extracting pipes are supported on short feet inside the 4-in. boiler tubes, so that they are close up to the top of the latter, and they are perforated on their top side with a number of small holes, the back or remote end of the pipe being plugged up.

The arrangement inside the front header box is illustrated in

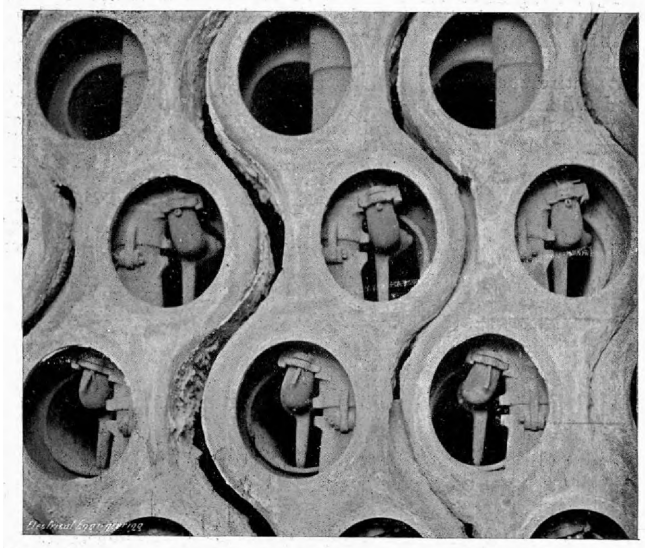


FIG. 6.—INSIDE OF FRONT HEADER BOX, SHOWING ARRANGEMENT OF TEMPERLEY-COCKBURN SYSTEM OF STEAM EXTRACTING PIPES.

Fig. 6, which shows the supporting feet and the connections to the ascension pipes.

By this system the inventor claims that the steam which is generated in the lower rows of tubes over the furnace, where probably 80 or 90 per cent. of the total evaporation of the boiler takes place, is passed freely upwards into the boiler steam space without the possibility of any steam plugging and incidental overheating of the tubes occurring, it being contended that the steam bubbles, as they are generated on the surface of the lower half of the tubes, which are exposed to the maximum furnace temperature, rise to the top of the tube and enter the orifices in the extracting pipe, passing from thence up the ascension pipe into the drum.

Owing to the mixture of steam and water in the ascension pipe being much lighter than the more or less solid water in the header box surrounding it, and also to the frictional loss being less than in the case of the plain header, an upward path of minimum resistance is provided for the steam, thus considerably assisting the circulation of the boiler.

This system has been found very effective in the case of the Deptford boilers, in giving immunity from tube troubles. Since the pipes were fitted, it has been found possible to work the boilers regularly at an evaporation of 25 to 30 per cent. in excess of the makers' rating, without any overheating occurring It has also been found that with these pipes in use, there is no falling off in the boiler efficiency at high overload rates.

The feed pumps are of the slow-stroke vertical compound type, made by Messrs. J. P. Hall & Sons. The feed water from the hot-well gravitates through a pair of Boby exhaust steam heaters, where it is raised to 212° F., the exhaust steam from the exciters, feed pumps, and other auxiliaries being utilised for this purpose. The feed pumps draw their water from the bottom of the Boby heaters, and discharge it through Green's economisers, from whence it passes at a temperature of 280° F. to the boilers.

An "Ados" integrating CO_2 recorder is installed in one of the stoke holes with a system of pipe connections, so that it can be thrown on to any boiler.

A flue gas analysis instrument of an improved "Orsat" type is also provided in a test laboratory adjacent to the stokehole. This laboratory is, in addition, equipped with all the necessary apparatus for coal and water testing, a sample of coal being drawn from each barge and subjected to destructive analysis.

Condensing Plant.

In the first installation of condensing plant laid down some seven years ago three fan-draught cooling towers were erected, the circulating water being obtained from artesian wells on the site of the Deptford works, owing to the difficulties at that time of obtaining water from the Thames for cooling purposes. When the first installation of the railway plant was in contemplation, however, the question of obtaining a supply of circulating water from the Thames was again gone into, and ultimately in 1907 a contract was placed for the laying of four 36-in. diameter cast-iron pipes in the bed of the river, extending outwards from the wharf frontage line some 150 ft., so as to be well beyond the lowest recorded tide line.

In conjunction with this scheme a condenser of 9,000 sq. ft. cooling surface and a set of four throw motor-driven air pumps were laid down. Both the condenser and air pumps were made to the designs of the Corporation, and embody certain unusual features which have been found to work very satisfactorily in practice, the condenser being arranged with special means for quickly clearing the water of condensation from the tubes, and the air pumps having a special design of flat-bottomed buckets without either bucket or foot valves.

The circulating water is obtained by a centrifugal pump of 300,000 gallons per hour capacity, arranged in the river pump house some 500 ft. away from the condenser in the engine-room.

In the pump house is also arranged a rotary strainer of an entirely new type for removing the floating *débris* from the water before it is passed in the circulating system. It was designed by Mr. T. M. Aitken, chief assistant Engineer at the Deptford works, and has been made in the Corporation's own workshops. It was the outcome of a great number of experiments by the Corporation, and has been constantly at work for over eighteen months with very satisfactory results. It can, moreover, be installed at an initial cost of about one-third of that of other strainers on the market. The strainer which is illustrated in Fig. 7 consists of a drum perforated with numerous

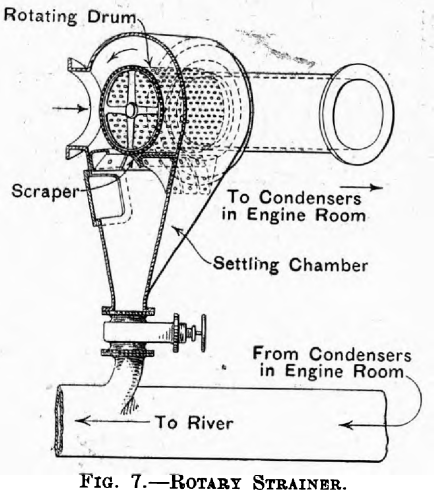


FIG. 7.—ROTARY STRAINER.

holes, which rotates at about two or three r.p.m. in a cast-iron chamber. It is driven from the centrifugal pump shaft through reduction gear. Any leaves, straw, or other debris entering with the water adhere to the outside of the drum, and are removed by a fixed scraper, the position of which is seen in the figure. This is adjusted so as to have a "shaving" action on the drum surface, so that any solid matter may also be effectively removed, and it all gravitates through a duct at the back of the scraper into the lower part of the housing chamber, which acts as a settling chamber. From this, it is returned to the river through a sludge valve, connected to the return pipe from the condensers, and opened either automatically or by hand. Larger sizes up to 650,000 gallons per hour are in course of construction for the new turbine plant which is being installed this year to deal with further extensions on the Brighton Railway, and designs have been got out for still larger sizes.

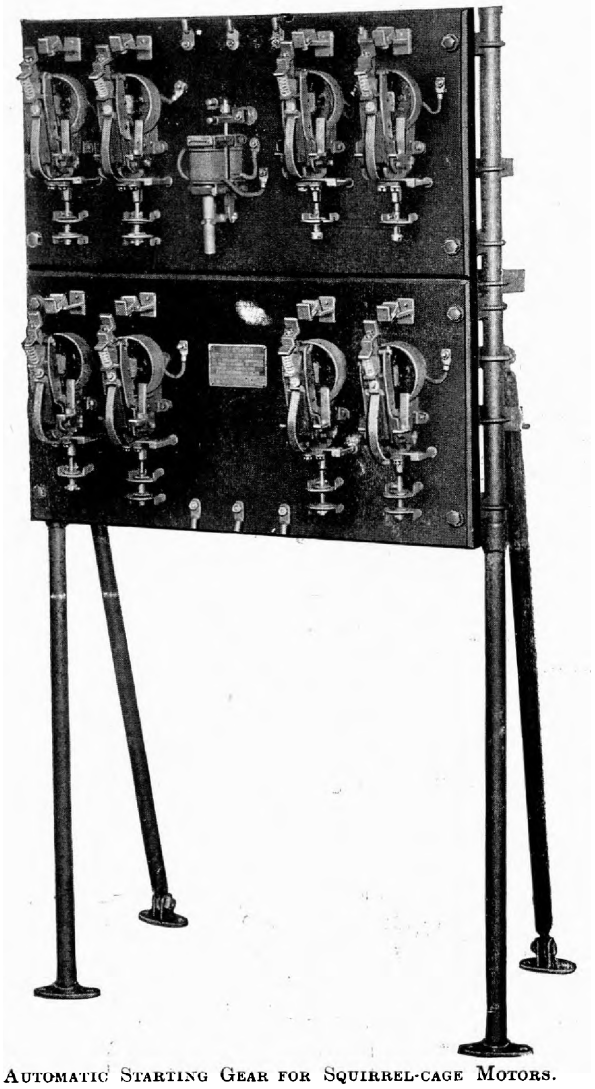
The Turin Exhibition.—The following electrical and engineering firms are included in the list of British exhibitors at the International Exhibition at Turin, which was opened by the King of Italy on April 29th :—Edgar Allen & Co. (Sheffield), Alley & MacLellan, Ltd. (Glasgow), British Vacuum Cleaner Co. (Fulham), Cambridge Scientific Instrument Co. (Cambridge), Campbell Gas Engine Co. (Halifax), Crypto Electrical Co. (London), Doulton and Co. (Burslem), Alfred Herbert & Co. (Coventry), Holden & Brooke, Ltd. (Manchester), R. Hornsby & Sons (Grantham), Merryweather & Sons (Greenwich), Nalder Bros. & Thomson (London), National Gas Engine Co. (Ashton-under-Lyne), Ozonair, Ltd. (London), R. W. Paul (London), Reason Manufacturing Co. (Brighton), Reavell & Co. (Ipswich), Hans Renold, Ltd. (Manchester), A. Reyrolle & Co. (Hebburn-on-Tyne), Simms' Magneto Co. (Kilburn), the Synchrome Co. (London), Underfeed Stoker Co. (Finsbury).

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AUTOMATIC STARTERS FOR SQUIRREL CAGE MOTORS

THE British Thomson-Houston Co. have given a good deal of attention to the design of automatic starting apparatus on the auto-transformer, a compensator system of squirrel cage induction motors of all sizes from 5 h.p. upward. One of their equipments for this purpose is shown in the accompanying illustration, and consists of a current limit relay, contactors, compensator coils and fuses mounted on a panel supported by pipe frame work. The current limiter controls the contactors, so that the full load line current is not exceeded during starting, and the motor is caused to start quickly or slowly according to the load on it.

The contactor will carry its rated current continuously with a large factor of safety. It opens and closes with a quick positive action, thus preventing fusion of the contacts. It will open the circuit on heavy overloads, arcing being dispersed by means of a powerful magnetic blow-out. Special attention has been given to the design in order to



AUTOMATIC STARTING GEAR FOR SQUIRREL-CAGE MOTORS.

eliminate the objectionable noise and vibration usually associated with alternating current magnets. The only solenoids in circuit after the motor has attained full speed are those on three contactors, and they use a very small amount of energy, and as the contactors open when the voltage fails, efficient no-voltage protection is afforded. Fuses for overload protection are supplied and mounted on the panel. As they are not connected in circuit during the period of starting, fuses of the running capacity of the motor can be used. The motor can be controlled either by opening and closing the circuit of the solenoids by means of a small switch, or by leaving this circuit closed, and using instead a double or triple pole switch (preferably of the oil type) for opening and closing the line circuit.

The system is particularly adapted to pump motors, where the control switch can be automatically actuated by a float or pressure gauge.

METAL FILAMENT LAMPS FOR CHURCH LIGHTING

SIEMENS BROTHERS DYNAMO WORKS, LTD. (incandescent lamp and fittings department, Tyssen Street, Dalston), have sent us the accompanying illustrations of the interior of a church illuminated by gas and electricity respectively. We are assured that the blocks have been made from photographs which have not been "faked" in any way.



FIG. 1.—CHURCH LIGHTED BY "ONEWATT" LAMPS.

In fact, the gas photograph has the advantage owing to the fact that gas-light printing paper has been used, whilst the ordinary chromo paper was used in the case of the electrical photograph. The beautiful outline of the details of the church interior is a testimony to the effectiveness of the electric lighting, which was in this case accomplished by Siemens' "Onewatt" lamps. Apart from the fact of a better illumina

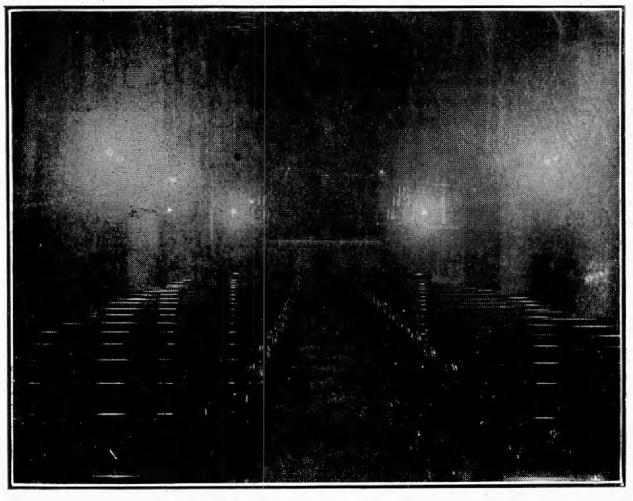


FIG. 2.—THE SAME CHURCH LIGHTED BY GAS.

tion, the actual lighting bill is considerably less than with gas, whilst it is also anticipated that money will be saved owing to the more cleanly light reducing re-decoration costs and cleaning bills. These advantages, together with the fact that the initial cost of high c.p. "Onewatt" lamps is now lower, should encourage electrical contractors to make greater efforts in connection with similar installations.

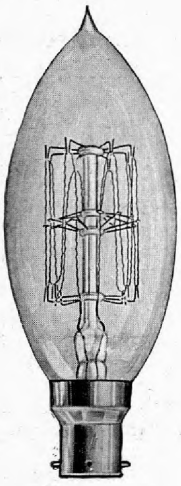
Birmingham Local Section of the Institution of Electrical Engineers.—The annual report of the section, submitted to the annual meeting yesterday, records seven general meetings, at which the average attendance was 77, and the annual dinner. The membership is now 418 (including 134 students), an increase of 20 since last year. The following committee were elected for the next session. *Chairman:* M. J. Railing. *Past Chairmen:* R. A. Chattock, Gisbert Kapp, R. K. Morcom. *Vice-Chairman:* A. M. Taylor. *Committee:* J. H. Barker, W. C. Goodchild, M. Kloss, W. J. Larke, F. M. Lea, F. J. Moffett, D. K. Morris, C. E. C. Shawfield, Maurice Solomon, J. J. Steinitz, W. E. Sumpner, R. Threlfall. *Hon. Secretary:* H. B. Matthews

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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Incandescent Lamps.

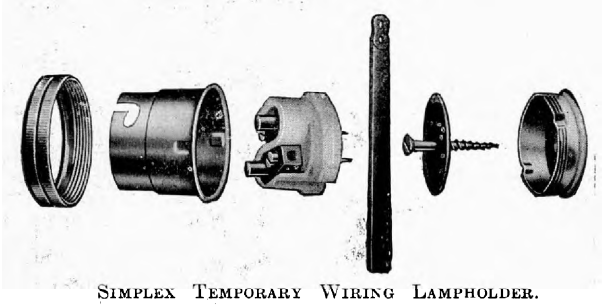
Messrs. Siemens Brothers Dynamo Works (Incandescent Lamp and Fittings Department, Tyssen Street, Dalston) announce a further range of "Tantalum" candle lamps. Hitherto, these lamps have not been supplied in higher voltages than 60, in 5 and 10 c.p. sizes, but the new types will be supplied in 10 and 16 c.ps. for 70 to 120 volt circuits. The filaments will, of course, be precisely the same as those of the ordinary "Tantalum" lamps at present on the market. They will be listed at 2s. 9d. each, and it is anticipated that they will be in large demand for series running in candelabra fittings on high voltage circuits. The lamps, one of which is illustrated here, are approximately 5 inches long and 1⅝ inches in diameter.



Tantalum Candle Lamp.

Switches and Switchgear.

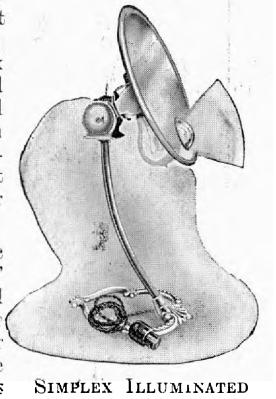
A recent catalogue of Coronation illumination material from Simplex Conduits, Ltd., contains among other interesting items a description of a new temporary wiring lampholder, which we illustrate here, taken apart for the sake of clearness. This holder is specially designed for requirements not easily met by ready-made strip, and should constitute a very inexpensive system quick in erection. It is a slightly modified form of standard holder. In erecting, the brass base is first screwed in the desired position and twin 7/22 wire laid in the grooves provided. The holder is then assembled



Simplex Temporary Wiring Lampholder.

and the screw spikes screwed home, which pierce the insulation and make contact with the conductors. Another feature of the list is a neat flagstaff made entirely of Simplex Conduit tube, which does not require any foundations for erection, and is put on the market at 40s.

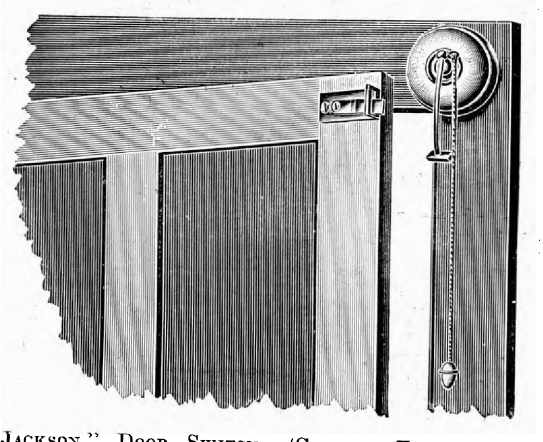
Another article to which Simplex Conduits, Ltd., have specially called our attention is the illuminated shaving mirror illustrated here, in which an ordinary lamp is placed behind the mirror close up to a lens let into the lower part of the mirror which directs the light as required.



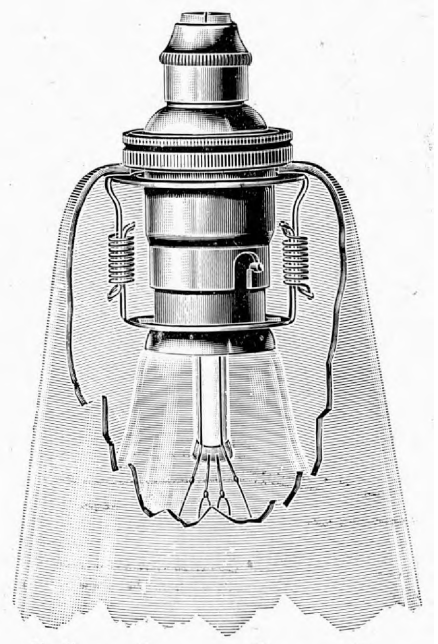
Simplex Illuminated Shaving Mirror.

A new pattern of semi-automatic door switch known as the "Jackson" switch, has recently been introduced by the General Electric Co. The arrangement as applied to a door opening inwards is clear from the accompanying figure. With this switch, instead of the light being put on every time the door is fastened whether required or not, the light is switched on by pulling the cord on entering when required, while the action of opening the door to leave automatically throws the switch to the off position. The arrangement can be fixed on the hinge side of the door in the case of doors opening outwards, and is suitable without alteration for right- and left-handed doors.

Another novelty just put on the market by the General Electric Co. is the "Hileach" shade carrier. The arrangement of this, which is shown in the illustration, is such that the ordinary shade ring is not required. The shade is held up by the top ring of the carrier through the action of the springs which are put in compression by inserting the lamp in the holder with its shoulder bearing against the lower ring of the carrier. The shade can be removed simply by



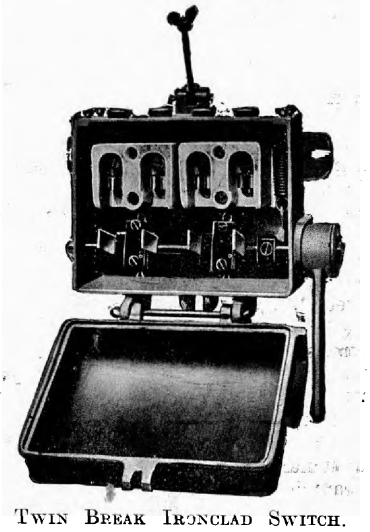
"Jackson" Door Switch. (General Electric Co.)



"Hileach" Shade Carrier. (General Electric Co.)

removing the lamp and the inconvenience of unscrewing the shade ring.

The accompanying illustration shows a new pattern of twin break ironclad switch, which has just been brought out



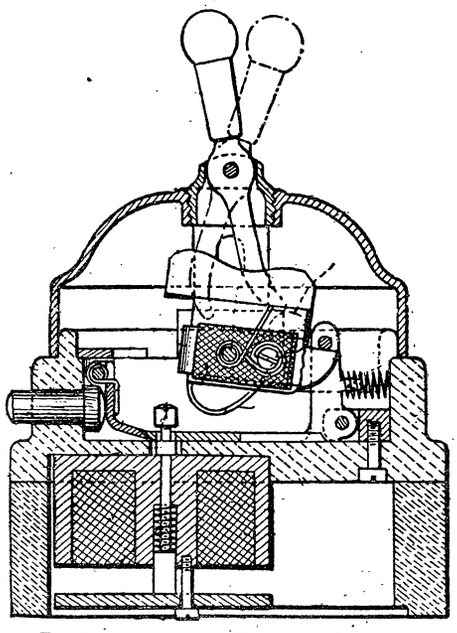
Twin Break Ironclad Switch.

by the General Electric Co. (67 Queen Victoria Street, E.C.) to meet the demand for a switch where current is not carried

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through the hinge. A long break is provided, and the contacts are surrounded by porcelain so that a short circuit between poles is practically impossible. The case can only be opened when the switch is off. The handle being in at the side and not projecting through a slot, avoids possibility of shocks through becoming alive, or burns due to flame coming through the slot. The arrangement of the springs is such as not to tend to pull the switch off when closed.

To meet the trade demand for small automatic circuit breakers, which can be relied upon to open an electric circuit immediately an overload occurs, the Thames Ironworks Shipbuilding & Engineering Co., Ltd. (Canning Town), are placing on the market a circuit breaker of little larger size than the ordinary tumbler switch. These switches are manufactured under Denny's Patents, and we give in the accompanying figure a section of the apparatus. In the pattern shown the magnet is protected by a porcelain surround, but another form is made omitting this, which is more suitable for distribution boards and conduit boxes. The switches are made for currents up to 5 amps. and for voltages up to 500. To a large extent they can replace the ordinary small porcelain bridge fuses and cut-outs for lighting and small power circuits, and incidentally avoid the trouble and inconvenience



Denny Automatic Tumbler Switch.
(Thames Ironworks Co.)

of replacing blown fuses. In size and appearance the switches are very similar to the ordinary tumbler switch, and are self-contained with a special type of electro-magnet, the winding of which is in series with the switch. The armature of the magnet is in direct mechanical connection with a tripping lever, which in turn retains the switch circuit closer in the "on" position. Should an overload occur, the armature is attracted by the magnet, and the tripping lever thereby operated, thus releasing the switch, which opens instantaneously, having no time element like a fuse. The operating lever, or knob, is not fixed in any way to the switch parts, so it is therefore impossible to close the switch on a short circuit. To release the switch by hand a push-button is provided at the bottom of the switch, which, on being depressed, operates the tripping lever, giving a quick break to the switch independent of the operator.

A new list of adapters, cord connectors, &c., is to hand from D. H. Bonnella & Son, Ltd. (58 and 60 Mortimer Street, W.). This contains adaptor to allow two or more plugs to be connected to one socket. Lampholder adaptors to take one or two plugs with or without lampholder as well, several patterns of two and three pin cord connectors and china covered wire connectors. Special table connections, sockets, carpet plate, &c., are also included.

The Foster Engineering Co. (Morden Road, Wimbledon) have introduced a dimming switch for use on alternating current circuits, which is really a choking coil of simple design, with tappings brought out to a multiple contact switch. The whole is enclosed in a neat case. The apparatus has the advantage over resistance dimmers that it does not waste energy, but, of course, it is only suitable for alternating current circuits.

Miscellaneous.

A new form of self-contained motor control pillar, consisting of a cylindrical case with a handle resembling that of a tramway controller on the top, has been introduced by the Electric and Ordnance Accessories Co. (Birmingham). The case, which is fully weather-proof, contains a D.P. overload and no-voltage circuit breaker, a drum-type starter, a shunt regulator for speed variation, a pair of switch fuses, and the necessary resistances. In the case of non-reversing motors, there is only one operating handle both for starting and speed regulation with a small push-button which is used to hold the circuit-breaker in during starting. The doors are interlocked so that the circuit breaker cuts current off when they are opened, and the whole construction is designed for heavy service with an efficient magnetic blow-out to the main contacts.

SINGLE PHASE TRACTION ON THE BRIGHTON RAILWAY

CONSIDERABLE progress has been made with the extensions to the equipment of the suburban lines of the London, Brighton, & South Coast Railway for electric traction on the single-phase system, and the portion between Victoria and the Crystal Palace, about nine miles of route, is being opened for traffic to-day. Trial runs have been in progress for some time, and the Board of Trade inspection was made last week. The section in question is only a part of the total extensions in hand, which amount in all to a track mileage of 46½. The Victoria and Crystal Palace section was pushed forward in view of the extra traffic in connection with the Festival of Empire, which could not have been carried by ordinary steam methods. The opening of the whole of the extension has had to be deferred, mainly owing to questions of power supply, as the additional generating plant in the Deptford station of the London Electric Supply Corporation, from whom the power is obtained, is not yet complete. To handle this traffic 30 new trains have been obtained, the stock composing them consisting of 30 motor coaches and 56 trailer cars. The motor coaches are each equipped with four Winter-Eichberg single-phase motors of similar design to those already in use on the South London Line, but larger, for they are rated at 175 h.p. on the one-hour rating, or 100 h.p. continuously. This increase in power does not imply that the original motors were found to be insufficient, or that higher speeds or accelerations are contemplated, but is simply on account of the different make-up of the trains with more trailers to each motor coach.

The equipments, as before, were supplied by the Allgemeine Electricitäts Gesellschaft, and the collections and control arrangements are identical with those used before. The cars themselves were built by the Metropolitan Amalgamated Carriage and Waggon Co. The bodies are of slightly different design from those running on the South London Line in that the side corridor has been omitted. This is not, as has been stated, due to the corridor having proved a failure from the traffic point of view, but is solely on account of the bodies having to be made narrower in order to pass through certain tunnels. The South London cars were exceptionally wide, being 9 feet in width over all, while the new cars for the Crystal Palace service have to be kept down to the standard width of 8 feet. The cars can be made up into two, three, four, six, eight or nine-coach trains, and the fitting of control equipments to some of the trailers enables a train of any size to be driven from either end.

On a special run last week without stops the outward journey from Victoria to the Crystal Palace was made in 15 minutes, and the return journey in 13½ minutes; but, according to the time-table, the ordinary service runs will be 23 minutes out and 21 minutes return, or about 33 per cent. faster than under steam conditions.

The overhead equipment does not present any difference from that employed on the earlier line, and that experience has not suggested improvements is the best proof of its suitability to the work. It was erected by Messrs. R. W. Blackwell & Co., and the whole of the extensions, like the conversion of the original piece of line, has been carried out under the immediate supervision of Mr. Phillip Dawson, Electrical Engineer to the London, Brighton, & South Coast Railway Co. As is well known, a scheme is in preparaton for considerable further extensions of the adoption of electric traction on the Company's lines, involving ultimately the conversion of the main line to Brighton, but at the present time it is premature to make any announcement regarding the adoption of the scheme by the directors.

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LIGHT AND ILLUMINATION

AT the meeting of the Illuminating Engineering Society on April 24, Mr. Haydn T. Harrison read a Paper entitled "The Ratio of Light to Illumination," in which he dealt generally with artificial lighting. Illumination he defined simply as the quantity of light falling on a surface. It had nothing to do with the colour or reflecting value of the surface, so that it was not strictly correct to say that instruments such as the Holophane Lumeter (used in Mr. Waldram's experiments mentioned below), measured illumination except when pointed to a surface of similar material to that of the screen in the instrument itself. He had carried out some experiments with his own "Universal" flicker photometer by replacing the comparison screen by the various tinted wallpapers used by Mr. Waldram, and obtained the following figures for the increase in illumination necessary for the rays reflected to have the same effect as when a white paper screen was used:—Bright red, 3·5 times; dull cardinal red, 6·5 times; medium blue, 4·8 times; light blue, 3.2 times; dark green 7·0 times; light green, 2·2 times. Comparisons of the light reflected from the area of these papers with that from white blotting paper gave similar results.

In view of the confusion in the use of terms often arising, he proposed the following definitions:—*Light.*—The emanations from a light source. *Illumination.*—The extent to which anything is illuminated; foot-candles. *Brilliancy.*—Refers to primary light source and is candle-power divided by area. *Intrinsic Brilliancy.*—Candle-power per unit surface. *Brightness and Intrinsic Brightness.*—Same as brilliancy. *Luminosity or Luminous Intensity.*—Same as brilliancy, but applied to secondary sources of light.

Mr. Harrison points out that if luminosity or luminous intensity is used as applied to indirect or secondary sources of light, we could state that any given area in a room was illuminated to a certain degree in foot-candles by direct light from a source plus so many lumens in the form of indirect illumination, and we should know at once the relative reflecting value of the surroundings of the light source, and also the likely density of the shadows.

The measurement of the illumination derived from all sources is an easy matter, but there is more difficulty in ascertaining the light value of the original source, owing to the effect of globes, reflectors, &c. Mr. Harrison then passed on to consider the relative merits of lights with reflectors or globes which increase the illumination in the direction required, versus unprotected lights from which good illumination is obtained by using the walls or ceiling as reflectors.

Few men, he said, would like to work in a study or dine in a dining-room where the light emanates from all directions, and where the iris of the eye is kept constantly contracted by the high luminosity of the surroundings. Shadowless illumination was always depressing, and it would be wise to deliberate carefully before any system of shadowless illumination was adopted, and to remember that the object of all illumination is to produce an effect by which the outlines of objects is easily seen, which result is greatly assisted by the effect of light and shade.

A Paper on the effect of wall papers on illumination, by Mr. P. J. Waldram was read at the same meeting. The author said that the predetermination of interior illumination was not easy, and it was not realised how much light was absorbed by wallpapers, &c., that might be usefully reflected. The author suggests that the reflection coefficient for any paper, colour, or texture can be ascertained with sufficient accuracy for all practical purposes by measuring its apparent surface brightness in a direction normal to its surface as compared with that of white blotting paper, or other suitable standard under the same illumination. Equipped with the distribution curve of the particular light unit or units which it is proposed to adopt, and the reflection coefficient of the wall and ceiling papers or colours, the installing engineer can say what direct flux of light will fall upon the walls, ceiling, and table plane of any room, and what will be the surface brightness due to that flux. All he requires to know is what increase in the flux will be due to reflection.

Some tests by Drs. Sharp and Miller in America in a room 12 ft. by 12 ft. by 10 ft. high, lighted with one pendant; the lamp directed an average flux of 1·20 foot-candles on to the ceiling, 2·50 foot-candles on to the walls, and 1·25 foot-candles on to a table plane 3 ft. from the floor. It was found that the total effect of reflection and counter reflection from walls and ceilings under these conditions was equivalent to an average secondary flux of 1·90 foot-candles on the walls, 0·65 foot-candles on the ceiling, whilst the illumination on the table plane was doubled to 2·5 foot-candles.

In the author's own experiments on a rather larger room, in which observations were taken with various wall-papers, it would appear that under average conditions the increase of flux of illumination on walls by reflection tends to vary somewhere from between 50 per cent. and 70 per cent. with white wall-paper, down to between 20 per cent. and 30 per cent. with very dark papers. The increase of flux of illumination on white ceilings appears to be in about the same proportion as on the wall-papers to which they are adjacent. The increased illumination on table planes in foot-candles appears to be about a mean between the increases in foot-candles of the flux on the walls and on the ceiling.

DISCUSSION.

The discussion was opened by Mr. A. P. TROTTER, who said that the total light in a room entirely covered with a colour with a known coefficient of absorption, such as those which had been given by Dr. Sumpner some time back, could be calculated, but in practice sufficient data could not be obtained, and experiments such as those of Mr. Waldram had to be resorted to.

Mr. JUSTUS ECK suggested the term luminosity for secondary illumination, and favoured the idea that manufacturers should send out polar curves of their lamps.

Mr. V. H. MACKINNEY (Holophane, Ltd.) objected to Mr. Harrison's remark regarding his company's Lumeter, and said with the standard card it could measure true foot-candles. He also pointed out that reflectors and globes had other functions than referred to by Mr. Harrison, such as the avoidance of glare, and said that when reading, darkening the surroundings too much had a bad effect on the eyes. The Holophane reflectors usually transmitted about 22 per cent. of the light upward for general illumination, and reflected 75 per cent. in the direction where most required. His company were carrying out experiments in a room 8 ft. cube, which could be fitted with wallpapers of any colour. Some of the results are given in the accompanying table. It is interesting to observe how the various

Illumination of room 8 ft. cube lighted by one 55-watt tungsten lamp.

Conditions.	Quantity of light (lumens) at working plane. Direct from source.	From ceiling.	From wall.	Total.	Watts required to give 100 lumens.
Bare Lamp—					
White ceiling and walls ...	17	50	53	100	55
Black ceiling, white walls ...	17		33	50	110
White ceiling, dark blue walls (22% reflective coeff.) ...	17		30	47	117
White ceiling, dark red walls (28%)	17		36	53	104
White ceiling, light green walls (45%)	17		53	70	78
Lamp with "extensive" Holophane reflector—					
White ceiling, light green walls	60		40	100	55
Lamp with intensive Holophane reflector	90		35	125	44
Lamp with focussing Holophane reflector	120		36	156	35

components change as different wallpapers are employed, and the figures show that even in a room with light green walls and a white ceiling, a saving of over 30 per cent. can be made by using the correct Holophane reflector.

Mr. T. E. RITCHIE had compared the Lumeter with five other well-known instruments, and regarded it as the second best. He did not agree that shadowless illumination was depressing, and generally defended indirect illumination.

Mr. J. G. CLARKE (Gas Light & Coke Co.) suggested that with a given scheme of lighting, and a given colour of walls, the illumination of the walls ought to be inversely proportional to the square of the linear dimensions of the room.

Mr. W. R. RAWLINGS emphasised how much the requirements of different rooms and of different people varied. Mr. J. Hewitt also spoke, and both Mr. Harrison and Mr. Waldram replied briefly.

The Association of Engineers-in-Charge.—Among the visits arranged are one to the Central London Railway tunnel extension from the Bank to Liverpool Street on May 13th, and one to Cambridge on May 27th, when the electricity works and the works of the Cambridge Scientific Instrument Co. will be inspected.

East London Railway.—It is reported that at a recent meeting of the Joint Committee, which consists of representatives of the Lessee Companies', it was decided to proceed with a scheme for converting the East London Railway, which consists of five miles of line, forming a connecting link between New Cross and north-west London, to electric traction. The estimated cost is said to be £50,000.

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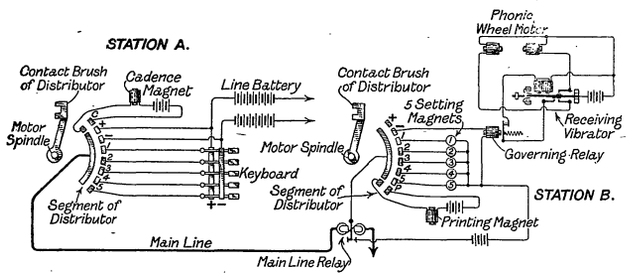
THE MURRAY PRINTING TELEGRAPH

At last Thursday's meeting of the Institution of Electrical Engineers, Mr. Donald Murray read a paper entitled "Practical Aspects of Printing Telegraphy." In the first part of the paper he discussed the field for printing telegraphy, the use of which would lie chiefly in connection with centres of population, and in assisting the co-operation between the telegraph and telephone. He suggested that for the transmission of intelligence over considerable distances the most efficient arrangement was a combination of the telephone and telegraph, the telephone acting as the collector and distributor for long telegraph lines. By co-operation between the telegraph and telephone the advantage of the cheap telegraph line was combined with the advantage of the low labour cost and time-saving of the telephone. Printing telegraphs, he said, would form essential links in the telephone-telegraph network, because printing telegraphs were the only means by which the carrying capacity of telegraph lines would be greatly increased and the labour cost at the same time decreased.

The second part of the paper contained a long and detailed account of the difficulties that have been encountered in connection with the development and practical application of printing telegraphs. There were several traffic difficulties such as the difficulty of making a copy of the received message, and changes were necessary in the forms used. The numbering of the messages appeared to present difficulty, and the saving in time theoretically obtainable was limited by a variety of traffic considerations. There were also difficulties with the difference of alphabets and signs in use in different countries. Code messages were, however, handled with less risk of error than by the Morse system. There were also mechanical difficulties of construction. Printing telegraph machines belonged to a theoretically bad group of mechanisms, in which the majority of the actions were striking instead of sliding or rolling, and it was only by close attention to details that success had been achieved.

In the last part of the paper was given a general description of the latest developments of the Murray system, which include the Murray automatic instruments and the new method of multiplex working.

In the Murray automatic system, the messages are first perforated by a keyboard instrument, on a strip of paper tape in the Baudot 5-unit alphabet. The perforated tape is then used to transmit the messages by means of an automatic transmitter at a speed of from 100 to 180 words a minute, and at the receiving station the arriving signals are recorded as perforations in a second paper tape. This reproduced tape at the receiving station then serves to operate an automatic typewriter. The line is worked duplex, giving one transmission in each



Connections of Murray Multiplex System.

direction simultaneously on the one wire. Received messages are printed in page form, at speeds up to about 200 words per minute. The essential feature of the typewriter is that the typebars are very short, only 2 in., to ensure high speed.

In the automatic printer, the letter, line, and column feeds are entirely automatic, but the page-feed is manually operated. The apparatus is rather extensive, and its advantages are more particularly felt in the case of long lines. It is in use with great success between St. Petersburg and Omsk, 2,400 miles, giving 60 to 65 words per minute over a line capable of less than 40 words per minute with Wheatstone apparatus.

The Murray multiplex system is to some extent founded on the Baudot, as it employs a similar distributor, with the important difference that it is driven, like the Delaney multiplex, by a Lacour phonic wheel motor. The system can be worked duplex, and will give up to eight transmissions on one wire. The distributor at one station sends out a governing impulse once in each revolution, which controls the speed and phase of that at the other end. The distributors are of very simple construction. The essential connections are shown diagrammatically in the figure. For the sake of clearness the segments for the other transmissions are omitted, and for the sake of simplicity the Baudot 5-key transmitter is shown at station *A*. The vibrator and phonic wheel that keep the contact brush of the distributor revolving are also omitted. The five transmitting keys at *A* normally rest against the top contact bar, which is connected to the negative end of a split battery. The depression of any key puts it in contact with the positive battery bar. The keys are connected to contact blocks of the distributor, and the various permutations of five positive and negative impulses are transmitted into the line as the distributor arm revolves. Two contacts on the distributor at station *A* are connected direct to the plus and minus poles of the battery. A positive and a negative governing impulse are therefore sent into the line with each revolution to control the speed of the distributor at station *B*. The receiving vibrator is provided with buffer springs so that the speed of the vibrating reed varies with the variation of the electric current driving the reed. The contacts 6 and 7 on the receiving vibrator energise the magnets of the phonic wheel-motor driving the distributor at *B*. Varying the speed of the reed will vary the speed of the distributor. If the contact brushes at the two stations are revolving at the same speed and are in phase with each other, and the brushes at both ends are on the plus contacts, a positive impulse will flow into the line at *A* and will operate the main line relay at station *B*, but there will be no local action nor will there be when the two negative contacts are reached, because the plus contact on the distributor is an idle contact. If, however, the distributor at *B* runs 1 or 2 per cent. faster than that at station *A*, when the brush at *A* is on the plus contact, so that the main line relay contact at station *B* is closed, the brush of the distributor at station *B* will have reached the minus contact, and the circuit through the governing relay will be closed, and the governing relay contact will be momentarily opened, and reduce the amount of current driving the reed. This will slow down.

The printer, with its five setting magnets, which control the equivalent of a combination lock releasing the mechanism of the type line required, acts on the same general principle as the other Murray printer, and is driven by a 1/16-h.p. motor, but space does not permit of full description here. Another instrument is the receiving perforator, which is used to perforate a strip from the received message, so that it can be retransmitted without loss of time.

At the conclusion of reading an abstract of the Paper at the meeting, Mr. Murray gave a practical demonstration of the working of a group of his latest instruments.

Great tribute to Mr. Murray's work was paid by Major W. A. J. O'Meara (Engineer-in-Chief to the G.P.O.), who opened the discussion. Mr. Murray had made good use of his long experience in the Post Office. He agreed that the telephone had a future as a feeder to the telegraphs, and regarded it as the principal requirement of telegraph systems, to make the best use of long lines for numerous short messages. He rather favoured the tape against the page printer as being easier to make corrections with.

A communication was then referred to from Mr. F. Higgins (Chief Telegraph Engineer, Exchange Telegraph Co.), repudiating Mr. Murray's statement that confusion occurred between fractions and shilling strokes on tape machines. An example of a Stock Exchange tape was shown. The conditions of news work, when the same message was sent to 500 subscribers at once, were rather different from Post Office work. In the former case they sacrificed speed in favour of accuracy, and had to have apparatus not requiring skilled attention.

Mr. G. F. Mansbridge (Superintendent, Postal Telegraph Factory) took up the point of telephones acting as feeders to telegraphs, but did not think the telephone could meet the commercial messages as well as the telegraph. With regard to coded messages, he imagined the dismay of a telephone operator at being called upon to pronounce "Jyjeplolyg ayilustma avokkotuj jybofoznit." Mr. F. Ryan (Eastern & Associated Telegraph Cos.) referred to the use of the keyboard perforator, which he did not consider very suitable for code messages. Mr. S. Evershed was very appreciative of the way Mr. Murray had overcome mechanical difficulties, and pointed out that the use of very short type arms was of even greater advantage than Mr. Murray had made out, as the moment of inertia was proportional to the cube and not to the square of the length.

Mr. A. J. Stubbs (Assistant Engineer-in-Chief, G.P.O.) referred to the advantage of simultaneous printing and perforating for retransmission, and mentioned that the Baudot system had been adapted to keyboard transmission.

Mr. W. Judd (Electrician-in-Chief, Eastern & Associated Telegraph Cos.) said that there was very little need for such apparatus on cable systems. Any system they adopted would have to receive the signal in actual Morse in order that when anything went wrong they could change over to standard apparatus. The difficulties in introducing printing systems related more to the traffic than the technical point of view.

Mr. J. Hume Bell (Secretary, Institution of Post Office Engineers) also pointed out traffic difficulties with printing systems. The speed of keyboard work was limited by the time

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to make out the handwriting of messages, which was often very bad, and the use of different kinds of forms to facilitate the sorting of messages was more difficult. Printers, however, reduced errors, and the receiving perforator saved a great deal of time.

Mr. W. Noble (Superintending Engineer, G.P.O.) remarked that the Baudot system was now at work between Birmingham and London, and 12 Hughes instruments were at work on the lines connecting other large towns. He spoke of the good work being done with systematic Wheatstone working, and doubted whether the Murray apparatus would really be able to keep up such a speed as 40 words per minute.

Mr. Murray said a few words, but reserved his full reply for the journal.

TEMPORARY WIRING FOR ILLUMINATIONS

THE Corporation of London have issued a short series of rules relating to the arrangement of Coronation illuminations in the form of a notice addressed to electrical contractors and others on the same general lines as the recommendations of the L.C.C. Fire Brigade Committee, referred to in ELECTRICAL ENGINEERING, December 8th, 1910, p. 781. The Corporation are, however, more explicit in the matter of the dimensions of signs, and require that they shall not project more than 4 ft. 6 in. from the front of the building to the extreme edge of the device, or be at a less distance than 2 ft. from the carriage-way. The height of such projections must be of a minimum of 8 ft. from the pavement to the underside of the device. Adequate fusing of both poles of all circuits and sub-circuits is required, and the latter are to be limited to 10 amperes. As in the L.C.C. recommendation, bare conductors are tabooed, and the importance of earthing all metal conduits and coverings is emphasised. Switches fuse as terminals are to be protected from the weather, and the insulation is to be of a "satisfactory nature." Festoons, garlands, &c., must have supports independent from the conductors, and an important hint is given that the effect of wind must not be overlooked in their design, and another rule reads as follows:—All shades and decorations of combustible materials in proximity to lamps should be rendered non-inflammable by a process which will withstand the action of rain for several days, and no shades or decorations of celluloid or similar substance should be used.

Manchester Smoke-Abatement Exhibition.—A meeting was held in the Midland Hotel, Manchester, on Friday, April 28th, of the supporters of the Smoke-Abatement Exhibition which is to be held in Manchester in November next. Mr. Alderman Fildes, Chairman of the Sanitary Committee of the Manchester Corporation, presided, and spoke at some length on the injurious effects of the murky atmosphere of Manchester, and said that the Gas and Electrical Committees of the Corporation could help greatly by encouraging the use of gas and electricity for many purposes where at the present time coal is used. Mr. J. W. Graham, Principal of Dalton Hall, moved a resolution approving of the proposed exhibition, which was carried, and said that the Smoke-Abatement League of Great Britain intended to hold their annual meeting and conference in Manchester during the exhibition. An Advisory Committee was appointed, consisting of the technical heads of the Manchester and Salford Gas, Electricity, and Sanitary Departments, and several professional gentlemen. Arrangements have been made with Mr. Walter Cawood, of the City Exhibition Hall, to undertake the management of the exhibition on behalf of the Society, and all communications must be addressed to him at 196 Deansgate, Manchester.

Siemens' "Zed" Fuses.—Messrs. Siemens Brothers' Dynamo Works, Ltd., call our attention to the following extract from the rules of the St. Pancras Borough Council:—"All main fuses should be of the enclosed cartridge type built up of porcelain. . . . All main fuses to be enclosed in a hardwood box lined with asbestos." Mr. S. W. Baynes (Borough Electrical Engineer, St. Pancras) has written to our contemporary, *The Electrical Contractor*, regarding this rule:—"That provided the fuses are protected in a similar manner to the 'Zed' fuses with porcelain, and that no metal parts charged with current are exposed, we do not intend requiring any further protection—that is to say, the teak box lined with asbestos will not be asked for." It will be remembered that one of the essential features of "Zed" fuses is the complete enclosure of all live parts, and, what is even more important, the complete enclosure in a sealed chamber of the fusible portion. We understand that some tests have recently been carried out by the Burma Electric Tramways & Lighting Co., Ltd., of Mandalay, illustrating the suitability of "Zed" fuses for the severe conditions of tramway work. A "Zed" fuse placed in a feeder circuit behaved perfectly, whether under a normal overload in actual practice, under a gradually increasing load, or under a dead short.

FIRE AT THE HINDHEAD AND DISTRICT ELECTRICITY WORKS

AT about 2 a.m. on Wednesday last week a fire broke out in the works of the Hindhead and District Electric Light Co. A few motor-car ignition cells had been sent to be charged, and this was done in the disused boiler room; the station is a Diesel engine one, and the boiler plant is no longer employed. When the fire was first discovered it was seen that the roof of this room was alight, but the generating plant was running as usual, as the fire had not extended to the engine room, in which also the switchboard was placed. The resident engineer, who lives at the station, immediately switched off the supply and stopped the engines, as the fire was spreading rapidly. The fire quickly reached the engine-room and the residential quarters. The engineer's family had to make a hurried escape, and the generating plant and switchboard were severely damaged. As soon as the consulting engineers to the company, Messrs. Handcock & Dykes, were informed on Wednesday morning, Mr. Dykes went down and assisted in the arrangements to enable the supply to be resumed. Part of the supply is direct continuous current for the more immediate neighbourhood, and part 2,000 volts alternating for transmission to Haslemere. It was found that one of the D.C. sets was not so much damaged as the others, and Messrs. Mirrlees, Bickerton & Day and the E.C.C. promptly responded to telegrams for spare parts. A spare balancer was borrowed from the Leatherhead station, and the D.C. supply was resumed on Friday morning. The auxiliary motors had all been burnt, but a lathe motor was found which was utilised to drive the pump for the circulating water. By Sunday one of the alternators had been sufficiently repaired, and the supply to Haslemere was restarted. The other two machines and the switchboard are quite incapacitated, and the company is to be congratulated on having succeeded in resuming supply so quickly, as the roof of the engine-room had fallen in during the fire, and the whole station was in a state of chaos.

The Pretoria Pit Explosion.—The members of the Miners' Federation of Great Britain who were present at the Government inquiry have drawn up their own report on the explosion, which is somewhat at variance with the opinions of the jury at the inquest, of the manager of the mine, the electrical engineer to the mine, and of Mr. Nelson (H.M. Electrical Inspector of Mines), and Dr. W. M. Thornton, none of whom considered that there was any evidence that the cause of the explosion was electrical. The miners' representatives, on the other hand, state that they are satisfied that it was due to an electric spark from the conveyor switch. The report further condemns the use of electrical machinery in parts of the mine where there was an abnormal proportion of gas, and calls for more stringent regulations respecting the use of electricity and their more general enforcement.

Electrical Driving of Weaving Sheds.—A great deal of interest has been taken recently with regard to the individual driving of looms by small electric motors specially designed for high efficiency. Some few months back the British Westinghouse Electric & Manufacturing Co., Ltd., secured an order for the equipment of a weaving shed on these lines from Messrs. Edward Hibbert & Co., of Hyde, through their Consulting Engineer, Robert Blackmore, Esq., of Stalybridge. This installation is now at work, and the following paragraph which appeared in the *Factory Times* is worthy of reproduction:—"The new shed recently built by Messrs. Edward Hibbert & Co., Greencroft Mill, is being driven by motors. The looms are running much quicker and steadier than they did under the ordinary system, and the operatives are well satisfied with the alteration. The motors are so arranged as to use a short belt, and the drive ensures smoothness of running and prevents slips."

Telephone Purchase.—On Tuesday the Railway and Canal Commissioners sat to hear a dispute between the National Telephone Co. and the Postmaster-General as to the plant which the Government is to purchase under the agreement of 1905. With the exception of what is known as the "private wire" business of the company, the whole undertaking is to be acquired on "tramway terms," *i.e.*, upon the basis of the value as plant and material only. At the same time the Postmaster-General has certain rights to refuse to purchase any plant which, in his opinion, is unsuitable for his purpose, and failing agreement in this respect the Railway and Canal Commissioners have to arbitrate. Hence this action. In opening the case for the company, Sir Alfred Cripps, K.C., stated that the Postmaster-General had served notice upon the company refusing to take over plant in certain areas where both the company and the Postmaster-General were at present in competition, but he contended that all this plant was quite up-to-date and had been constructed under the supervision of, and according to, the specification of the Postmaster-General himself. The Attorney-General, on the other hand, argued that the objection to take over the plant in question is because it is worked on the magneto system, and not on the central battery system, which is now standard telephone practice. The arbitration is expected to last a considerable time.

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CORRESPONDENCE

THE USE OF BATTERIES.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—While the matter is still fresh in the minds of your readers, may I trespass a little further on your valuable space? I will endeavour to be very brief.

I believe the difference of opinion which exists about the relative values of boosters and regulating cells is largely due to previous impressions. The Britisher comes to the question with the sizes of boosters, as hitherto determined for discharge, rigidly fixed in his mind. He compares this with the regulating switches he sees on the Continent, and at once comes to the conclusion that they are about equal in cost, especially when considering the frightful inefficiency of the ordinary type of booster when charging the battery.

But he overlooks the fact that, in following Continental practice, he must add 20 per cent. additional cells to his battery, and will now require a booster for charging purposes alone, which is big enough (if made triple-parallel) to deal with his discharge.

What, then, is the objection to using this booster for the discharge? It cannot be on the score of cheapness, for the cost with the booster alone is less than one-third of that with the combined arrangement.

The objections alleged are two: (1) that the switchgear is more complicated. This is due merely to insufficient information having been given in the paper, for the use of large "selector" switches has been employed, within my own experience, on some of the heaviest direct-current generator panels in the kingdom for many years with never the least trouble; and the switches would not be touched from the beginning to the end of the discharge. (2) That useful current at time of peak is taken up in driving the booster. This is quite true; but useful current is also locked up in idle cells with the regulator method. A consideration of the example taken in my Paper will show that out of 303 cells a discharge is obtained which is only equivalent to that from 290 cells fully worked, representing a 4 per cent. loss of locked-up current. With the booster arrangement, for the same size of battery, 6 per cent. of the battery current would be taken up by the booster motor, but out of this energy some 4 per cent. is returned to the battery circuit, the actual loss being, therefore, only 2 per cent. Moreover, since the booster only costs about £0·5 per kw., whereas the battery costs about £6·0 per kw., it is obvious that a lot of capital is locked up needlessly in the regulating cells.

It should be mentioned (several speakers having misunderstood this point) that the regulator cells shown in some of my figures are not really regulating cells at all, but are merely for "floating" purposes, and carry no heavy currents. They can be done away with, if desired, by employing a small "bucking" booster; but two or three cells are required to compensate for the non-regulating properties of the static booster, where this is employed.

Avondale, Ashfield Road, King's Heath, May 6th, 1911.

Yours faithfully,
A. M. TAYLOR.

THE LIFE OF METAL FILAMENT LAMPS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—I hope I am not trespassing too much on your columns, but I should just like to say in reply to the reference to metal filament lamps on p. 234 of your issue of the 4th inst., that it appears to me there is only one point that should appeal to the consumer, and that is: How to get the desired illumination at the least cost, including current and lamps? And I reply that the report of the Westminster Electrical Testing Laboratory conclusively showed that by using the Cryselco metal filament lamp the desired light is obtained at a less cost per hour than with any other make of lamp tested, including the cost of lamps and current. This to my mind is the crux of the whole question. The Westminster Electrical Testing Laboratory also gave the "economical life of the different lamps," *i.e.*, life to 1·5 watts per c.p. The economical life of the Cryselco lamp was more than fourteen times that of the Osram lamp.

I am, yours faithfully,
CRYSELCO, LIMITED,
H. S. DEACON,
Managing Director.

Bedford, May 4th, 1911.

The Constantinople Telephone Contract.—*The Times* Constantinople correspondent states that the telephone contract was signed on Saturday by Djaird Bey and Mr. H. Laws Webb. He adds that Mr. Webb has left for London in connection with the organisation of the new company and its staff.

Olympia Exhibition, 1905, Trust Fund.—We understand that this Fund has now been realised, and the sum of £378·12s. 8d. been paid into the funds of The Electrical Trades Benevolent Institution, and £203 17s. 7d. to the Benevolent Fund of the Institution of Electrical Engineers. The trustees for this fund were: Sir W. H. Preece, Messrs. E. Cunliffe Owen, J. E. Kingsbury, C. S. Northcote, J. E. Edgcumbe, and W. Davenport.

ILLUMINATION

A PAPER, which was read by F. J. Hawkins yesterday before the Junior Institution of Engineers, dealt with the subject of illumination. After a few remarks on the inverted gas burner, the author took up the electrical side of the question at greater length. Stress was laid on the importance of reducing the glare effect to a minimum, at the same time obtaining the most effective distribution of light. Curves were given showing that the glare effect gradually drops with increase in distance of the source of light in the case of low candle-power intensities, whereas with a 400-c.p. source there was no appreciable difference in this effect under the same conditions. Illumination curves were also given, which showed that the minimum glare effect was to be obtained by keeping the angle between the line of maximum candle power and the vertical as small as possible. With regard to the lighting of main thoroughfares, it was pointed out that, although low candle-power units, correctly spaced, were the most suitable for ideal illumination, the cost of installing and maintaining was greatly against them, and a more economical system was suggested in the adoption of high candle-power units mounted about 30 feet high. An example of this can be seen in Cheapside, where the Oriflamme arc lamps, with prismatic reflectors for obtaining a good diffusion of light, are used on the central suspension principle (see ELECTRICAL ENGINEERING, Vol. vi. p. 803). This is a great advantage where high buildings of a light colour abound, for an equal amount of light reaches both sides, and considerable reflection is obtained. With reference to the lighting of side streets, where the lamp-posts had to be put on the pavements, it was pointed out that, in order to obtain effective illumination, reflectors and shades of proper design were necessary, and a suggested type was illustrated, which shielded the light from the eyes of pedestrians, at the same time giving maximum illumination on the road. No definite data were given on the lighting of interiors, as each particular case was a problem by itself, depending on the dimensions, the height, and colour of the walls and ceiling. A table of the coefficients of reflection (ρ) for the various colours is given, which, if multiplied by the intensity of illumination (I), will give the surface brightness ρI, where $I = c \cos a/d^2$, c = the candle-power of the source of light, d = distance, and a = angle of incidence of rays striking surface.

For the purpose of shop-window lighting, tubular lamps placed round the inside of the windows were suggested, as the whole of the light was then reflected on the goods displayed, and an even distribution obtained. The author concludes with a few remarks on the future aspects of illumination, mention being made of the Moore tube-light and the possibility of improvements in the mercury-vapour lamp to modify the colour of the light.

Electrical Trades' Benevolent Institution.—The following subscriptions and donations have been received since those given in our list last week. Subscriptions:—Nalder Brothers & Thompson, £5 5s.; L. W. Wild, £1 1s.; Hawtayne & Zeden, £1 1s.; Concordia Electric Wire Co., £3 3s. Donations:—Pope Electric Lamp Co., £1 1s.; J. R. Icke, 2s. 6d.; L. W. Wild, £2 2s.; C. Bassett, £1 1s.; R. Hornby & Sons, £1 1s.; J. W. Flower, 10s. 6d.; J. H. Avery, 10s. 6d.; J. S. Plumtree, 10s. 6d.; "Electricity," £1 1s. As announced elsewhere, the grant of £378 12s. 6d. from the Olympia Exhibition of 1905 has now been received.

Parliamentary Intelligence.—The Sidmouth Gas and Electricity Bill was read a third time in the House of Lords on Thursday. The Luton Corporation Bill, which includes a wiring clause, was read a third time in the House of Commons last week.

Before the Standing Orders Committee last week the Yorkshire Electric Power Co., and the Electrical Distribution of Yorkshire, Ltd., unsuccessfully opposed an application by the Pontefract Corporation for permission to introduce a late bill confirming an agreement for the transfer of the Pontefract Electric Lighting to the West Riding Tramways Co.

The Croydon and Southern District Railless Traction Bill has been withdrawn.

The London United Tramways, Liverpool Overhead Railway, Notts and Derbyshire Tramways, Luton Corporation, and the Metropolitan Electric Supply (Acton) Bills were read a second time in the House of Lords on Thursday. The Winchester Corporation (Electric Supply) Bill was read a second time in the House of Commons on Monday.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—Member: G. S. Corlett. Associate Member: E. Hall. Associates: A. B. Anderson, H. Ashton, A. Bursill, W. B. Ellis, A. E. Hall, J. C. Johnston, H. Millar, A. R. Newman, P. H. Nye, E. H. Winton. Students: G. Beaumont, W. Biggam, J Dayal, N. R. De Pomeroy, H. V. Henniker, F. E. Hill, H. M. Jordison, W. Kerr, A. S. MacWhirter, J. Oliphant, J. Parker, C. J. Polden, W. Smith, P. G. Spary, W. W. Stainer, R. V. Stone, C. S. Williams.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published May 4th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

8,984/10. **Metal Filament Lamps.** BRITISH THOMSON-HOUSTON Co. and J. GRAY. Filaments drawn from an alloy of tungsten with another metal are strung on the carriers or spiders before the latter metal is driven out by volatilisation. In order to permit of the contraction of the filament during the volatilisation, it is previously corrugated or crinkled.

8,988/10. **Incandescent Lamp Caps.** J. E. CRIGGAL and the BRITISH VITRITE WORKS, LTD. In the manufacture of lamp caps according to the 1902 Swan patent (*see* ELECTRICAL ENGINEERING, November 3rd, 1910, Vol. vi., p. 695), the two metal contact pieces are provided with a metallic bridge to ensure their being correctly spaced in the mould. The machine which pours in and moulds the molten glass filling also cuts away the metal bridge. Fourteen figures.

12,261/10. **Exhaust Steam Plant.** G. LAYTON (Knutsford). To avoid the necessity for a heat accumulator in exhaust steam plants where the supply of steam is intermittent, the exhaust turbine is provided with a heavy flywheel, from which energy is taken between the periods of steam supply, or a storage battery is used in conjunction with the turbo-generator to sustain the supply. Six figures.

15,873/10. **High Tension Condenser.** W. & R. BULLIMORE and A. C. CROSSER, LTD. This is a method for the prevention of sparking from the inner to the outer conductor, as is usual in condensers where thin dielectrics are employed. It consists of a septum, with a central aperture, preferably of the same material as the dielectric, being placed in a suitably-shaped vessel closed at one end, at a point so that the inner conductor terminates near the central aperture of the septum, while the outer conductor is carried up past the septum, thus separating the conductors sufficiently to prevent sparking. Instead of the septum inside, a flange outside can be used, when the inner coating would be extended beyond the flange. Four figures.

17,308/10. **Non-spillable Vents for Accumulators.** D. W. JOHN and J. H. BERRY. This is an invention to prevent the spilling of acid. It consists of a stopper, one end of which is in the form of a valve seat, and the other end in the form of a cup, in which a heavy ball rests. A piece of pure rubber connects this ball with the valve, so that directly the accumulators are tilted the ball rolls about and closes the valve by means of its rubber connection. Eight figures.

207/11. **Primary Batteries.** A. HEIL (Germany). Instead of using the usual dioxide, a depolariser in the form of a dark brown hydrated oxide of manganese mixed with graphite is employed, the whole being placed in a porous cell with solid carbon and with zinc for the other electrodes, which dip into a solution of ammonium-nitrate or ammonium chloride.

14,121/10. **Sterilising Liquids.** V. HENRI and HELBRONNER and VON RECKLINGTON (France). This is a method for treating liquids by means of ultra-violet rays. A hollow cylinder, whose inner periphery is supplied with the liquid, is made to rotate, causing a surface friction between the cylinder and the liquid, which draws the liquid out into a thin film, to enable the rays to penetrate it. Nine figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: REID [Insulating material] 9,858/10.

Dynamos, Motors, and Transformers: BALACHOWSKY and CAIRE [Regulation of machines] 9,373/10; LEHMANN, ROSS-HARVEY and INRIG [Variable-speed dynamo] 12,651/10; A.-G. BROWN, BOVERI & CIE [Repulsion motors operating as generators] 25,473/10.

Electric Ignition: VICKERS, SONS & MAXIM, LTD., and ELIA [Submarine mines] 12,742/10; SEARLE [Control of gas burners] 20,735/10; BLICKENSDERFER [Sparking plug] 181/11; FLETCHER [Contact breaker] 2,435/11.

Electrochemistry & Electrometallurgy: HÄRDEN [Electric furnaces] 9,897/10; JOHNSON (*Chemische Fabrik Griesheim-Elektron*) [Purification of magnesium] 22,016/10; LINDER [Ozoniser] 447/11.

Heating and Cooking: GRAY [Electric ovens] 9,611/10.

Incandescent Lamps: BEUTTELL, 9,615/10.

Instruments and Meters: BIERMASZ [Transmitting compass positions to a distance] 7,906/11.

Switchgear, Fuses, and Fittings: ADAMS MANUFACTURING Co. (*Cutler Hammer Manufacturing Co., U.S.A.*) [Motor controllers] 9,171/10, 9,199/10, 9,276/10, and 9,278/10; HARLOW and FAYE-HANSEN [Protective apparatus for A.C. systems] 9,603/10; BRITISH THOMSON-HOUSTON Co. and WEDMORE [Switch mechanism] 11,707/10; ADAMS MANUFACTURING Co. and ADAMS [Change-over switches] 12,701/10; A. REYROLLE & Co. and SCHUIL [Lightning arresters] 14,476/10; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Protective devices] 14,512/10; DEAN [Ironclad switches and fuses] 15,684/10; Pugh and Gamblee [Time-switches] 22,368/10; LUCAS and EDWARDS [Switch for electric horns] 22,481/10; HOPE [Time switches] 24,439/10.

Telephony and Telegraphy: MARTIN [Telephony] 1,299/10; KEITH [Telephony] 1,421/10; FALES [Telephony] 1,422/10; DICKER (*Automatic Electric Co.*) [Telephony] 1,423/10; FALES [Telephony] 7,876-7-8/11.

Traction: J. STONE & Co. and DARKER [Electric lighting, heating, and ventilating of trains] 6,666/10; W. R. SYKES INTERLOCKING SIGNAL Co., SYKES and TARRANT [Signalling] 9,880/10; CHAPMAN [Signalling] 10,125/10; COOPER [Clutch for electric vehicles] 18,850/10; HARRIS [Air-brake couplers] 20,665/10; FILSELL [Safety apparatus] 20,684/10.

Miscellaneous: CLAYTON [Illuminated signs] 9,069/10; ASTIÉ [Illuminated signs] 9,394/10; GEB. SIEMENS & Co. [Fireproof conductive materials] 19,866/10; BOULT (*Electric Compositor Co.*) [Type line-casting machines] 23,474/10; SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke Ges.*) [Electro-dynamical couplings] 28,940/10; LEE and WEEDMAN [Mine alarm instruments] 2,382/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution Systems, &c.: HULTMAN [Manufacture of conduits for underground cable] 5,813/11.

Dynamos, &c.: A. G. BROWN, BOVERI ET CIE. [Variable frequency commutator machines] 7,061/11; LEWIS [Control of A.-C. motors] 8,783/11.

Incandescent Lamps: SCHWAB [Filaments] 8,004/11.

Switchgear, &c.: HARTMANN & BRAUN A.-G. [Push-button switches] 6,147/11.

Telephony, &c.: GOLDSCHMIDT [Apparatus for intensifying weak alternating currents] 8,978/11.

Traction: SOC. ANON. FORGES DE BELLECOURT [Tramcar bogies] 15,865/10.

Miscellaneous: KASSEN [Clock-controlled electric alarm] 9,049/11; BURSTYN [Irradiance coils] 9,349/11.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

12,128 of May 17th, 1897. **Railway Signalling.** J. W. WEBB and A. M. THOMPSON. This improves on the system of power signalling, where the points are worked by motors and the signals by electro-magnets, by introducing an interlocking lever frame in combination with the well-known tappet-locking system.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: P. MACGAHAN [Three-phase fault-finding apparatus] 26,887/04.

Instruments, &c.: P. R. ARNO [Current indicator and recorder] 1,221/06.

Storage Batteries: C. P. ELIESON [Accumulator plates] 1,187/04; H. OPPENHEIMER (*A. G. Mix & Genest*) [Battery Tester] 1,151/06.

Switchgear, &c.: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Block Signalling] 1,564/06.

Telephony, &c.: P. A. NEWTON (*Gray National Telautograph Co.*) [Telautographs] 1,103/99; A. J. BOULT (*Gruhn*) [Telegraph systems] 1,178/03.

Traction: W. GRIFFITHS and B. H. BEDELL [Insulators for surface contact systems] 1,537/02; WESTINGHOUSE BRAKE Co. (*Westinghouse Air Brake Co.*) [Air brakes] 1,388/04.

Miscellaneous: F. W. LE TALL (*Cooper Hewitt Electric Co.*) [Vapour apparatus] 1,364/04; P. C. HEWITT [Control of vapour apparatus] 706/06.

Opposition to Grant of Patents

20,639/09. **Cooking and Heating Apparatus.** A. F. BERRY. The grant of this patent has been allowed in spite of opposition. The specification (abstracted in ELECTRICAL ENGINEERING, October 6th, 1910, p. 636) relates to the continuous heating up of a large mass of metal from which heat is extracted by conduction when required.

23,096/10. **Centrifugal Fans.** J. KEITH. Opposition has been entered to the grant of this patent. The specification describes an improved design of runner for centrifugal fans.

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LOCAL NOTES

Acton: *Electricity Works Transfer.*—It has been agreed that the Metropolitan Electric Supply Co. shall take over the Council's electricity undertaking as from March 31st, instead of waiting until the date of Royal Assent to the Bill which is now before Parliament.

Bacup: *Bulk Supply.*—An agreement has been entered into for the supply of electricity in bulk by the Rawtenstall Corporation.

Bispham: *Overhead Wires.*—The Board of Trade has sanctioned the use of overhead wires in connection with the Council's electric lighting scheme.

Blackburn: *Plant Extensions.*—At a meeting of the Town Council on Thursday a resolution was moved to refer back the Electricity Committee's proposal to invite tenders from certain firms for steam turbines on the ground that the firms in question had not their works in Blackburn. Alderman Higham, Chairman of the Electricity Committee, having pointed out the fact that no firm of turbine builders have works in Blackburn, and that they were advised to adopt turbines in preference to reciprocating engines, the resolution was defeated by a large majority.

Bournemouth: *Abandonment of Conduit System.*—The reconstruction of the conduit system in the centre of the town has been completed, and the cars are now running by permission of the Board of Trade before the official inspection takes place.

Bridlington: *Electrical Fountains.*—The Property Committee propose to erect an electrical fountain on the Princes' Parade, and in this connection a special meeting of the Town Council is to be held to consider a recommendation that the Chairman and Deputy-Chairman of the Committee be sent to Berlin to inspect electrical fountains in operation.

Bury: *Tramway Profits.*—There was a net profit of £4,469 on the Bury tramways for last year. Of this sum £2,800 has been transferred to reserve, and £1,669 to relief of rates.

Dublin: *Electricity Extensions.*—The Local Government Board inquiry into an application by the Corporation for sanction to a loan of £128,129, referred to in our last issue, was resumed on Tuesday last week. Mr. Mark Ruddle, City Electrical Engineer, gave evidence in detail as to the new plant which will be required. The Committee have decided to accept the tender of the Maschinenfabrik Oerliken for steam turbo-alternators, condensing plant, and switchboard at £11,458, and that of Messrs. Babcock & Wilcox for the boiler plant, chimney, pumps, pipe-work, coal conveyer, &c., at £23,240. The acceptance of these tenders, of course, is subject to the Board of Trade sanction to the necessary loan.

Dundee: *Tramway Fares.*—Mr. Peter Fisher, the tramway manager, proposes to introduce a maximum fare of 1d. for any distance to or from High Street, limiting ½d. stages to 880 yards. This new scheme will abolish the present system of cheap workmen's fares.

New Sub-station.—The Electricity Committee have acquired land for a new sub-station at Downfield.

Edinburgh: *Electricity Profits.*—The recommendation of the Electric Light Committee, referred to in our last issue, that the profits on the electricity undertaking for 1909–10, amounting to £7,300, should be applied to the reduction of the capital debt of the undertaking, has been rejected by the Council.

Glasgow: *Tramcar Speeds.*—In reply to a question in the House of Commons by Mr. Watt last week as to the maximum speed sanctioned for the Glasgow Corporation tramway system, Mr. Sydney Buxton, President of the Board of Trade, stated that the maximum speeds vary in different parts of the City from 4 miles to 16 miles an hour.

Heywood: *Electricity Losses.*—The electricity and tramway accounts of the Council for the past year show deficiencies of £2,044 and £1,403 respectively.

Lewes: *Street Lighting.*—The Lewes and District Electric Supply Co. is to be given an opportunity to tender for the lighting of the streets for five years in competition with the Gas Company.

London: L.C.C. Tramways.—The Highways Committee report that the cost of street widenings in connection with the proposed tramways from Marble Arch to Cricklewood will be £277,000, compared with the original estimate of £95,000. Nevertheless, if the support of the various road authorities can be obtained, it is recommended that the scheme be proceeded with.

Portrush: *Electric Supply.*—The Lighting and Water Committee again recommend the Council to proceed with the consideration of an electric lighting scheme.

St. Anne's-on-Sea: *Electrical Engineer's Remuneration.*—The Council have referred back a proposal that the electrical engineer should be paid a bonus of 5 per cent. on the profits of the electrical undertaking.

West Ham: *Bank Overdrafts.*—The legal expenses in connection with the recent dispute concerning the bank overdrafts for the purpose of the electricity undertaking amounted to £11,333. Deducting the amount repaid by the bank, and which had been received as interest, it is estimated that the net cost to the ratepayers will be equivalent to a penny rate.

West Hartlepool: *Electricity Accounts.*—After meeting all charges there is a net surplus of £1,505 from the working of the electricity department for 1910–11.

Tramway Arbitration.—The Arbitrator who sat to decide the price to be paid by the Corporation for two sections of the West Hartlepool Tramway Co.'s undertaking has determined the price at £12,096, the company paying three-fifths of the arbitration costs. The price asked originally by the Tramway Company was £22,000.

Willesden: *Electricity Profits.*—There was a net profit of £1,600 on the electric lighting undertaking for the past year.

Worcester: *Three-phase Supply.*—The Corporation have now agreed to the scheme of the City Electrical Engineer for substituting three-phase supply for single-phase in connection with the offer of Messrs. Heenan & Froude to take a minimum supply for three years equivalent to £500 per annum.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bexhill.—The Electric Light Committee recommend the installation of a new superheater, at an estimated cost of £180.

Blackburn.—An expenditure of £45,170 is to be incurred upon extensions at the electricity works.

Bradford.—The Electricity Committee recommend the extension of the generating plant at the Valley Road works at an estimated cost of £19,440. This amount includes:—A third B.T.-H. turbo-generator, complete with auxiliaries, steam, exhaust, circulating water and drain piping, &c., £10,292; piping, £900; buildings, £1,600; cables for third turbo-generator, £650; works battery and connections, £1,100; deep well pump, with electrically-driven lifting plant, casing 700 to 800 feet deep, £2,500.

Colne.—A loan of £2,000 for mains extensions is to be applied for.

OSRAM·LAMPS

Colwyn Bay.—A loan of £2,700 is to be taken up for electric lighting extensions.

Hastings.—A Local Government Board inquiry was held last week concerning a loan of £1,000 for extensions of the electric lighting mains to the workhouse.

Ireland.—A Board of Trade inquiry was held last week concerning an application by the Donaghadee Council for an electric lighting Provisional Order. Messrs. Wilkins & Burden, of Dublin, are the consulting engineers.

The Armagh Council have under consideration a scheme of electric lighting.

Leicester.—A Local Government Board inquiry has been held concerning a loan of £17,000 for electrical extensions. The main portion of the loan is for extensions to the tramway power station, and the remainder is for the necessary alterations in order to have the tramway power station and the lighting power station under one control.

Manchester.—The Electricity Committee invite tenders by May 17th for three-core, three-phase, paper-insulated plain lead-sheathed cable, and single-conductor, paper-insulated cable. Particulars from Secretary to Electricity Department.

South Shields.—A Local Government Board inquiry will shortly be held concerning a loan of £8,960 for new electrical plant.

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Stockton.—Application is to be made for a loan of £6,750 for extensions at the electricity works.

Newcastle-under-Lyme.—Extensions to the electricity works, at an estimated cost of £5,000, are contemplated.

Worthing.—The storage battery at the electricity works is to be replated at an estimated cost of £900.

WIRING

Bradford.—Tenders are invited for an electrical installation at the new department of textile industries at the Technical College. City Architect.

Cardiff.—Extensive alterations to the premises of Messrs. Waddington, Sons & Co., City Road. Architect, R. O. Dowdeswell, Cardiff.

Cheltenham.—New municipal offices.

Edinburgh.—New school in M'Leod Street.

Exeter.—Additions to Okehampton Road Schools. Architect, J. Jerman, 1 Bedford Circus.

Leeds.—Hostel for women students at the City of Leeds Training College, Headingley. Architect, G. W. Atkinson, 1 Mark Lane.

Leyton.—The Council invite tenders for the lighting of the Town Hall and two branch libraries, by electricity. Particulars from the Borough Electrical Engineer.

Llandudno.—New church at W. Llandudno. Builder, Mr. P. Edwards, Chester.

London.—Tenders are invited for wiring two wards at the Mile End Infirmary. Chief Engineer of the Workhouse, Bancroft Road.—Twenty-three houses in Strathyr Avenue, Croydon. C. S. Banks, 16 Oakfield Road, Croydon.—Twenty-five houses in Kingscote Road, Croydon. R. Palmer, Sherwood Road.

Northampton.—Proposed secondary school for girls in St. George's Avenue.

Southsea.—Cinematograph theatre. W. H. Marshall, 38 Clarence Parade.

Wellingborough.—New elementary school. Architects, Messrs. Talbot, Brown & Fisher, Wellingborough.

West Ham.—New fire brigade quarters. Town Clerk.

Wolverhampton.—Considerable extensions at St. Jude's school.

MISCELLANEOUS

Bampton.—The Council have decided to light the streets by electricity.

Burnley.—The Tramway Committee recommend an expenditure of £14,650 on extensions to the tramway system. The new work includes three new single-deck cars, overhead equipment, and cables.

Carnarvon.—The Council will shortly consider the conversion of the lighting of the streets from gas to electricity.

London: *Hammersmith.*—Following out the decision of the Council in 1908 to substitute electric lamps for gas lamps in all streets where low-tension mains are laid, the Electricity Committee recommend the conversion of a further sixty-eight posts at an estimated cost of £393.

Portsmouth.—Tenders are invited for supply and fitting of sixty-eight Mazda electric lamps at the Town Hall. Particulars from the Borough Engineer. Tenders by May 22nd.

Swansea.—The Council will shortly be advertising for a supply of motors and starting switches for one or two years.

TENDERS RECEIVED AND ACCEPTED

Chelmsford.—Messrs. Aiton & Co. tendered at £200, and Messrs. Babcock & Wilcox at £230, for steam piping for the motor generator. The former tender has been accepted. The tender of Messrs. Warren, Beattie & Co. for the supply of a Taylor-Scotson regulator at £95 has also been accepted.

The Diesel Engine Co. have received a large number of orders since February, including 420 b.h.p. engine for Letchworth Garden City; 330 b.h.p. engine for the Leek Council; 340 b.h.p. engine for the Great Northern Railway Co.; 525 b.h.p. and 225 b.h.p. engines for Messrs. Dick Kerr & Co.; two 150 b.h.p. engines for the Reigate Council; two 270 b.h.p. and two 200 b.h.p. engines for the Chilian Government; and 320 b.h.p. engine for Chili (per Messrs. Balfour, Williamson & Co.); in addition, a large number of engines of smaller capacity for England and abroad.



APPOINTMENTS AND PERSONAL NOTES

An engineer is required by the Australian Commonwealth Government capable of designing and superintending the establishment of wireless telegraphy stations. Salary £600 per annum. (See an advertisement on another page.)

The South Wales Electrical Power Distribution Co. require two young architectural draughtsmen. (See an advertisement on another page.)

Mr. J. Harland Bowden has been nominated for the election as President of the Electrical Contractors Association.

Mr. F. W. Roberts, who has been with the National Telephone Co. for twenty-five years, and was until September last Brighton Manager for the company, has left England to take up the post of Engineer-in-Chief to the United River Plate Telephone Co., of Buenos Ayres. During the past six months Mr. Roberts has been engaged on the staff of the National Telephone Co. who have been entrusted with the task of preparing an inventory of the plant in view of the forthcoming purchase by the State.

The Highways Committee of the L.C.C. recommend the appointment of Mr. W. W. Warren and Mr. R. A. S. Duncan as shift engineers at the Greenwich power-house, at a salary of £250 per annum, rising by £10 per annum to a maximum of £300 per annum.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5, Philpot Lane, London, E.C., inform us that the price of electrolytic copper bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 to £56 10s. per ton (last week £56 5s. to £56 15s.).

Unica Gearing.—Through a printer's error the address of Messrs. Rodgers Bros., who have acquired the gear cutting business of Messrs. J. B. Hamilton & Co., was given as Baker Street, Brighton. This should have been Baker Street, Brixton.

The Electrical Apparatus Co.—This firm have now moved into their new factory at Vauxhall, which has six or seven times the accommodation of their Battersea works. The new address is Vauxhall Works, South Lambeth Road, S.W., and the telephone number is Brixton 1975.

Agency.—Messrs. William Sanders & Co., switchboard and switch manufacturers, Falcon Electrical Works, Wednesbury, have terminated their agency with Messrs. O'Reilly, Holt & Fielden, and have appointed Mr. H. V. Sadler as their sole London and district representative, who will have charge of their new office at 90 Charing Cross Road (second floor).

Patent for Sale.—The owner of British Patents No. 7,286 of 1905 and 7,286a of 1905 relating to prevention of sparking in motors and to improvements in variable speed motors, desires to dispose of same. (See advertisement on another page.)

Silvertown Works Athletic Club.—The first annual sports meeting of this club was held on Saturday last at the Memorial Grounds, Canning Town, and was highly successful. The prizes were presented by Mrs. P. S. M. Brodie, and music was provided by the "Graysilver" Band.

Liquidations.—The North-Western Electricity and Power Gas Syndicate, Ltd., is to be wound up voluntarily. Creditors are requested to send particulars of their claims to the liquidator, Mr. C. E. Bullock, Albion Street, Hanley, Staffs, not later than May 30th.

The Electric Fog Signal Co., Ltd., is to be wound up voluntarily. Mr. A. T. Spear, 44 Myddleton Road, Uxbridge, is liquidator.

A meeting of the British Radio-Telegraph and Telephone Co., Ltd., will be held at 5 London Wall Buildings, London, on June 6th at 2.30 p.m. to hear the liquidator's account of the winding-up.

Bankruptcy.—Mr. W. H. Illingworth, trading as the Yorkshire Metal Filament Lamp Co., 14 Upper Fountaine Street, Leeds, has been adjudicated bankrupt. The public examination will take place at 10.30 a.m. on May 19th at the Halifax County Court.

The Thomas Transmission.—We understand that the road trial of the Thomas lorry, which we described on page 236 of our last issue, has been satisfactorily concluded. The tests at Brooklands, which were to follow the road trial last Saturday, have, however, not been proceeded with, as the authorities at Brooklands were not willing to allow the track to be used for such a heavy vehicle. A slight error was unfortunately made in our description. The petrol consumption in the previous Lancashire test should have been 9·7 miles per gallon, and not 9·7 tons, as printed.

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COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

South Metropolitan Electric Tramways & Lighting Co.—At the meeting last week, the chairman stated that considerable reduction in the working expenses could be made if the company were free to generate their own electricity, but unfortunately they were bound to take all their current from the Croydon and Beckenham Councils.

Dinner to Mr. Evan Parry.—On Saturday a farewell dinner was given to Mr. Evan Parry, B.Sc., who is leaving this country to take up an appointment as electrical adviser to the New Zealand Government in connection with the large scheme which that Government propose to carry out for the development of electric power transmission and the utilisation of the various sources of water power available. The dinner was held at the Trocadero Restaurant, and between seventy and eighty friends and well-wishers were present. Dr. H. F. Parshall, who was in the chair, in proposing the toast of the guest, said that Mr. Parry had been closely associated with him for the last eighteen years, and that he deeply felt the severance of a connection which had always been extremely cordial and friendly throughout. He congratulated the New Zealand Government on having secured the services of a man so eminently qualified to carry through the schemes contemplated by them. The toast was supported by Mr. Mordey, Mr. Trotter, Mr. Hammond, Mr. Devonshire, and Mr. Tegetmaier (Chairman of the Auckland Tramways), all of whom spoke in eulogistic terms of Mr. Parry and his work. A presentation was made to Mr. Parry of a handsome silver cup, upon which the names of the hosts were inscribed.

Rating Appeals.—On Wednesday and Thursday last week, an appeal by the L.C.C. against the assessment of the Greenwich power station was heard by the Middlesex Quarter Sessions. The gross assessment appealed against was £60,000, but the L.C.C. claimed for gross assessment of £37,500, and a rateable value of £25,000. After hearing the case, the Court awarded a gross assessment of £55,000, and a rateable value of £31,400. During the hearing of the case one or two interesting points came out. For instance, it was stated that owing to the restrictions placed upon the working of the station by the Admiralty in consequence of interference with the Greenwich Observatory, the Musgrave reciprocating engines are only used in respect of 8 per cent. of the total output of the station, and it was therefore claimed that although the total capacity of the station was 50,000 kw., the actual working capacity was only 34,000 kw. The total cost of the land and buildings was put at £837,173, and the cost per kw. of reciprocating engines and generators was £8·36. For the turbines the cost per kw. works out at £3·86, and it was in view of the shorter life of the reciprocating engines, and the considerably less use made of them, that the L.C.C. based part of its claim for a reduction in the assessment. With regard to the lives of the various portions of the plant, the Assessment Committee put buildings at 90 years, whilst the L.C.C. adopted 80 years. For the reciprocating engines the L.C.C. took the figure of 20 years, whilst the Assessment Committee claimed 40 to 42 years; steam turbines and generators were put at 20 years by the L.C.C. against 30 years by the other side; and boilers and economisers 20 years, against 25 years. Both sides agreed upon 25 years for steam pipes, and 30 years exhaust pipes; 30 years for switchgear, and 20 years for conveyers.

Another rating appeal of some interest was also heard at the Middlesex Quarter Sessions last week, when the Metropolitan Electric Supply Co., appealed against the assessment of their mains and sub-stations, in the Paddington district, by the Paddington Assessment Committee. The works were originally rated at £26,675 gross, and £18,065 rateable. This was altered on objection to £24,064 gross, and £13,723 rateable, and it was against these latter figures that the appeal was made. In this case also the Quarter Sessions considerably reduced the assessment.

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DYNAMOS, see Motors and Dynamos.

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Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

FIRE EXTINGUISHERS.
"Kyl Fyre," Ltd., Eastbourne.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Crossley Bros., Ltd., Openshaw, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.

HEATING AND COOKING APPARATUS.
Bastian Electric Heating Syndicate, Ltd., Palmerston House, Old Broad St., E.C.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87–89, Cleveland Street, W.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
Ferranti, Ltd., Hollinwood, Lancs.
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Weidmann (H.), Rapperswil, Switzerland.

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Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.
Ruberoid Co., Ltd., 81 & 83, Knightrider St., E.C.

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Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
The Fredk. Crane Chemical Co., 22 & 23. Newhall Hill, Birmingham.

LAMPS (Incandescent).
Boddy (G. M.) & Co, 15, Gray's Inn Road, W.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Brush Electrical Engineering Co., Ltd., 1, Kingsway, W.C.
Cryselco, Ltd., Kempston Works, Bedford.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Horvath (S.), 51, Standen Rd., Southfields, S.W.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Krupka & Jacoby, 11, Queen Victoria St., E.C.
Philips Metallic Glowlampworks, Ltd., Eindhoven, Holland.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

METERS.
Aron Meter Co., Ltd., 80A, Salusbury Road, Kilburn, N.W.
Bastian Meter Co., Ltd., Kentish Town, N.W.
British Thomson-Houston Co., Ltd., Rugby.
Ferranti, Ltd., Hollinwood, Lancs.

MICA AND MICANITE.
Jaroslaw (D.), 5, George St., Tower Hill, E.C.

MINE EQUIPMENTS AND APPARATUS.
British-Thomson Houston Co. Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Spagnoletti, Ltd., Goldhawk Rd., W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
General Electric Co., Ltd., 67, Queen Victoria St. E.C.
Ingleby & Co., Elland Road, Leeds.
J. L. Manufacturing Co., Ltd., Southall.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
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Raworth (J. E.), 30, Broadway, Westminster.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

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Willans & Robinson, Ltd., Rugby.

RESISTANCE WIRE.
Drennan, Glover & Cooper, 429–431, Corn Exchange Buildings, Manchester.

SIGNS (Electric).
Krupka & Jacoby, 11, Queen Victoria St., London, E.C.

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Belliss & Morcom, Ltd., Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
Vickers, Sons & Maxim, Ltd., Sheffield.
Willans & Robinson, Ltd., Rugby

SWITCHGEAR.
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British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Brown, Boveri & Co., Ltd., Caxton House, Westminster.
Electrical Apparatus Co., Ltd., Milford Works, Queen's Rd., Battersea, S.W.
Ellison (George), Warstone Lane, Birmingham.
Ferranti Ltd., Hollinwood, Lancs.
Reyrolle & Co., Ltd. Hebburn-on-Tyne.
Union Electric Co., Ltd., Park St., Southwark, S.E.

TECHNICAL BOOKS AND JOURNALS.
Blackie & Son, Ltd., 50, Old Bailey, E.C.
Cassell & Co., Ltd., La Belle Sauvage, E.C.
Constable (Archibald) & Co., Ltd., 10 Orange St., Haymarket, W.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W.
Electric Journal, 422, Mansion House Chambers, E.C.
Electrical Engineering Abstracts, 57–58, Chancery Lane, London, W.C.
Gresham Publishing Co., 34, Southampton Street, Strand, W.C.
Griffin (Charles) & Co., Ltd., 12, Exeter Street, Strand, W.C.
Indian Industries and Power, 204, Temple Chambers, E.C.
Lewis's Scientific Circulating Library, 136, Gower Street, W.C.
Longmans, Green & Co., 39, Paternoster Row, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.
Western Electric Co., Ltd., North Woolwich, E.

TESTING LABORATORIES.
Electrical Standardizing & Testing Institution (Faraday House), 62–70, Southampton Row, W.C.

VENTILATION AND FANS.
Wilson-Wolf Engineering Co., Ltd., Bradford.

VULCANISED FIBRE.
Mosses & Mitchell, 122–124, Golden Lane, E.C.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

A Special Literary Supplement is included in this issue, containing notices and reviews of books, and a carefully revised list of selected works on electrical engineering and allied subjects.

A section of the Midi railway in the south of France is now being equipped for electric traction. The single-phase system with 12,000 volts trolley-line pressure and a frequency of 16⅔ cycles is to be employed. Some particulars of an A.E.G. locomotive for this line are given. (Page 265.)

The second annual report of the International Electrical Commission has been issued. (Page 265.)

An arrangement, known as the Bruston Automatic Electric Lighting System, in which the generating set is started up as soon as the lights are switched on, is described. (Page 266.)

Special arrangements are being made for the supply of large numbers of carbon lamps at special rates for Coronation illuminations. (Page 266.)

A short description is given of the principal features of the Jahns governor. (Page 266.)

There is a dispute between the National Telephone Co., Ltd., and the Post Office with regard to the interpretation of certain clauses in the agreement for the transfer of the telephone system to the Post Office at the end of this year. The points now being discussed are whether the notices given by the Postmaster-General of the plant which he proposes not to take over are in proper form, and whether he has a right to refuse to take over certain portions of the plant in competitive areas, which, although they may not be necessary for the new service, are acknowledged to be suitable for the technical point of view. (Page 267.)

The discussion of Mr. Collis's Paper on circuit breaking by the South Wales Institute of Engineers was concluded on April 20th. (Page 267.)

The National Electrical Manufacturers' Association have issued a set of proposed regulations for the hiring out of arc lamps. (Page 267.)

Amongst the specifications published by the Patent Office last Thursday was one by H. Gray, dealing with electric ovens. Another, by W. J. Reid, describes the manufacture of a new insulating material. J. Härden has introduced an electric furnace with a concave roof to reflect the heat from an arc between two inclined metal electrodes. Siemens Bros. Dynamo Works (Siemens Schuckertwerke Ges.) describe a simplified form of dynamical coupling. Opposition has been entered to the grant of a patent to the Murex Magnetic Co. and A. A. Lockwood, which deals with the magnetic preparation of ores, and a patent to W. E. Bullock and J. Calcott, for the treatment of iron and steel, has been granted in spite of opposition. (Page 268.)

A sum of £41,000 is to be handed over to relief of rates from the Birmingham tramway profits, and £15,000 from the electricity profits.—Satisfactory reports are made upon the use of tramcar meters at Bournemouth and Walthamstow.—The Hartlepool Corporation are contesting the arbitrator's award with regard to the purchase of the local tramways.—The Board of Trade have refused to grant the Bermondsey Council a lighting provisional order enabling it to compete with the London Electric Supply Corporation and the County of London Electric Supply Co.—The Manchester Tramways Committee are to pay £80,000 in

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relief of rates, and the Electricity Committee £24,500. —The Norwich Tramways Co. are offering to sell their undertaking to the Corporation. (Page 269.)

A DIESEL engine plant is to be installed at Bath; an electric lighting scheme has been placed before the Ilkley Council; extensions are to be carried out as follows:—Poplar, £42,455; South Shields, £7,500; Wimbledon, £7,459; York, £15,000; Derby, £8,500; tramway extensions at an estimated cost of £17,600 and £99,805 are contemplated at Dundee and Birmingham respectively. (Page 270.)

L.C.C. Tramways Bill.—The consideration of the Tramways Bill of the London County Council was concluded last week by a House of Commons Committee presided over by Sir Luke White. The Bill included a number of new tramways and street improvements, although several lines originally projected have had to be abandoned owing to the opposition of the road authorities. The most important line before the committee was the one down the Edgware Road from Cricklewood to Marble Arch, to which there was considerable opposition. In the first place the Commissioner of Police reported against the advisability of having a tramway terminus at Marble Arch. Following on this report, fears were expressed in certain quarters that it was the intention of the County Council at some future date to attempt to extend the line down Park Lane. In addition, it was found that the cost of street widenings, originally put at about £75,000, would actually cost well over £250,000. When the committee deliberated upon the scheme, the voting was equal, without the Chairman's casting vote, and his advice that the scheme should be withdrawn was followed by the County Council.

The Turin Exhibition.—To the list of British exhibitors of electrical and allied apparatus should be added the name of Venner & Co., who are showing their well-known time switches.

Students' Section of the Institution of Electrical Engineers.—The annual report records the holding of 10 London meetings at which the average attendance was 52, in addition to the 10 students' meetings at Manchester, and 4 at Glasgow. A tour was made in the Birmingham district last July to visit objects of electrical engineering interest, and a tour in Sweden is arranged for the coming summer. Certain alterations in the rules have been made.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, MAY 18TH.

Institution of Electrical Engineers.

8 p.m. "Automatic Telephone Systems," by W. Aitken.

TUESDAY, MAY 23RD.

Faraday Society.

8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Discussion on "High Temperatures."

THURSDAY, MAY 25TH.

Electro-Harmonic Society.

6.30 p.m. Annual general meeting at Institution of Electrical Engineers, Victoria Embankment.

National Telephone Co.

7 for 7.30 p.m. Annual Dinner at Hotel Cecil.

FRIDAY, MAY 26TH.

Physical Society.

3 p.m. Visit to National Physical Laboratory.

Institution of Electrical Engineers.

4.30 p.m. Annual General Meeting.

Institution of Electrical Engineers.

8 p.m. "The Heating of Cables with Current," by S. W. Melson and H. C. Booth.

The Railless Electric Traction Bills.—The prospects of the installation of trolley omnibus installations in Great Britain, which were so bright at the beginning of the Parliamentary session, have received a severe check. Three Bills have been voluntarily withdrawn by the promoters for various reasons, and that relating to Matlock was rejected by a House of Lords Committee last week. As a consequence the same promoters withdrew a Bill which they had deposited for Malvern. Subsequently, the same Committee passed the Brighton, Hove & District Railless Traction Bill, which was promoted by the Brighton, Hove & Preston Omnibus Co. as a counter-move to the promotion of the Brighton & District Tramways Bill, which has also since been withdrawn. The Brighton Railless Electric Traction Bill, however, was considerably reduced in scope. As deposited, the scheme of the Bill included the whole of the route from Rottingdean to Brighton, and on to Worthing, but as passed only the short portion between Brighton and Rottingdean is included.



Mr. Flecks instals a telephone.

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"ELECTRICAL ENGINEERING"

LITERARY SUPPLEMENT

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Electric Crane Construction." By C. W. Hill. 313 pp. 9 in. by 6½ in. 337 figures. (London: Chas. Griffin & Co.) 25s. net; abroad, 25s. 10d.

Reid's Handy Colliery Guide and Directory for the Counties of Northumberland, Durham, and Yorkshire. 212 pp. 6½ in. by 4¼ in. (Newcastle-upon-Tyne: Andrew Reid & Co., Ltd.) 2s. 6d.; abroad, 2s. 8d.

"Arc Lamps and Accessory Apparatus." By J. H. Johnson. 132 pp. 6½ in. by 4¼ in. 20 figures. (London: A. Constable & Co.) 1s. 6d. net; by post, 1s. 7½d.

"Motors, Secondary Batteries, Measuring Instruments, and Switchgear." By S. K. Broadfoot. 96 pp. 6½ in. by 4¼ in. 16 figures. (London: A. Constable & Co.) 1s. net; by post, 1s. 1½d.

"Transformers," by Prof. H. Bohle and Prof. D. Robertson. 356 pp. 9 in. by 5½ in. About 330 figures and 17 plates. (London: Chas. Griffin & Co.) 21*s.* net; abroad, 22*s.* net.

"A Handbook of Testing Materials." By C. A. M. Smith. 284 pp. 9 in. by 5 in. 134 figures. (London: Constable & Co.) 6s. net; abroad, 6s. 8d. net.

"Testing of Electro-Magnetic Machinery and Other Apparatus." By B. V. Svenson and B. Frankenfield. Vol. II., "Alternating Currents." Pp. 324. 8¾ in. by 5½ in.; about 150 figures. (London: Macmillan & Co.) 11s. net; abroad, 11s. 9d.

"Electric Accumulators." Edited by B. E. Jones. 160 pp. 6¾ in. by 4¼ in. 57 figures. (London: Cassell & Co.) 1s. net; by post 1s. 2d.

"Electric Primary Batteries." Edited by B. E. Jones. 160 pp. 6¾ in. by 4¼ in. 91 figures. (London: Cassell & Co.) 1s. net; by post, 1s. 2d.

"A Handbook of Wireless Telegraphy." By Dr. J. Erskine-Murray. Third edition. 386 pp. 8¾ in. by 5¾ in. About 192 figures. (London: Crosby Lockwood & Son.) 10s. 6d. net; abroad 11s. 4d.

"Motion Study." By F. B. Gilbreth. 116 pp. 8 in. by 5½ in. 44 figures. (London: Constable & Co., Ltd.) 4s. 6d. net; abroad, 4s. 10d.

"Wiring Rules, with Extracts from the Board of Trade Regulations and the Home Office Rules for Factories and Workshops." The Institution of Electrical Engineers. 42 pp. 8½ in. by 5½ in. (London: E. and F. N. Spon.) 6d. net; abroad, 7d.

"Imperial Telegraphic Communication." By Charles Bright, F.R.S.E. 212 pp., 7¾ in. by 5 in. (London: P. S. King & Son.) 3s. 6d. net; abroad, 3s. 9d.

REVIEWS OF BOOKS

The Law Relating to the Generation, Distribution, and Use of Electricity, including Electric Traction. By C. M. Knowles. Part I.: Electric Lighting and Power, 447 pp.; Part II.: Electric Traction, 403 pp. 9¾ in. by 6¼ in. (London: Stevens & Sons.) Two vols., 42s.; abroad, 43s. 8d.

A SUPERFICIAL knowledge of the law relating to electricity supply and electric traction is essential to practically everybody who is connected with the electrical industry, but a mere superficial knowledge is not sufficient for the Borough Electrical Engineer and Manager, nor for his Chairman; and Town Clerks, as well as general managers of electricity supply companies, should be actual authorities on the subject. To all of these, Mr. Knowles' work will come as a veritable boon.

As is the case in the majority of legal books dealing with a particular Act or series of Acts, it is not written in the form of a treatise, but ranks rather as a work of reference. The law of electricity supply and traction is not expounded in a general manner, as would be done in an educational work; each Act is given *in extenso* (including the Electric Lighting Act of 1909), and is interspersed with notes and comments of cases helping to interpret the various clauses. An excellent feature is that clauses of other Acts which are cited in any of the Electric Lighting Acts or affect the law of electricity supply are given also, and their relevance explained when necessary, and a similar treatment is followed in the volume dealing with the law of electric traction. Further, the volumes contain Board of Trade Regulations, Model Orders, Bills and Clauses, and sections on Private Bill Procedure.

It is obviously impossible to include in such a work every fairly important case in which a decision has been given under one of the Acts in question, but a large number are included, although we certainly miss one or two old friends—at any rate, we have been unable to find them with the assistance of the index. Good indexing, we realise, is difficult, and there is certainly room for improvement in this respect in the volumes in question. More headings in the General Index would have been an assistance, and in the table of cases—even if it is contrary to recognised practice—entries should be made alphabetically in the name of the defendants as well as the plaintiffs. For instance, a reader may remember that an important judgment was given in an action brought by a consumer against a supply authority with regard to interruptions in supply or failure to maintain pressure, but unless he remembers the name of the firm or individual bringing the action he will have difficulty in finding the reference in the book, as the name of the defendant Corporation will not be given in the General Index or in its alphabetical place in the Table of Cases. There are few books, however, in which the indexing is above criticism, and this detail should not prevent Mr. Knowles' book from becoming a standard work of reference.

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Part I. Electric Lighting and Power.
Part II. Electric Traction.

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Electric Crane Construction. By C. W. Hill. 313 pp., 9 in. by 6½ in., 337 figures. (London: Chas. Griffin & Co.) 25s. net; abroad 25s. 10d.

A STRIKING feature of this work is the large collection of drawings of cranes and details which represent a valuable store of accumulated experience. The title of the book limits it to electric cranes, but now-a-days electric power is so universal in crane construction that it forms practically a general, and indeed, a very complete, handbook of crane design. The design of almost every known type of crane, transporter and cableway is treated of, and interesting chapters consider starting torque, acceleration and power required for crane driving. A due proportion of the space is devoted to electrical as well as mechanical details, and separate chapters are included on brake—magnets, motors and controllers. The vexed question of the rating of crane motors is gone into, and the author, after pointing out the futility of rating on the basis of one hour or even shorter runs at full load, sets forth the method of D. R. Pohl for calculating a loading and duration of test which shall be equivalent as regards temperature rise to running at the load and load-factor desired. Very useful formulæ are given for the design of controller resistances. An interesting but, as compared with the scale of the rest of the book, a rather brief chapter on electric crane installations follows. Here mention is made of equalisation of the load due to a group of cranes of a battery working in conjunction with a reversible booster, but the possibility of utilising flywheel power storage for the purpose is not discussed. The whole work is straightforward and may be recommended as being written from a thoroughly engineering point of view, preserving a nice balance between academic and rule-of-thumb methods of treatment. Not only are stores of data included, but they are in a form readily usable by designers of electric cranes and similar machinery.

Gas Engines. By W. J. Marshall and Captain H. R. Sankey, R.E. 278 pp. 8¼ in. by 5½ in. 127 figures. (London: Constable & Co.) 6s. net; abroad, 6s. 8d.

THE authors do not, in this book, set themselves to compete with the many excellent works on the internal-combustion engine which have been written for the use of those concerned in the manufacture of gas engines or for the use of students, but rather address themselves to purchasers or users who wish to know the principles underlying the use and construction of gas engines, the methods of diagnosing and remedying defects when they occur. Many useful hints may be gathered on running gas engines, and much practical information will be found as to the arrangement of a gas-engine installation. The outline scheme for gas-engine testing should also be very useful. The large gas engine is kept in view as much as machines of smaller size, and there are excellent illustrations of parts of engines of well-known makers. The book is clearly written, and should be useful to those who desire a working knowledge of the gas engine without making an exhaustive study of its many problems.

Electric Wiring, Fittings, Switches, and Lamps: Circuits. By W. P. Maycock. 4th edition. 628 pp. 7¼ in. by 5 in. 624 figures. (London: Whittaker & Co.) 6s. net; abroad 6s. 8d.

So far as it goes, this book is excellent, and it certainly contains a great deal of matter which will be of service to the wiring contractor and his foreman and also to the consultant. But the Author has imposed upon himself certain limitations as to the scope of the present volume, so that, although it contains over 600 pages and an equal number of illustrations, such details as particulars of the specification of wires, and the determination of the sizes required in any particular installation, are apparently reserved for a later volume, and while several accessories and earthing connections for conduit systems are described, the general treatment both of conduit and casing wiring is reserved. On the other hand, great trouble has been taken to collect descriptions of special types of switches, plugs and various accessories, in addition to those which are more familiar, and there are sections on electric signs, heating, surface wiring, bells, telephones, fire alarms, &c.

Electric Wiring Diagrams. By W. Perren Maycock. 146 pp. 5 in. by 7¾ in. 246 figures. (London: Whittaker & Co.) 2s. 6d. net; abroad 2s. 9d.

THE diagrams from the book reviewed above have been collected and republished separately in this small volume. Although some of them are very "special" arrangements, a large number will be found useful in everyday practice.

Transformers. By Prof. H. Bohle and Prof. D. Robertson. 356 pp. 9 in. by 5½ in.; about 330 figures and 17 plates. (London: Chas. Griffin & Co.) 21s. net; abroad, 22s. net.

AN immense amount of work has evidently been put into this book, which, though quite suitable as a text-book for students, is more of the nature of a treatise for the use of designers. The authors have gone to great trouble to evolve a new list of symbols for which the publishers prepared special type. The various values of an alternating function are expressed by the same letter with different signs worked into it to denote instantaneous, maximum or mean, while suffixes are used to distinguish between different quantities of the same kind. Another innovation is the use of the "volt-second" in place of the "line" as the unit of magnetic flux. The inconvenience in reading occasioned by the adoption of this new unit is remedied to some extent by the insertion, in curves and examples, of

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the corresponding values in the usual C.G.S. units, but the use of the "line" contributes in no small degree in assisting towards a useful physical conception of electromagnet phenomena, and, as it is adopted internationally, there seems every reason to regain it.

In spite of all this original treatment, the authors have by no means neglected the work of other investigators. The subject is treated with considerable completeness, and a special chapter is devoted to insulating materials, the particular advantages and drawbacks of each being clearly stated.

One of the authors, Mr. Robertson, has evolved an entirely new method of design which eliminates the customary series of trial designs, and leads at once to a good design. This method has been developed from some equations which showed that the efficiency of a transformer depends upon the value of an abstract quantity equal to the geometrical mean of the lengths obtained by dividing the total cross-sections of the iron and copper spaces by the respective lengths of the iron and copper. This figure and another abstract quantity, the "loss-length," are used as the basis for the design, which is carried through by reference to a number of curves and tables. The introduction of these abstract quantities causes the process and sequence of the design itself to be somewhat obscure, but doubtless the rapidity with which the desired result is obtained justifies the introduction of quantities with no real physical meaning.

Testing of Electromagnetic Machinery and other Apparatus. By B. V. Swenson and B. Frankenfield. Vol. II., Alternating Currents. 324 pp., 8¾ in. by 5½ in., about 150 figures. (London: Macmillan & Co.) 11s. net; abroad, 11s. 9d.

THIS is a comprehensive laboratory companion, consisting of instructions for carrying out over one hundred and twenty tests and experiments on alternating-current apparatus and machines, together with full notes on the theory and method of each test and useful diagrams. The work shows signs of careful preparation, and a valuable feature is the inclusion under each experiment of a list of references to books and articles in technical journals, American, British, and Continental, published between 1902 and 1908, and dealing with the particular subject or test in question. The work is sound, and appears to cover the ground pretty thoroughly. Five different methods of determining wave form, and five methods of analysing wave forms are given; the effect of frequency on meter readings is included; and notes on special machines, such as commutator motors and the split pole converter are also provided.

A Handbook of Testing Materials. By C. A. M. Smith. 284 pp. 9 in. by 5 in. 134 figures. (London: Constable & Co.) 6s. net; abroad, 6s. 8d.

IN the general description of laboratory testing machines and their uses, the author addresses himself principally to students at college laboratories, but there will probably be a somewhat wider circle to which the book will be of interest. The general principles rather than the mechanical details of the machines are treated of, and a considerable amount of space is devoted to strain measuring instruments, such as the Ewing extensometer and other varieties. Torsion, impact, and hardness tests and alternating stress tests are considered, as well as the testing of cements, stones, timber, &c. Another chapter gives hints on experiments in college laboratories. The results of tests are not dealt with at quite the same length as are the methods of testing, but a good deal of interesting matter is brought together, particularly in the appendices.

Installation Manuals for Electric Wiremen. (6½ in. by 4¼ in.) (London: A. Constable and Co.)

Arc Lamps and Accessory Apparatus. By J. H. Johnson. 132 pp. 20 figures. 1s. 6d. net; by post, 1s. 7½d.

CONSIDERING its size and price, this little book is remarkably complete, and it can be recommended to those requiring a general practical acquaintance with the construction and working of arc lamps and accessories with them. A number of fairly representative modern designs are described, and the aim and effect of the different mechanical and electrical devices special to certain makes are clearly explained. A good deal of useful practical information is scattered throughout the book, which is above the average quality of the usual cheap handbook.

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St. Stephen's House, Westminster, S.W.

Motors, Secondary Batteries, Measuring Instruments, and Switchgear. By S. K. Broadfoot. 96 pp. 16 figures. (London: A. Constable and Co.) 1s. net; by post, 1s. 1½d.

THIS handbook attempts to cover too much, and many of the earlier sections, although quite elementary in character, are too short to give much instruction as to the working of the apparatus referred to. On the other hand, it contains practical hints as to care and management of motors and batteries which should be useful to a certain class of electrician. Explanations of phase displacement, power factor, and power measurement seem to be out of place in a book of this character, and it is unfortunate that there is a mistake in the diagram of connections of a single-phase wattmeter used for measurement of the power in a balanced three-phase circuit.

Electric Accumulators. Edited by B. E. Jones. 160 pp. 6¾ in. by 4¼ in. 57 figures. (London: Cassell & Co.) 1s. net; by post, 1s. 2d.

THIS work appears to abound with useful information and illustrations, and should be received well by both practical and amateur electricians. The earlier chapters give, in very elementary form, full instructions how to construct, maintain, and charge accumulators, clearly illustrated with diagrams of connections. The author seems, however, to be somewhat out in his calculations, for a battery containing three positive plates, 7 in. × 7 in. × 3/16 in. will give a much larger output than 30 ampere-hours, the batteries on the market sold at 30 actual ampere-hours containing three positive plates of dimensions 4 in. × 4 in. × 3/16 in. The latter half of the book is more advanced, one chapter showing how alternating current, by means of a motor-generator or rectifier, can be converted to a direct current for charging purposes, and the closing chapter describes how to make pocket accumulators. Considering the low price of this book it is very well compiled, and should be found useful to those requiring a good knowledge of this branch of electricity.

Electric Primary Batteries. Edited by B. E. Jones. 160 pp. 6¾ in. by 4¼ in. 91 figures. (London: Cassell & Co.) 1s. net; by post, 1s. 2d.

THIS book is profusely illustrated, and contains much useful information which should be appreciated by amateur electricians, but apparently the author has misapplied his intention of helping the public by showing them the possibilities of batteries by his disparaging remarks in a later chapter on the failure of primary cells for electric lighting. The author evidently does not realise the very largely increased field which has been opened up for the primary battery by the metal filament lamp. The example given of carbon lamps and bichromate cells is not a good one as representing modern practice. No mention, except the mere name, appears to be made of the Dania dry cell, which is one of the best on the market, and which will completely recoup itself on being placed in a jar with salammoniac and water. Another very good cell left in the cold is the Economic battery for intermittent lighting, also the Boron cell.

Motion Study. By F. B. Gilbreth. 116 pp. 8 in. by 5½ in.; 44 figures. (London: Constable & Co., Ltd.) 4s. 6d. net; abroad, 4s. 10d.

ON glancing through the pages, which are profusely illustrated with photographs of the various movements of a bricklayer building a wall, one is inclined to jump to the conclusion that they are the work of a "crank." After reading some of the earlier pages, however, one realises the importance of the subject, which is simply the study of the sequence of movements and mental processes involved in any kind of labour, with a view of reducing the time and physical or mental work necessary to produce any required result. The book is highly suggestive, and an application of the systematic methods described, such as the proper placing in position of materials and tools, and the correct sequence of operations, can but result in a great saving of time. The methods may be applied to any kind of work from the stamping of circular office letters to heavy engineering, and bricklaying is merely used as a simple example.

The "Northampton Gazette."—We have received a copy of the April issue of the "Northampton Gazette," which is the official publication of the Northampton Past Day Students' Association and the Northampton Institute Engineering Society. This is the second number of a magazine intended to keep old students of the Northampton Institute in touch with each other. It is largely taken up with news and announcements relating to the Institute and those connected with it, but articles of technical interest are also included.

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Application of Arc Lamps to Practical Purposes. Justus Eck. 2s. 6d. net; by post, 2s. 9d. (*Reviewed Dec. 15th*, 1910.)
Arc Lamps and Accessory Apparatus. J. H. Johnson. 1s. 6d. net; by post, 1s. 7½d. (*See Review this week.*)
Electric Wiring, Fittings, Switches, and Lamps: Circuits. W. P. Maycock. 6s. net.; abr., 6s. 8d. (*See Review this week.*)
Electrical Circuits and Diagrams. N. H. Schneider. In two parts, 1s. 6d. each net; by post, 1s. 9d. each.
Theory and Practice of Electric Wiring. W. S. Ibbetson. 5s.; abr., 5s. 6d.
Practical Electric Wiring. C. C. Metcalfe. 5s. net; abr., 5s. 8d.
Institution of Electrical Engineers' Wiring Rules, with Extracts from the Board of Trade Regulations and the Home Office Rules for Mines. 6th ed. 6d. net; by post, 7d.
Phœnix Fire Office Rules for Electric Installations. 6d. net; by post, 7d.

Mining.

Modern Practice in Mining. R. A. S. Redmayne. *Vol. I.*, Coal: Its Occurrence, Value and Methods of Boring. 6s. net; abr., 6s. 6d. *Vol. II.*, The Sinking of Shafts. 7s. 6d. net; abr., 8s. 2d.
Mining (An Elementary Treatise). A. Lupton. 9s. net; abr., 9s. 8d.
Electricity as Applied to Mining. A. Lupton. 2nd edition. 12s. net; abr., 12s. 9d.
Electrical Practice in Collieries. D. Burns. 3rd edition. 7s. 6d. net; abr., 8s. 2d.
Electric Blasting Apparatus and Explosives. W. Maurice. 8s. 6d. net; abr., 9s.
The Shot-Firer's Guide. W. Maurice. 3s. 6d. net; abr., 3s. 10d.

Telephony, Telegraphy, Wireless Telegraphy, and Railway Signalling.

Practical Telephone Handbook and Guide to Telephone Exchanges. J. Poole. 4th edition. 6s. net; abr., 6s. 8d.
American Telephone Practice. K. B. Miller. 4th ed. 17s. net; abr., 18s.
Telegraphy. A Detailed Exposition of the Telegraph System of the British Post Office. T. E. Herbert. 6s. 6d. net; abr., 7s. 6d.
Telegraphy. Preece and Sivewright. 7s. 6d.; abr., 8s. 2d.
Electrical Testing for Telegraph Engineers. J. E. Young. 10s. 6d. net; abr., 11s. 3d.
Handbook of Electrical Testing. H. R. Kempe. 7th ed. 18s. net; abr., 19s. (*Reviewed July 29th*, 1909.)
Submarine Telegraphs, Their History, Construction and Working. Charles Bright. 63s. net; abr., 63s., carriage forward.
Students' Guide to Submarine Cable Testing. Fisher and Darby. 7s. 6d. net; abr., 8s.
Submarine Cable-Laying and Repairing. H. D. Wilkinson. 15s. net; abr., 15s. 9d.
Principles of Electric Wave Telegraphy. J. A. Fleming, F.R.S. 2nd edition. 28s. net; abr., 29s. 8d. (*Reviewed Dec. 15th*, 1910.)
Elementary Manual of Radiotelegraphy and Radiotelephony for Students and Operators. J. A. Fleming, F.R.S. 7s. 6d. net; abr., 8s. (*Reviewed Dec. 31st*, 1908.)
Radio-Telegraphy. C. C. Monckton. 6s. net; abr., 6s. 6d.
A Handbook of Wireless Telegraphy. J. Erskine-Murray. 3rd. ed. 10s. 6d. net; abr., 11s. 3d.
Wireless Telegraphy and Telephony. A. E. Kennelly. 2nd edition. 4s. net; abr., 4s. 4d. (*Reviewed May 26th*, 1910.)
Application of Electricity to Railway Working. W. E. Langdon. 10s. 6d.; abr., 11s. 2d.
Power Railway Signalling. H. Raynor Wilson. 18s. net; abr., 19s. (*Reviewed Nov. 5th*, 1908.)

Motors, Generators, and Transformers (Theory and Design of).

Dynamo-Electric Machinery. S. P. Thompson, F.R.S. *Vol. I.*, Continuous Current Machines. 30s. net; abr., 31s. 3d. *Vol. II.*, Alternating Current Machinery. 30s. net; abr., 31s.
Electric Machine Design. Parshall and Hobart. 42s. net; abr., carriage forward.
The Dynamo. Hawkins and Wallis. 5th edition. *Vol. I.*, 10s. 6d. net; abr., 11s. 6d. *Vol. II.*, 10s. 6d. net; abr., 11s. 6d. (*Reviewed March 31st*, 1910.)
High-speed Dynamo Electric Machinery. Hobart and Ellis. 25s. net; abr., 26s. 4d. (*Reviewed Dec. 10th*, 1908.)
Electric Motors. H. M. Hobart. 18s. net; abr., 19s. 4d. (*Reviewed Dec. 15th*, 1910.)
Armature Construction. Hobart and Ellis. 15s. net; abr., 15s. 6d.
Construction of Dynamos: Alternating and Direct Current. T. Sewell. 7s. 6d. net; abr., 8s. 3d.
Elementary Principles of Continuous Current Dynamo Design. H. M. Hobart. 7s. 6d. net; abr., 8s.

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Pocket Books and Hand-books.

Pocket Book of Useful Formulæ and Memoranda for Civil, Mechanical, and Electrical Engineers. Sir G. L. Molesworth, K.C.I.E. With an Electrical Supplement by W. H. Molesworth. 26th ed. 5s. net; abr., 5s. 4d.

Spon's Tables and Memoranda for Engineers. J. T. Hurst. 12th ed. 1s. net; by post, 1s. 1d. In celluloid case, 1s. 6d. net; by post, 1s. 7d.

The Pocket Book of Pocket Books. Being Molesworth's and Hurst's Pocket Books (latest editions), printed on India paper and bound together in one volume. 10s. 6d. net.

Pocket Book of Electrical Rules and Tables for the Use of Electricians and Engineers. Munro and Jamieson. 19th ed. 8s. 6d.; abr., 8s. 10d.

Electrical Engineer's Pocket Book. H. A. Foster. 5th ed. 21s. net; abr., 22s.

Walker's Loose-leaf Pocket Book for Engineers. Tables, &c., N. R. Corke. 10s. 6d. net; abr., 10s. 9d. (*Reviewed June 30th*, 1910.)

Mechanical World Electrical Pocket Book for 1911. 6d. net; post free, 7½d. (*Reviewed January 19th*, 1911.)

Mechanical World Pocket Diary and Year Book for 1911. Cloth, 6d. net; by post, 8½d. Leather, 1s. 6d. net; by post, 1s. 9d. (*Reviewed January 19th*, 1911.)

Electrochemistry and Electrometallurgy.

Practical Electrochemistry. B. Blount. 2nd edition. 15s. net; abr., 15s. 9d.

Text-book of Electrochemistry. S. Arrhenius. Translated by J. McCrae. 9s. 6d. net; abr., 10s. 3d.

Practical Methods of Electrochemistry. F. M. Perkin. 6s. net; abr., 6s. 6d.

Electrochemistry. *Part I.*, General Theory. R. A. Lehfeldt. 5s.; abr., 5s. 5d.

Electrometallurgy. W. G. McMillan. Revised by W. R. Cooper. 3rd edition. 12s. 6d. net; abr., 13s. 6d.

Electrometallurgy. J. B. C. Kershaw. 6s. net; abr., 6s. 8d.

Electric Furnaces. W. Borchers. Translated by H. G. Solomon. 7s. 6d. net; abr., 8s.

Electric Furnaces. J. Wright. 8s. 6d. net; abr., 9s. 4d.

Electro-Plating and Electro-Refining. A. Philip. 12s. 6d. net; abr., 13s. 6d.

Selected lists of books on Mathematics and of Miscellaneous Books will be sent on application.

THE NATIONAL TELEPHONE JOURNAL

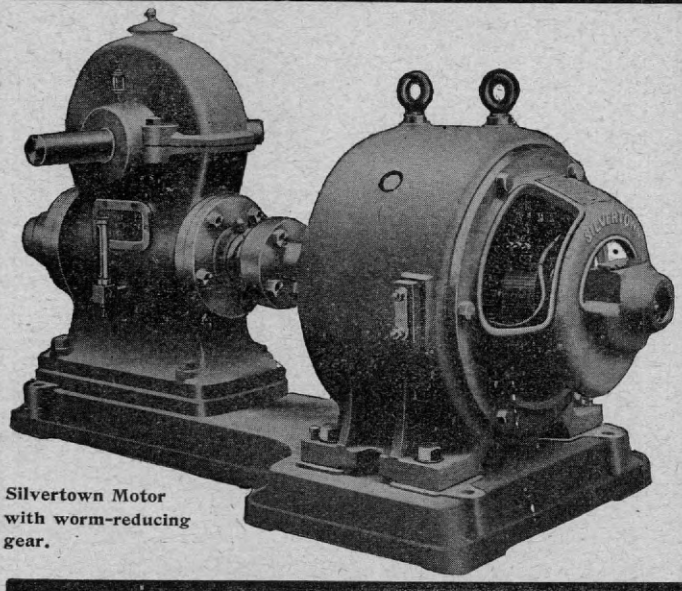
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Note on the Measurement of Impedance and Effective Resistance by means of the Barretter. By B. S. Cohen, A.M.I.C.E.
Success. By A. K. Murray.
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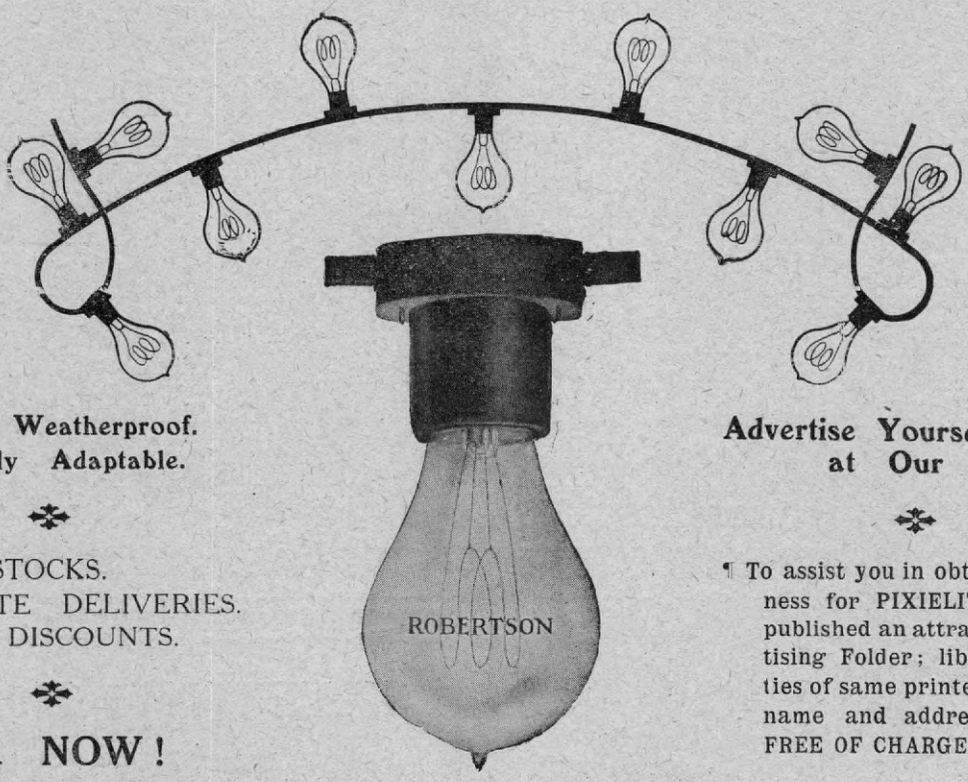
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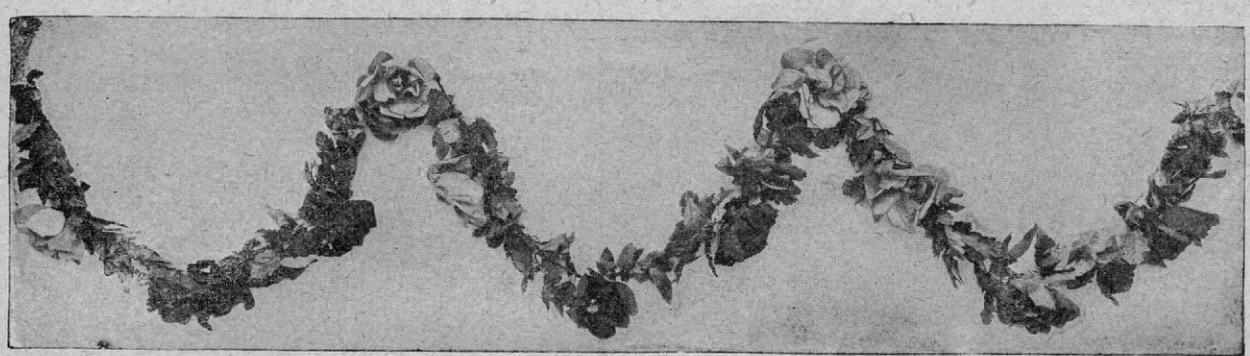
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ELECTRIC TRACTION ON THE FRENCH MIDI RAILWAY

IN 1908 the Compagnie des Chemins de Fer du Midi decided to introduce electric traction on a portion of its main line system, and equipped a ten-mile section of the branch line between Villefranche-Vernet les Bains and Perpignan (Villefranche-Marquixanes) for experimental purposes. The single-phase system with a trolley-line pressure of 12,000 volts, and a frequency of 16⅔ was decided upon. An order has already been placed with the Société Anonyme Westinghouse for the electrical equipment of the 70-mile main line section between Pau and Montrejean, together with branch lines. This comprises in all some 175 miles, of which the 70 miles between Pau and Montrejean is double track with gradients up to 3·3 per cent. and a minimum radius of curvature of 330 yards. For the supply of electrical energy to these lines, four large water power stations will be built, one of which is already in course of construction. These

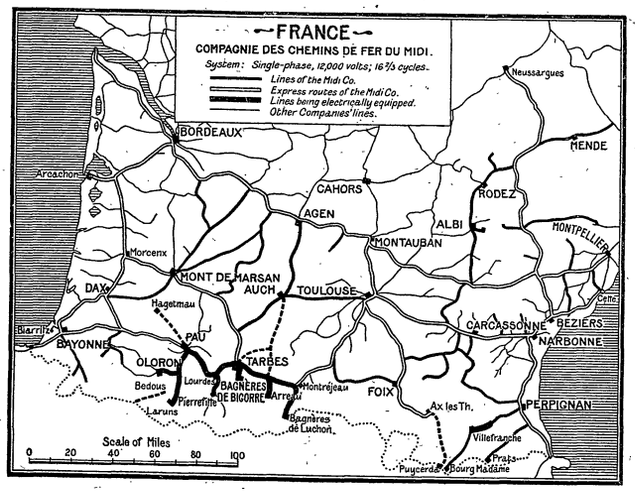


FIG. 1.—MAP OF THE MIDI RAILWAY SYSTEM.

will be at Soulon (12,000 h.p.), Eget (18,000 h.p.), Porta (10,000 h.p.), and at Ossau (10,000 h.p.). The current will be generated single-phase, 16⅔ cycles, and will be transmitted at 60,000 volts to sub-stations at Pau, Lourdes, Tarbes, Launemezan and Montrejean, where it will be transformed down to the trolley line pressure of 12,000 volts.

The express passenger trains will run at speeds up to 62 miles per hour, while the maximum speeds of the heavy passenger trains will be 40 miles per hour. The passenger and goods trains will be hauled by locomotives, while the single-track branch-line service will be dealt with by motor-coaches and trailing cars. The accompanying figure illustrates the locomotive supplied by the Allgemeine Elek-

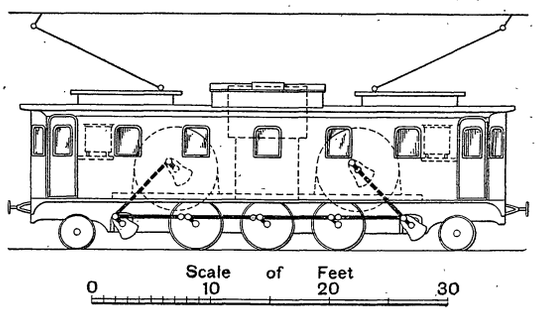


FIG. 2.—A.E.G. 1,600-H.P. LOCOMOTIVE FOR THE FRENCH MIDI RAILWAY.

tricitäts Gesellschaft. It is a 3/5 coupled locomotive of the 1-C-1 design with the three driving axles coupled together and to two jack-axles coupled in turn to two 800-h.p. Winter-Eichberg repulsion motors. The total weight of the locomotive is 85 tons, the adhesion weight 54 tons, and the weight per driving axle 18 tons. One transformer in the middle of the locomotive supplies both motors. The maximum draw-bar pull is 27,500 lbs., and the speed 47 miles per hour. A feature of the electrical control is that energy is returned to the line on down-grades at speeds between 18·5 and 34 miles per hour. The order placed with the Société Anonyme Westinghouse includes a batch of thirty double-bogie motor-coaches, each equipped with four Westinghouse motors of 125 h.p. These cars will have multiple-unit control, and will be employed, as stated above, on the branch lines. Each will weigh about 56 tons and will be capable of hauling four trailing cars.

THE INTERNATIONAL ELECTROTECHNICAL COMMISSION

THE second annual report of the International Electrotechnical Commission for the year ended Dec. 31st, 1910, has just come to hand. The report recapitulates the events leading up to the present situation, including the preliminary meeting in London in June, 1906, when the Commission was officially constituted, and the Council meeting in London in 1908. An unofficial conference was held in Brussels in August, 1910, under the presidency of M. Eric Gerard, but the full report of the proceedings is not yet available. The full meeting originally planned for Berlin this year has been abandoned in favour of Turin, on account of the International Electrical Congress arranged there by the Associazione Elettrotecnica Italiana. The date of the meeting is Sept. 11th to 16th, and the suggestions of the Brussels conference, at present before the various committees, will come up for ratification. Other questions will also be discussed.

Work has proceeded during the year under review. The subject of nomenclature is being studied by committees. The consideration of the terms in alphabetical order has been given up, as the division of the subjects into sections presented less difficulties, advanced in respect as to agreement on symbols and rating of electrical machinery. We understand, however, that in the near future a small international committee appointed at the Brussels conference, consisting of Dr. Budde (Germany), Dr. Silvanus Thompson (Great Britain), M. Brunswick (France), and M. Eric Gerard (Belgium), is to meet and discuss the work on nomenclature. This committee is to prepare a list of terms and definitions dealing with the one subject of electrical machinery, which list is to be ratified by the meeting at Turin in the beginning of September next.

There are now seventeen countries in which an Electrotechnical Committee has been formed, in the majority of cases with the assistance and co-operation of their respective Governments, the latest adherents being Holland and Switzerland. The British committee and its sub-committees have held twelve meetings during the year. The list of terms from A to E has been completed and sent to the central office. A French translation of the English list of terms (A–E) has been made, and an English translation of the French list of terms (A–E) was made by Mr. Robert Hammond, a member of the committee. The list of terms from F to J has been completed by the Sub-Committee on Nomenclature, and will shortly be submitted to the committee for approval. The Sub-Committee on Nomenclature has under consideration the German list of terms submitted at the Brussels Conference. A large number of the terms in the German list have already been dealt with in the English list of terms (A–J), and definitions are in course of preparation for other words requiring definition.

The Society of Engineers.—The annual dinner of the Society of Engineers (Incorporated) is to be held at the Criterion Restaurant on Saturday, the 27th inst., at 6.30 for 7 p.m. Mr. F. G. Bloyd, the President, will be in the chair. After the dinner there will be a conversazione and concert, the programme having been arranged by Mr. Chas. Capper.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—Members: A. Reyrolle, G. P. Robertson. Associate members: R. Brooks, H. G. Cakebread, C. Corbridge, E. Denton, A. O. Gibbon, F. Hersee, W. H. Hunstone, H. R. Legge, A. S. Markes, C. Munzel, E. S. Perrin, W. D. Ross, M. C. Timms, L. B. Turner, W. B. Turner. Associates: J. P. Forster, W. H. Lea, H. E. Mortimer, F. H. Ousey, H. P. Wiggins.

Faraday Society.—A general discussion on high temperatures is to be held on May 23rd at 8 p.m. at the Institution of Electrical Engineers. The following programme has been arranged: Dr. Arthur L. Day, of the Carnegie Institute, Washington, will read a Paper on "Recent Advances in Gas Thermometry"; Dr. J. A. Harker, F.R.S., will describe the high temperature equipment at the National Physical Laboratory; Mr. H. C. Greenwood, M.Sc., will read a Note on "Boiling Points of Metals," and Mr. A. Blackie will speak on "The Behaviour of Silica at High Temperatures." Contributions to the discussion have been promised by Prof. Bodenstein "On the Maintenance of Constant High Temperatures," M. Féry "On Stellar Pyrometry," and others. Dr. R. T. Glazebrook, F.R.S., Director of the National Physical Laboratory, will preside. During the afternoon of May 23rd the Society, by the kind invitation of the Director, will visit the National Physical Laboratory to inspect the high temperature equipment.

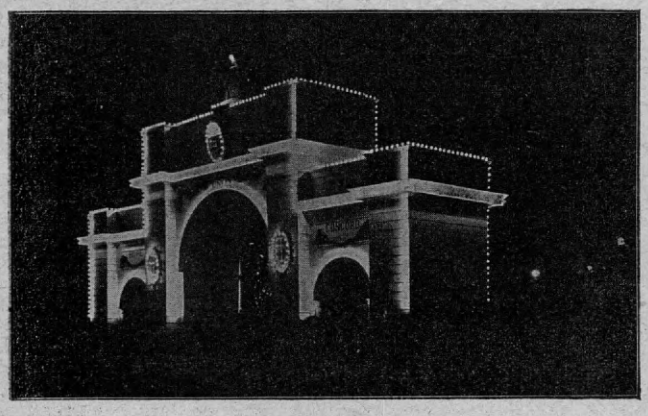
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THE "BRUSTON" AUTOMATIC GENERATING SYSTEM

OWING to the courtesy of Messrs. R. A. Lister & Co. (47 Victoria Street, S.W.), we recently had an opportunity of inspecting an arrangement for the automatic supply of a lighting installation known as the "Bruston" system. This consists of a petrol or gas engine and a shunt-wound dynamo of the ordinary type, a small battery of accumulators of small size, and a relay which controls the starting and stopping of the plant. To start up, it is only necessary to switch on three or four lamps or more, depending on the state of the battery, which supplies the lamps in the first instance. As soon as the current required by the lamps is strong enough to actuate the relay the circuit is closed, and the current from the battery starts the machine as a motor by means of a solenoid starter. The engine, which is connected by belt to the motor, gets up speed, and then drives the motor as a dynamo, which now supplies the lamps direct and also charges the battery. In order to relieve the compression for easy starting, an exhaust-valve lifter is provided, in the form of a distance piece attached to a rod, which is also actuated by the solenoid. At starting the position of the rod is such that the distance piece is in contact with a projection on the valve stem, which keeps the valve open, but as soon as the solenoid has cut out all the motor starting resistance, it at the same time moves the distance piece, and allows the valve to travel freely up and down. In the event of only one lamp being required, it would be supplied by the battery until the volts were so low that the relay would again start up the set and recharge the battery. When the lamps are all switched off the plant automatically shuts down. With petrol the plant gets up speed in about 4 seconds, but with gas supplied direct from the mains the set will start up in about 2½ seconds. The engine runs under forced lubrication supplied by a small pump. There are no special foundations, the whole plant simply resting on two girders with felt placed at the corners to take up what little vibration there is.

CARBON LAMPS FOR ILLUMINATION

CARBON filament lamps will doubtless enjoy a spell of prosperity during the forthcoming Coronation celebrations, as owing to the temporary nature of the various installations, the higher price of metal filament lamps will be a consideration. Messrs. Siemens Brothers Dynamo Works, Ltd., Tyssen Street, Dalston, inform us that they are now holding large stocks of carbon lamps, which can be supplied immediately at remarkably low prices, which will only hold good until the present stocks are exhausted. As all orders will be executed in the strict rotation in which they are received it would be advisable to send orders or reserve sufficient quantities immediately. These types of lamps have been in great demand for illumination work, and we illustrate here some night effects which were



ILLUMINATIONS IN SOUTH AFRICA.

obtained during the Royal visit to South Africa on the occasion of the opening of the Imperial Parliament there. Many thousands of lamps were employed in these decorations, which were supplied by the South African branches of the above firm, and as will be seen, highly satisfactory results were obtained. Similar lamps will be used in the various Coronation schemes which Messrs. Siemens Brothers are catering for, and the actual fixing and erecting work will be placed in the hands of thoroughly competent electrical contractors. Messrs. Siemens Brothers will be pleased to forward a copy of their Coronation devices and accessories list to any who are interested in illumination schemes.

THE JAHNS GOVERNOR

AN illustrated booklet describing this form of governor has been issued by Jens Orten-Böving & Co. (9½ Union Court, Old Broad Street, E.C.). The Jahns governor is made in a great variety of forms for different circumstances, but in all of them the essential features are practically the same. The points specially aimed at in its design are maximum uniformity of action throughout the stroke, maximum sensitiveness, and maximum regulating force. The sensitiveness of the governor varies in inverse ratio to the internal friction, so that the less the friction the higher the sensitiveness. The insensitiveness (or sluggishness) due to the internal friction of a governor may be defined as the proportion which the change in speed necessary to produce motion in the sleeve bears to the total speed. If at any time the speed of the governor has been rising and comes to a steady value, n_1, and if it then begins to fall, the sleeve, owing to internal friction, will not begin to move downwards until the speed has fallen to a value less than n_1, which we may call n_2. Then the insensitiveness will be $\frac{n_1-n_2}{n_2}$. In the Jahns governor this quantity has a value of 0·00175, or 0·175 per cent., which is claimed to be considerably lower than in any other governor on the market. Exposed balls, swinging arms, &c., are replaced by a neat enclosed system with suitably formed and guided weights and balanced levers, powerful adjustable springs, ball or roller bearings at every friction point, and perfectly automatic lubrication throughout. The governor weights move absolutely radially in straight lines on steel rollers, which carry the weight as well as the side pressure, and the springs act directly on the weights themselves, without the intervention of any pins or levers. The straight-line movement of the weights ensures a straight-line law for the travel of the weights, and is a feature not possessed by any other governor.

The lever system connecting the weight with the sliding sleeve is of a very simple character, and runs in oil in the lower part of the case. Rollers are employed to diminish friction wherever possible, and the arrangement of the springs is such that both can be adjusted independently. A simple addition permits of speed adjustment while running.

Scottish Local Section of the Institution of Electrical Engineers.—The annual report of this section records the holding of six meetings and the conversazione. The section now embraces a larger area than formerly, as is indicated by its change of name, from the Glasgow section to the Scottish section. The membership amounts to 355, including 75 students. The following are the officers for the coming session:—*Chairman:* Mr. F. A. Newington. *Past Chairmen:* Mr. W. W. Lackie, Mr. E. George Tidd, and Mr. S. Mavor. *Vice-Chairman:* Mr. J. Lowson. *Chairman of Students' Section:* Mr. W. W. Lackie. *Hon. Secretary and Treasurer:* Mr. J. E. Sayers. *Ordinary Members of Committee:* Mr. W. M'Whirter, Mr. J. A. Robertson, Dr. Magnus Maclean, Mr. T. B. Murray, Mr. T. C. Parsons, Mr. J. Ferguson, Dr. J. T. Bottomley, Mr. D. A. Starr, and Mr. Lee L. Murray. The Glasgow Students' Section has held six meetings during the past session.

Conference on Engineering Training.—Arrangements have been made by the Institution of Civil Engineers to hold a conference on the education and training of engineers on June 28th and 29th. The subject matter will be divided into three groups, viz., general education, scientific training, and practical training. A large number of well-known men have consented to form the general committee. The President of the Conference will be Mr. Alex. Siemens, and the chairmen of the three sections will be Mr. A. G. Lyster, Prof. W. C. Unwin, F.R.S., and Mr. R. Elliott Cooper. The following subjects are to be introduced for consideration:—The extent to which mathematical and scientific subjects should share with other subjects of literate education the attention of schoolboys who intend to enter later the engineering profession. The question of specialised entrance examinations for University or College courses of study in Engineering Science with a view to the curricula to be followed, and also of the inclusion in the latter of courses in modern languages. The relation of practical training to college study; whether, or to what extent, before, sandwiched, or after its conclusion. The position and uses of engineering laboratories in relation to education at college. The value of a University Degree in Engineering Science in relation to professional competence. The requirements of practical training in works, with the necessary complement of scientific study. Practical training in workshops or on works of construction, with special reference to training in the engineer's office. The relation of engineering employers and colleges from the point of view of the practical training of college students. Workshop training as a preliminary to practical training in other branches of engineering.

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THE TELEPHONE TRANSFER

Dispute between the Post Office and Telephone Co.

AS was briefly mentioned in our last issue, the Railway and Canal Commissioners are having to decide a dispute between the Post Office and the National Telephone Co., Ltd., as to what plant is to be taken over by the Post Office when the Company's licence expires at the end of this year.

Under the agreement made between the Government and the Company in 1905, the Post Office undertakes to buy all plant in use in non-competitive areas which was in use at that date, and also that which was erected subsequently, if it is in accordance with an agreed specification, which practically defined what was recognised as good practice at the time. In competitive areas, however—which includes London, Cardiff, Newcastle, Hull, Portsmouth, and Brighton—the Post Office is not compelled to buy any plant which is "unsuitable," and any dispute as to whether it is suitable or not is to be submitted to arbitration.

The Postmaster-General has given notice that he deems certain plant unsuitable, and this is disputed by the Company. The case has been proceeding since Tuesday last week, but up to the present the attention of the Railway and Canal Commissioners has been chiefly directed to two points, upon which a decision will probably first be given before the more technical part of the case is proceeded with.

The Company contend, in the first place, that the notices given as to the Postmaster-General's refusal to take over certain plant are invalid, owing to the want of proper definition of the plant which he desires to reject.

For instance, in the agreement, telegraph line or line is defined as including not only the wires, but also the posts, insulators, and other supports. The Postmaster-General objects to take over all iron wires which form a part of any telegraphic line, which according to the definition would include span-wires, and even the stay-wires holding up poles, to which not only these lines are attached, but also in many cases other lines which he wishes to take over. Further, he objects to lines along, upon, or across any railway worked *or about to be worked* by electric power, which definition, it is pointed out, might include not only all those cables and wires above or across the tube railways in London, where, of course, they are unaffected by the working of the line, but also others, the position of which it is impossible to determine without the gift of prophecy. The Company contend that the notice must not take the form of such general descriptions as this, but should be of sufficiently definite a nature to enable them to prepare a list of the actual plant and material objected to. The Postmaster-General also objects to taking over lines leading to the "Avenue" exchange in London (which will eventually be replaced by a new exchange in course of erection by the Post Office in Creechurch Lane, Fenchurch Street), but it is pointed out that both these junctions are in many cases contained in cables with other junction and private lines which the Post Office have not excluded. The Company claim that the material which the Post Office desires to reject must be of such a nature that it is easily separable from what is to be taken over and retained, and that for all these reasons the notices (given before January 1st last under the terms of the agreement) are invalid.

The second point which is now being discussed is the interpretation of the word "unsuitable." It appears that some of the plant and lines objected to in competitive areas is quite modern and efficient, and suitable for the service, but is not wanted because it duplicates existing plant or lines, and the Commissioners are asked to decide whether "unsuitable" includes what may be more accurately characterised as redundant. The complaint is also made that the Postmaster-General has even widened his interpretation of what is unsuitable to include plant that will shortly be replaced by new plant when the London exchange system is remodelled. For instance, the existing Avenue exchange, already mentioned, is one of the older ones in London that have not been re-equipped on the common battery system, and the new exchange in Creechurch Lane will, when ready, enable it to be dispensed with. But the Avenue exchange is at present necessary for the service, as the new exchange is not completed, and the Company maintain that the suitability of the Avenue exchange is therefore established.

Counsel for the National Telephone Co. are Sir Alfred Cripps, K.C., Mr. W. Danckwerts, K.C., Mr. Forbes Lankester, K.C., Mr. E. Morton, K.C., and Mr. H. H. Gaine; for the Post Office, the Attorney-General (Sir Rufus Isaacs, K.C.), the Solicitor-General (Sir John Simon, K.C.), and Mr. Branson.

A number of models have been prepared, and were exhibited in Court to assist in explaining to the Commissioners, Justice A. L. Lawrence, the Hon. A. E. Gathorne-Hardy, and Sir James Woodhouse, the various technical matters and the issues involved.

After Sir Alfred Cripps had opened the case for the National Telephone Co., and Mr. Danckwerts had followed, Sir A. B. W. Kennedy was called as the first witness. The Judge, however, said he would like to hear the other side on the two points mentioned above, and Sir Rufus Isaacs and Sir John Simon addressed the Court. It was agreed that, until these points were decided upon, the more technical question as to the suitability of the existing plant should not be discussed. Sir A. B. W. Kennedy and Major O'Meara then gave the Court a general description of the various systems of telephony. Sir Rufus Isaacs replied for the Crown on the points in question, and Sir Alfred Cripps was making his final speech when we went to press.

CIRCUIT BREAKING

THE discussion on Mr. A. G. Collis's Paper on Circuit Breaking, before the South Wales Institute of Engineers (see ELECTRICAL ENGINEERING, March 9th, p. 125) was concluded on Thursday, April 20th, at Cardiff, by the reading of a communication from Mr. A. M. Taylor.

Referring to Mr. Collis's remarks as to the action of a magnetic blow-out solenoid on an alternating current circuit, he remarked that although, over a number of phases, the direction of flux would be reversed, the period in which his switch acted, commencing from the point of zero current, was so short that the current was unidirectional. Under these conditions, the magnetic blow-out could quench the arc. Any deterioration of the oil due to the action of the arc from the magnetic blow-out was balanced by the rapid circulation of the oil due to the action of the switch blade. In some tests which he (Mr. Taylor) had made with two types of switches manufactured by leading makers, he had found that gaps of 1 in. and 1·5 in. respectively were made before the auxiliary contacts broke the circuit. Even if the loss of time due to the damping action of the oil and the friction of the parts were neglected, this corresponded to ·036 and ·042 second respectively, and these times would be increased if long rods and cranks were used for remote control. Hence Mr. Collis's time of ·01 second was inconceivable unless some special means of opening had been adopted. Regarding Mr. Collis's example of a rise of 9,300 volts on a 2,000 volt 200 yard feeder carrying 500 amperes, it was not stated whether the circuit was broken under its own self-induction only, or with a motor in circuit. Where a cable was short-circuited straight across, a voltage rise in excess of the alternator voltage could be produced, this rise depending on the rate of change of current at the instant of rupture. A resistance introduced into the circuit at the switch during circuit breaking operations would, by limiting this rate of change, reduce the reactance voltage of the generator.

HIRE OF ARC LAMPS

IN view of the diversity in practice regarding the hire of arc lamps, the National Electrical Manufacturers' Association have prepared a series of rules regarding the conditions on which arc lamps are to be supplied on approval or on hire, in the hope of promoting uniformity in such matters. These rules provide in arc lamps on approval that no charge is made for the use of lamps during the approval period, and each lamp will be provided with one trim of carbons. All further carbons used must be paid for. The lamps must be properly erected and burnt with the carbons supplied, and no larger current or higher voltage must be used beyond that stated on the instructions. The goods are to be returned properly packed within the time period agreed. Should they be detained longer, it will be considered that the lamps are definitely purchased. The lamps when returned will be inspected, and breakages or repairs necessary, other than those due to fair wear and tear, are to be paid for at the usual rates.

When arc lamps are on hire, except in the case of electrical exhibitions, all carbons are to be paid for. The total costs of freight and carriage from the works to the hirer and back again to be paid by the hirer, and from the time the lamps reach the hirer to the time of their return to the maker, they are held in trust by the hirer, who will be responsible for any loss or damage which may occur. The period of hire shall be reckoned from the time the goods leave the maker to the date they are received by him. The hiring prices do not include the cost of wiring for or fixing the lamps and resistances.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published May 11th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

9,611/10. **Electric Ovens.** H. Gray. In this oven the air is heated by heating elements disposed within the lower portion of and near the sides of the cooking chamber of the oven. It is then conducted up through conduits to the upper part of the chamber, when it flows down evenly through the cooking space to the lower part of the oven, to be re-heated by the resistances, without passing out of the chamber, and so makes a continual circulation. Four figures.

9,858/10. **Insulating Material.** W. J. Reid. This patent relates to the manufacture of a material suitable for insulation, and consists in treating with paraffin wax a mixture of 40 to 60 parts of finely powdered cork, and 40 to 60 parts by weight of linseed oil, which has been subjected to a temperature usual in preparing boiled oil for painters' use for such a time that it becomes viscid, and will draw into threads when cool. This mass can be moulded while hot into any shape, and then hardened by exposure to the air at a temperature of 100° F.

9897/10. **Electric Furnace.** J. Härdén. This patent describes a furnace which has a concave roof for radiating and reflecting the heat from a long arc derived from two metal electrodes on to the surface of the charge. The electrodes, which are placed above the charge, each consist of a hollow metal tube with a dome-shaped cap adapted for the circulation of a cooling medium, and are inclined upward from a recess in the furnace wall. Four figures.

25,473/10. **Repulsion Motors Operating as Generators.** Akt.-Ges., Brown, Boveri et Cie. When repulsion motors are driven in a direction opposite to their torque, they act as generators, and large currents at a low periodicity are generated, which are liable to damage the windings of the stator and rotor. The object of the invention is to prevent this by connecting, in series with either or both the circuits, a non-inductive resistance, with which is supplied a switch for short-circuiting it. The resistances need only be put into circuit at high speeds, when dangerous currents are likely to flow, and then can be thrown in automatically at a certain speed. Four figures.

22,368/10. **Electric Time Switches.** W. C. Pugh and A. Gamblee. This covers an improvement in the type of time switches which are opened and closed by a clock-worked mechanism. A cam moves axially by means of a gear-wheel, and is controlled by an adjustable finger so as to actuate a lever to close the switch at a predetermined time, also a sleeve which is connected to, but is rotationally adjustable with relation to the cam, and a projection mounted on the sleeve to control the lever and permit a spring to actuate it to open the switch at a certain time. Six figures.

28,940/11. **Electro-dynamical Couplings.** Siemens Bros. Dynamo Works, Ltd. (*Siemens Schuckertwerke Ges.*) This invention describes a simplified form of coupling, and covers in particular that part of the power which is transmitted indirectly from one shaft to the other. An armature made up of two separate concentric iron cores, wound with a series of short-circuited conductors common to both cores, is mechanically coupled to one of the shafts. There is also provided a rotating field produced by supplying a stationary polyphase winding from an outside source, of such a phase that a motoring action is set up between the armature and the rotating field, and the inner conductors on the armature generate current for the outer motoring conductors. The other shaft is mechanically coupled to a direct-current field system. When the speeds of the two shafts are equal and in the same direction, there is no torque transmitted from one shaft to the other, but when the speed of the armature is less than that of the shaft coupled to the D.C. field, a torque is transmitted directly and partly indirectly. The armature need not have two separate iron cores; one common core will often prove satisfactory. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Martyn [Bonding cables] 9,921/10; Koopman and Pontelec Welding Patents, Ltd. [Conductor supports] 10,693/10; Mitchell and Dudgeon [Overhead section insulators] 25,369/10.

Dynamos, Motors, and Transformers: Siemens Bros. Dynamo Works (*Siemens Schuckertwerke Ges.*) [Regulation of A.C. generators in parallel] 29,549/10; Koopman and Pontelec Welding Patents [Transformers] 4,911/11; Siemens Schuckertwerke Ges. [Rotor cooling] 5,247/11; Schneider [Verifying the operation of distant transmission apparatus] 28,700/10.

Electric Ignition: Fletcher [Magneto-electric machines] 2,434/11.

Electrometallurgy and Electrochemistry: Härdén [Reduction of metals from their oxides and other compounds] 7,303/10; Henri, Helbronner, and Von Recklinghausen [Sterilisation of liquids] 12,947/10; Billon-Daguerre [Sterilisation of liquids] 2,735/11.

Heating and Cooking: Koopman and Pontelec Welding Patents, Ltd. [Heating-machines] 10,694/10; Veritys, Ltd., and Pipkin [Soldering-iron] 11,088/10.

Incandescent Lamps: Harrison [Manufacture of filaments] 10,871/10; Harrison [Exhaustion of] 10,872/10; Kitsee [Metallic filaments] 11,415/10; Roberts and Prescott [Lamp-shade attachments] 21,349/10; Ludecke and Imperial Lamp Works, 23,222/10.

Instruments and Meters: Harris [Moving coil measuring instruments] 10,048/10; Kretz [Coin-operated mechanism for supply] 10,334/10; Allgemeine Elektricitäts Ges. [Consumption meter] 1,930/11.

Storage Batteries: Pape [Storage cells], 906/11.

Switchgear, Fuses and Fittings: Torchio [Manufacture of insulated conductors] 10,160/10; Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [Motor starters] 10,191/10; Eversheed & Vignoles and Kilroy [Gun control] 10,356/10; Siemens Bros. Dynamo Works (*Siemens Schuckertwerke Ges.*) [Motor controllers] 17,235/10; Price [Switches for dynamos, accumulators, &c.] 18,869/10; Waterhouse [Ceiling roses] 20,156/10.

Telephony and Telegraphy: Johnson and Johnson [Telephonic apparatus] 21,359/10; Siemens Bros. & Co. (*Siemens and Halske Akt.-Ges.*) [Telephone exchange circuits] 29,672/10.

Traction: Electric & Ordnance Accessories Co. and Seal [Lighting of carriages and other vehicles] 2,088/10; Samaia [Railway and tramway points, control] 11,371/10; Buck [Trolley arms] 25,864/10.

Miscellaneous: Presser [Electric welding] 15,033/10; Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [Electromagnetic relays] 2,249/11; Siemens Bros. & Co. (*Siemens and Halske Akt.-Ges.*) [Electric order-signalling] 6,626/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: Blondel, 27,989/10.

Telegraphy: Soc. des Établissements Gaumont [Phonic relay] 9,364/11.

Incandescent Lamps: Schaffer, 9,719/11; Schaller, 9,815/11; Schaller [Lamp with liquid incandescing body] 9,816/11.

Distribution Systems, &c.: Giles [Device for indicating earth on line] 9,745/11.

The following amended Specification can now be obtained.

L. D. Cibie [Arc lamps] 21,008/09; H. Hammarlund [Recording instruments] 27,380/09.

Opposition to Grant of Patents

13,009/10. **Separation of Ores.** Murex Magnetic Co. and A. A. Lockwood. Opposition has been entered to the grant of this patent, a process for the magnetic preparation of an ore, which consists in treating it with a magnetic substance, an oily liquid, and a solution of potassium sulphide.

16,300/09. **Treatment of Iron and Steel.** W. E. Bullock and J. Calcott. This patent has been granted by the Comptroller in spite of opposition. (See Electrical Engineering, January 5th, p. 7.)

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: G. Wilkinson [Electric joints and boxes] 2,084/02.

Dynamos, &c.: C. A. Parsons, G. G. Stoney, and A. H. Law [Dynamos] 2,151/06.

Electric Ignition: A. Herz [Explosion engines] 2,152/03; G. A. E. Edwards (*H. M. Reichenbach*) [Internal combustion engines] 1,759/06.

Electrometallurgy, &c.: J. Raschen and G. C. Clayton [Electrolysis] 2,152/04.

Heating and Cooking: J. Girlot [Apparatus for heating materials] 1,961/02.

Incandescent Lamps: P. H. Thomas [Vapour electric apparatus] 707/06; J. Neu [Apparatus for raising lamps] 2,153/06.

Instruments, &c.: W. Armour [Temperature recorder] 1,906/06.

Switchgear, &c.: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Switches] 2,065/06; H. E. Edwards [Switches] 2,196/06.

Telephony, &c.: W. L. Wise (*J. H. Peirce, U.S.A.*) [Telegraphs] 2,274/04.

Miscellaneous: H. Nehmer [Gas lighters] 2,063/04; S. O. Cowper-Coles [Electrotype for ornamenting] 2,071/06.

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CATALOGUES AND PAMPHLETS RECEIVED

ELECTRIC WELDING.—An illustrated catalogue from the British Insulated & Helsby Cable Co., Prescot, Lancashire, describing the Prescot spot and seam welders, is before us. These are devices for electrically welding plates of iron or steel, and are claimed to give effects equal to riveting. They are provided with two suitably shaped electrodes, which make contact with the metals to be welded, and through which a heavy current is passed at a very low pressure, until the intervening metal is white-hot, when the current is cut off and the metal between the electrodes is compressed, forming a weld. The current being only in use during the actual heating operation, brings the consumption down very low. The welder is wound for a pressure of 200 volts at 50 periods single phase. The electrodes are made of copper, and in order to prevent undue wear under the extreme heat, it is arranged for water to flow through the handle of the electrodes to the welding point, this being so efficient that the noses of the electrodes can be touched by the hand immediately the weld is completed.

WATER SOFTENERS, &c.—New leaflets from the Harris Patent Water Feed Filter (1910), Ltd. (24 Grainger Street West, Newcastle-on-Tyne), call attention to the Harris-Anderson water softener and oil eliminators, and the Harris-Anderson patent anti-corrosion system for condensers. Effective photographs of the state of protected and unprotected tubes are reproduced, and a long list is given of installations where the system is in use.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ILLUMINATIONS.—Messrs. Caspar & Co. (33 King's Road, N.W.) send us a leaflet describing attractive signs and devices for Coronation illuminations, including excellent transparency portraits of the King and Queen for illumination.

ARC LAMPS.—A leaflet from the Allgemeine Elektricitäts Gesellschaft refers to a new high candle-power arc lamp used in conjunction with coloured screens which the company have specially designed for colour matching. Interesting three-colour reproductions of materials photographed by this lamp, by incandescent lamps, Nernst lamps, and gas give a striking illustration of its suitability.

BALLAST RESISTANCES.—The A.E.G. also send us a pamphlet relating to iron-wire resistances for automatic voltage equalisation on traction lighting circuits. The resistances are made up like incandescent lamps in glass bulbs with the ordinary lamp contacts.

TURBO-COMPRESSORS.—Another recent A.E.G. publication in German is a booklet on turbo-compressors and blowers, containing interesting particulars of this rapidly developing class of plant with illustrations of actual installations.

ENGINEERING SUPPLIES.—A new edition of this catalogue has reached us from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.). This list sets out clearly small motors, spares, and accessories in a manner which will be found useful to central station engineers for ready reference. A feature of this catalogue is the electric "Mary-Ann," a contrivance which should be of great utility as a domestic labour-saving appliance. From the same firm we have a copy of their mixed plant catalogue, which is well arranged, and should be a great help to engineers in getting out estimates for various lighting plants. The complete way in which the equipments listed have been standardised is not the least useful point about the list.

RESISTANCES.—Messrs. The M. & C. Manufacturing Co. (Conduit Place, Paddington, W.), have sent us a leaflet dealing with resistances for cinematograph work, which, with satisfactory ventilation, are guaranteed to withstand from 60 to 100 per cent. overload.

TELEPHONES.—We have received from the Western Electric Co. (Norfolk House, Victoria Embankment, W.C.), a copy of a revised catalogue, which deals with various types of interphones and "Westerphones," and all the necessary material for installing them. The same firm also send a booklet with details of the improved Blue Bell Dry Cell and other wet batteries, such as the Leclanché, Fuller, and Gravity, and describes a pocket telephone battery gauge for testing purposes.

MOTOR CONVERTERS.—A new pamphlet from Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, gives a full description of the La Cour Motor Converters, and their various uses, together with important curves, showing characteristics of the traction and lighting types. Numerous orders and repeat orders are continually being received, and we understand that one company alone has ordered sixteen of these machines, each of 475 kw. capacity, for sub-station work.

LOCAL NOTES

Birmingham: *Tramway Receipts.*—The net profits from the tramways for the year 1910–11 amount to £65,516, an increase of £9,074 over the previous year. After placing £24,413 to reserve, bringing this to £132,150, the balance of £41,103 is to be transferred to relief of rates.

Electricity Accounts.—After meeting all charges, the accounts of the electricity undertaking show a net profit of £35,449. The sum of £20,000 is transferred to renewals fund, and the balance carried to relief of the rates.

Blackpool: *Electricity Profits.*—Last year 171 new consumers were connected to the mains, and the profit for the year was £5,300.

Bournemouth: *Tramway Receipts.*—The traffic receipts for 1910–11 show an increase of £3,213 on the previous twelve months. The tramway manager recommends the Council to retain the tramcar meters, which have been on trial for six months. He regards them now as an essential and indispensable part of the equipment.

Bridlington: *Electrical Fountains.*—The proposal of the Property Committee that a deputation should visit Berlin to inspect the working of electrical fountains with a view to having one installed on the parade, has been rejected by the Corporation.

Glasgow: *Tramway Assessment.*—The Tramway Committee are appealing to the Sheriff's Court against a decision of the Assessment Committee fixing the assessment of the tramways at the full value, instead of one-fourth, similar to the rating of railways.

Hartlepool: *Tramway Arbitration.*—In reference to the arbitrator's award of £12,963 for the purchase of certain tramway routes as mentioned in our last issue, there still remain certain legal points to be argued. These will be heard by Mr. Justice Bray on June 13th. The Corporation are advised that the arbitrator has no jurisdiction to make any award, on the ground that at the date upon which the value of the tramways was fixed by him, the Tramway Company were not the actual owners of the lines, they being then in the hands of the original promoters, Messrs. Sellon and Ashby, and that no deed of assignment had been executed. Consequently neither party could claim payment.

Hull: *Telephone Accounts.*—The telephone accounts for the year to March 31st, show a gross profit of £5,026, an increase of £203 over the previous year. The royalties paid to the Government amounted to £1,258. The cost per station now stands at £19·95 compared with the estimate of £20 given by Mr. A. R. Bennett, at the original Local Government Board inquiry.

Ipswich: *Electricity Profits.*—The total revenue from the electricity undertaking for the year to March 31st, was £14,495, and after meeting all charges, including sinking fund and interest, there is a net profit of £1,509 before making any provision for depreciation.

Tramway Profits.—The tramway accounts show a deficit of £2,230 compared with £1,733 in the previous year.

Johannesburg: *Strike of Tramway Employees.*—According to messages from Johannesburg, considerable disturbance is being caused by a strike of tramway employees. It seems that two men have been discharged, and their reinstatement is demanded, together with an assurance that the strikers will not be victimised later. Cars have been running with volunteer drivers accompanied by an armed policeman, and in this way the full service has been maintained. Nevertheless, the cars have been boarded by strikers, and in some cases stopped. The services of mounted police have helped to keep the way clear for the passage of the cars. An attack has been made upon the power station.

Leatherhead: *Street Lighting.*—The local Electricity & Gas Companies have been asked to tender for street lighting.

Leeds: *Electricity Profits.*—The Electricity Department is able to contribute £9,927 to relief of rates out of the profits for 1910–11, an increase of £1,062 over the previous year.

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Bermondsey: *Electric Supply Competition.*—The Board of Trade, after holding an inquiry lasting for three days, has refused the Council's application for an electric lighting Provisional Order in the districts of Horsleydown, St. Olave and St. Thomas. In these districts the supply at present is in the hands of the County and London Electric Supply Co. and the London Electric Supply Corporation. The County Council opposed the application, on the ground that already the undertakings of the two Companies may have to be purchased, and that the granting of competing powers would place the County Council in competition with the Borough Council, should the companies be purchased by the former in 1931. It was also objected that in view of the indebtedness of the Borough Council, it was undesirable that it should incur any capital outlay upon electricity works on an area already served by two companies.

Stepney: *Wapping Sub-station.*—The London County Council are recommended to sanction a loan of £5,260 for sub-station buildings at Wapping, repayable in 50 years.

Manchester: *Electricity Profits.*—At the last meeting of the City Council, the Electricity Committee recommended that the sum of £19,496 should be handed over from their profits in relief of rates. An amendment was moved that this amount should be increased to £24,500, and in spite of the opposition of the Chairman of the Committee, the amendment was carried.

Tramway Profits.—At the same meeting the Tramway Committee's proposed contribution of £75,000 to relief of rates was raised to £80,000 by the Council, the Chairman of the Committee dissenting in this case also.

Nelson: *Electricity Profits.*—There has been a net profit of £826 upon the working of the electricity undertaking for 1910–11, instead of an estimated loss of £898.

Newark: *Lighting Order Revoked.*—The Board of Trade have revoked the Newark Electric Lighting Order granted in 1900.

Newcastle-on-Tyne: *Electric Signs.*—In an omnibus bill which was considered by the Local Legislation Committee of the House of Commons last week, the Newcastle Corporation sought powers to control electric street signs. The Newcastle-upon-Tyne Electric Supply Co. opposed, and as the Corporation had had to come to terms with the North-Eastern Railway Co., and allow their signs to remain without control, the Committee regarded the case for the charge as a weak one, and refused the powers asked for.

Norwich: *Tramway Purchase.*—Some negotiations for the purchase of the Norwich Tramways by the Corporation fell through a short while ago, the Company not then being willing to sell. The Company is controlled by the Imperial Tramways Co., which also owns the Coventry Tramways, and in the latter case the Corporation have availed themselves of their powers to give notice to purchase that undertaking. In these circumstances the Imperial Company have now expressed their willingness to enter into the negotiations for the sale of the Norwich Undertaking, and a proposition to this effect has been placed before the Council.

Walthamstow: *Tram Car Meters.*—The Tramway Manager has on trial 40 Chamberlain and Hookham traction meters. Although they have only been in use for a short time, there has been a marked decrease in the consumption of power.

Warrenpoint: *Electricity Supply.*—A Lancashire firm of electrical engineers have placed an electricity supply scheme before the Council.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bath.—The Electricity Committee propose to instal a Diesel engine and generator at the power station at an estimated cost of £7,580.

Derby.—The estimated capital expenditure for the year to March 31st, 1912, upon the electrical undertaking is £8,500.

Handsworth (Staffs).—The Council require a supply of cable for lighting and tramway purposes. Consulting engineers, Messrs. Kennedy & Jenkins, 17 Victoria Street, London.

Ilkley.—Mr. J. C. Speight, of St. Anne's-on-Sea, has placed a scheme of electric supply before the Council, the total cost of which is estimated at £6,324. This plant provides for the use of suction gas, but by laying mains only in the compulsory area and using town gas it is calculated that the cost could be reduced to £5,024.

Ireland.—The Tipperary Guardians have decided to proceed with their scheme for electrically lighting the workhouse buildings. It is expected that an annual saving of £277 will be made compared with the present gas lighting.

Italy.—Tenders are invited by June 2nd for the supply of electric cables and wires to the Italian naval authorities. Copy of specification and conditions may be seen at 73 Basinghall Street, E.C.

London: *Poplar.*—A scheme of extensions to the generating station and plant at a cost of £42,455 has been adopted by the Council.

South Shields.—A Local Government Board inquiry was held last week concerning a loan of £7,500 for additional generating plant. Mr. J. F. C. Snell gave evidence on behalf of the Council, and recommended the Borough Electrical Engineer's scheme for installing a 1,500 kw. turbine driving a 1,000 kw. direct current generator and a 1,100 kw. alternating current generator. Smith's Dock Co. still oppose the loan on the ground that the Council could obtain current more cheaply from the County of Durham Electric Supply Co. Evidence against the scheme was also given by the latter.

Wimbledon.—The Electric Lighting Committee recommend the installation of additional machinery and the laying of mains for supply to the Maldens and Coombe district at an estimated cost of £7,459.

York.—A Local Government Board inquiry was held last week concerning a loan of £15,000 for extension to the electricity works. There was no opposition. During the course of the inquiry the Inspector, Mr. H. R. Hooper, expressed the opinion that the Corporation would have been advised not to have taken £800, as they have done, from the reserve fund for the relief of rates, for by leaving profits to the credit of the undertaking was the only chance of getting it on a sound financial basis.

WIRING

Birmingham.—Alterations to Probationary block, at Infirmary, Dudley Road. Architect, W. H. Ward, Paradise Street.

Brighton.—New Brighton and Sussex Grammar School. Brighton Education Committee.

Cardiff.—Business premises for Messrs. Morgan & Co., The Hayes. Architects, James & Morgan, Charles Street Chambers.

Additions to Grange Town Schools. Education Committee.

Wiring of the Corporation Baths, Guildford Crescent. City Electrical Engineer.

Glasgow.—Extension to United Wire Works, Dale Street.

—Additions to Glasgow and West of Scotland College of Domestic Science.

Manchester.—Elementary School, Fairfield Road, Droylesden, Lancs. Education Committee.

New Art Gallery and Free Library.

Mexborough.—Tenders are invited for a country-house electrical installation complete. Apply 12 Milton Road, Mexborough.

Neath.—Additions to Council schools.

Perth.—New street between St. John's Place and King Edward Street.

MISCELLANEOUS

Birmingham.—An expenditure of £99,805 is contemplated by the Corporation upon the Bristol Road, Colmore Row, to Hockley Brook and Garrison Lane tramway routes.

Canada.—The Board of Control, City Hall, Toronto, invite tenders by June 6th, for pumps and electrical equipment. Copies of specification at 73 Basinghall Street, E.C.

Denmark.—The Copenhagen Corporation require 3,000 electric meters. Tenders by May 23rd, to "Direktören for Belysningsvaesenet, Raadhuset."

Dundee.—A recommendation by the Tramway Manager to double all the existing single tramway lines at an estimated cost of £17,600, has been adopted by the Tramways Committee.



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Glasgow.—A special Sub-Committee on street lighting recommends that flame arc lamps be installed in a number of main streets before adopting a general sheme of improved lighting for the city.

Netherlands, East Indies.—The Board of Trade Commercial Intelligence Department have an address to which inquiries may be sent in connection with the proposed installation of electric cranes at Padang.

Oulton Broad.—The local Electricity Co. have offered to undertake street lighting by electricity.

Walsall.—Tenders are invited for electrical pumping plant at the new sewage disposal works. Borough Engineer.

TENDERS RECEIVED AND ACCEPTED

Colchester.—The tender of Messrs. W. T. Henley's Telegraph Works Co., Ltd., for the supply of low tension cables at £595 has been accepted.

Derby.—Contracts have been entered into with the British Insulated & Helsby Cables, Ltd., the British Thomson-Houston Co., and Messrs. Ferranti, Ltd.

Luton.—Application is to be made for a loan of £13,500 for electric extensions. Conditionally upon sanction being granted, the tender of the Brush Electrical Engineering Co. for a 50 kw. exhaust steam turbo-gererator at £2,495 10s., and a 400 kw. exhaust turbo-generator at £1,913 has been accepted. The complete scheme includes, in addition to the two generators, a cooling tower, switchgear and mains, the estimates for which are £7,039.

London: *L.C.C.*—The tender of Messrs. Walter Scott, Ltd., is recommended for acceptance for a supply of renewable guard rails for the tramways at £9,700. The rails are to be made by the Sandberg (high silicon) process at Leeds. A cheaper tender for the same process by Messrs. P. and W. Machellan, but for the rails to be made in Germany, has been put on one side.

The tender of the Rees Roturbo Pump Co., Ltd., for an electrically driven pump for draining water from cable manholes at £110 10s., is recommended for acceptance.

Marylebone.—The tender of Messrs. C. A. Parsons & Co., Ltd., has been accepted for the supply of commutator at £220, and that of the Electrical Power Storage Co., Ltd., for a 15- to 20-cwt. electric truck for the stores warehouses at £260.

Stockton.—The tender of Messrs. Richardson's, Westgarth & Co., for a 400 kw. turbo-generator at £2,293 has been accepted, subject to the sanction of the Local Government Board to the necessary loan.

The Halifax Corporation have placed an order for sixty Chamberlain & Hookham car meters for their trams. The same firm's tenders have also been accepted by Govan, Kirkcaldy, and Salford for ordinary meters.

The Mirrless Watson Co., Ltd., Glasgow, inform us that they have received, among others, the following orders:—Surface condensing plants: Two sets for Malta Dockyard; two sets for Stoke-on-Trent Electricity Works; two sets for Japanese Explosive Co.; one set for the Compania De Gas y Electricidad, Habana. For counter-current jet plants:—Two sets for the Golden Rook Sugar Factory, St. Kitts; one set for Formosa; one set for Pernambuco; and one set for San Domingo.

APPOINTMENTS AND PERSONAL NOTES

Mr. C. F. Edwin has been appointed Chief Electrical Engineer to the Chilian Navy. Mr. Edwin obtained his Diploma in Electrical Engineering in the Central Technical College in 1904. Since that date he has been with Messrs. Siemens Bros. Dynamo Works, Ltd., having held the position of Chief of Test House for nearly four years.

The salary of Mr. R. Marshall, Borough Electrical Engineer at Ayr, has been increased from £300 to £350 per annum.

The Birmingham Tramways Committee recommend that the salary of the traffic superintendent, Mr. J. McDonnell, be increased from £250 to £300 per annum.

A sub-committee of the Perth Tramway Committee recommends that the appointments of electrical engineer and tramway manager, now held by Mr. J. Lambert, be separated. It is recommended that Mr. Lambert shall continue as electrical engineer at his present salary of £275, plus £50 per annum for taking charge of the overhead equipment of the tramways. The Lighting Committee are to be asked to increase Mr. Lambert's salary by £25, thus making his total remuneration £350 per annum.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, net c.i.f. port of arrival, quoted on Tuesday night, was £55 15s. to £56 5s. per ton (last week £56 to £56 10s.)

Australian Agency.—An agent who already represents a number of British firms in Australia desires to obtain additional agencies of British manufacturers of electrical goods. Particulars may be obtained through the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

Patents for Sale.—The proprietor of patent No. 9023 of 1908 relating to improvements in the construction of condensers wishes to dispose of same. (See an advertisement on another page.)

"Tinol."—Messrs. Neville, Williams and Co. advise us that the "Tinol" branch of their business has been converted into a limited company. All communications relating to "Tinol" should be addressed to Bi-Metals, Limited, 80A Southwark Street, S.E. Messrs. Neville, Williams and Co. are continuing the electrical manufacturing business as before.

Bankruptcy.—A receiving order has been made against J. D. Carlmark, Electrical Engineer, 402 High Street, West Bromwich.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Colombo Electric Tramways & Lighting Co.—A dividend of 8 per cent. for 1910 is recommended, carrying forward £3,710, after transferring £8,300 to general reserve.

Shanghai Electric Traction Co.—There was a net profit of £7,584 for 1910, compared with a loss of about £1,000 in 1909. After writing off the debit balance the sum of £6,635 is carried forward.

Calcutta Electric Supply Co.—After placing £20,000 to depreciation and renewals and £7,500 to reserve, the directors recommend a final dividend on the ordinary shares for the December half year, making 8½ per cent. for the year. The amount carried forward is £5,621.

Rangoon Electric Tramways Supply Co.—Dividend of 4 per cent. on the ordinary shares for 1910.

Auckland Electric Tramways Co.—Interim dividend at the rate of 6 per cent per annum on the ordinary shares for the December half-year.

Cascade Water, Power & Light Co.—Subscriptions have been invited during the week for $285,500 first mortgage 4½ per cent. bonds of $500 each. This company is an amalgamation of a number of electric supply companies in British Columbia, and for the year ending August 31st, 1910, after meeting all interest and sinking fund charges, there was a net surplus of $82,399.

Adelaide Electric Supply Co.—Meetings were held last week authorising the raising of an additional £150,000 debenture stock.

Companies to be Struck off Register.—The undermentioned will be struck off the Register of Joint Stock Companies at the expiration of three months:—Aberdare Electric Lighting Co.; Buenos Ayres Electric Light Co.; Heswall District Power Co.; Private Wire and Telephone Installation Co.

NEW COMPANIES

MERSEY POWER CO., Colonial House, Water Street, Liverpool. Capital, £250,000. To acquire from G. H. Cox and H. J. Falk the Runcorn Urban and Rural Electric Lighting Provisional Orders and the Widnes Electric Lighting Provisional Order.

RESISTO ELECTRICAL ENGINEERING CO. Registered by R. Warner & Co., 10 Walbrook, E.C. Capital, £7,500. Manufacturers of and dealers in electrical apparatus.

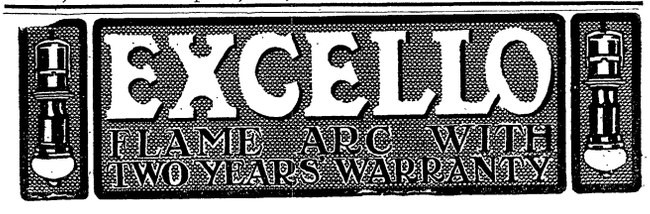
ARGENTINE ELECTROLYTIC SYNDICATE. Registered by Jordan & Sons, 116 Chancery Lane, W.C. Capital, £2,500.

ELECTRIC FITTINGS CO. (1911), 38 Conduit Street, London, W. Capital £5,000. To take over the existing business carried on at the above address, and to adopt an agreement with W. R. Sutton and A. W. Mills.

BAXTER & CAUNTER, 1 Trentishoe Mansions, Charing Cross Road, London. Capital, £50,000 (10,000 preference). To take over the existing business carried on at the above address.

TELEPHONE DEVELOPMENT CO., 36 Whitefriars Street, E.C. Capital, £25,000. To take over a concession granted or to be granted by the Imperial Ottoman Government to the Consortium Anglo-Franco-American for the construction of a telephone system in Constantinople.

SOUTH-EAST KENT ELECTRIC POWER CO., Castle-hill House, Dover. Capital, £1,000.



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OF
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(One Free Entry is given to every Advertiser. Entries under additional headings, 6d. per insertion.)

ACCESSORIES (Electric Light and General Supplies).
Cable Accessories Co., Ltd., Britannia St. Works, Tividale, Staffs.
Electrical Co., Ltd., 122-124, Charing Cross Road, W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Tudor Accumulator Co. Ltd., 119, Victoria St., S.W.

AIR COMPRESSORS.
Belliss & Morcom, Ltd., Birmingham.

AUCTIONEERS AND VALUERS.
Wheatley Kirk, Price & Co., 46, Watling St., E.C.

ALUMINIUM.
British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

ARC LAMPS AND ACCESSORIES.
Beck Flame Lamp, Ltd., Suffolk House, Laurence Pountney Hill, E.C.
British Thomson-Houston Co., Ltd., Rugby.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.
Jandus Arc Lamp and Electric Co., Ltd., Hartham Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Union Electric Co., Ltd., Park Street, Southwark, S.E.

ARMATURE REPAIRS.
Marryat & Place, 28, Hatton Garden, E.C.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Rickard (Wm.), Ltd., Ashbourne Road Mills, Derby.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Mirrlees Watson & Co., Ltd., Glasgow.
Willans & Robinson, Ltd., Rugby.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

FIRE EXTINGUISHERS.
"Kyl Fyre," Ltd., Eastbourne.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Crossley Bros., Ltd., Openshaw, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.

HEATING AND COOKING APPARATUS.
Bastian Electric Heating Syndicate, Ltd., Palmerston House, Old Broad St., E.C.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87-89, Cleveland Street, W.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.

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INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.
Ruberoid Co., Ltd., 81 & 83, Knightrider St., E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
The Fredk. Crane Chemical Co., 22 & 23, Newhall Hill, Birmingham.

LAMPS (Incandescent).
Boddy (G. M.) & Co., 15, Gray's Inn Road, W.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Brush Electrical Engineering Co., Ltd., 1, Kingsway, W.C.
Cryselco, Ltd., Kempston Works, Bedford.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Horvath (S.), 51, Standen Rd., Southfields, S.W.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Krupka & Jacoby, 11, Queen Victoria St., E.C.
Philips Metallic Glowlampworks, Ltd., Eindhoven, Holland.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

METERS.
Aron Meter Co., Ltd., 80A, Salusbury Road, Kilburn, N.W.
Bastian Meter Co., Ltd., Kentish Town, N.W.
British Thomson-Houston Co., Ltd., Rugby.
Ferranti, Ltd., Hollinwood, Lancs.

MICA AND MICANITE.
Jaroslaw (D.), 5, George St., Tower Hill, E.C.

MINE EQUIPMENTS AND APPARATUS.
British-Thomson Houston Co. Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Spagnoletti, Ltd., Goldhawk Rd., W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park. Manchester.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
General Electric Co., Ltd., 67, Queen Victoria St. E.C.
Ingleby & Co., Elland Road, Leeds.
J. L. Manufacturing Co., Ltd., Southall.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
Willans & Robinson, Ltd., Rugby.

RESISTANCE WIRE.
Drennan, Glover & Cooper, 429-431, Corn Exchange Buildings, Manchester.

SIGNS (Electric).
Krupka & Jacoby, 11, Queen Victoria St., London, E.C.

STEAM CONSUMPTION RECORDERS.
Lea Recorder Co., 28, Deansgate, Manchester.

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Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W.
Electric Journal, 422, Mansion House Chambers, E.C.
Electrical Engineering Abstracts, 57-58, Chancery Lane, London, W.C.
Griffin (Charles) & Co., Ltd., 12, Exeter Street, Strand, W.C.
Indian Industries and Power, 204, Temple Chambers, E.C.
Lewis's Scientific Circulating Library, 136, Gower Street, W.C.
Longmans, Green & Co., 39, Paternoster Row, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.
Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C.

TELEPHONES.
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British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.
Western Electric Co., Ltd., North Woolwich, E.

TESTING LABORATORIES.
Electrical Standardizing & Testing Institution (Faraday House), 62-70, Southampton Row, W.C.

VENTILATION AND FANS.
Wilson-Wolf Engineering Co., Ltd., Bradford.

VULCANISED FIBRE.
Mosses & Mitchell, 122-124, Golden Lane, E.C.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

No. 230 [Vol. VII., No. 21] THURSDAY, MAY 25, 1911. [Price One Penny.
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VALUATIONS,
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16, ALBERT SQUARE, MANCHESTER.

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SUMMARY

A special article by Mr. Frank Broadbent, discusses the advantages of electric power and lighting in printing establishments on the score of economy and convenience, and describes the special facilities which electric driving offers in the way of easy and accurate control of printing machines. (Page 275.)

A long and fully illustrated article describes the new printing works of our printers, Messrs. Richard Clay & Sons, Ltd., at Brunswick Street, Stamford Street, S.E. This works consists of a large four-floored ferro-concrete building, with special features as regards heating, ventilating, and fire-protection, containing a full equipment of up-to-date electrically-driven machinery, including a large number of rotary and flat-bed presses in great variety of size and design, special folding, gathering, stitching, wrappering, and cutting machinery, complete electrotyping and stereotyping plant, comprising machines and all the paraphernalia of a modern printing house. Electric drive by individual continuous-current motors is employed throughout, and the lighting is entirely by means of metal filament lamps. (Page 279.)

At the Institution of Electrical Engineers last Thursday, Mr. W. Aitken read a Paper on automatic telephone exchanges. He dealt with the subject in considerable detail, and expressed himself strongly in favour of the automatic switchboard, quoting American results to show its efficiency and economy. In the discussion, Messrs. J. E. Kingsbury, F. Gill, and M. S. Connor all considered that sufficient cause had not been shown for the abandonment of the manual board in favour of the automatic; Mr. A. W. Whalley, however, thought that, whatever the expense, the saving in time in obtaining connections and clearing should justify the erection of an automatic exchange system in London, and Mr. R. Scruby related the favourable impressions he had obtained from his examination of automatic exchanges in America. In the first part of his Paper, Mr. Aitken also described the recent adoption of keyless ringing on the incoming junction boards of ordinary C.B. exchanges, and explained an arrangement for automatic clearing which the British Insulated & Helsby Cables, Ltd., have recently introduced for private branch exchanges too small to have a regular operator. (Page 293.)

We publish a brief description of a new A.-C. motor suitable for driving printing machinery and already largely used on the Continent. Speed regulation over a wide range is carried out by shifting the brushes. (Page 259.)

In a Paper read in Dublin, Mr. G. L. Drury discussed the construction and maintenance of the motor bogies of electric railway coaches, pointing out the most frequent causes of failure and commenting upon the effect of worn gears, extra weight, &c., on the current consumption. (Page 296.)

Mr. J. Faithfull Begg gave an address at a meeting of the London Chamber of Commerce last Thurs-

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day, objecting to the transfer of the telephone service to the Post Office, and endorsing Mr. Laws Webb's proposal to establish a Public Telephone Authority, representing all interests, popularly controlled, and free from political interference. (Page 296.)

Mr. R. W. Paul has recently designed an instrument known as the Ampall, for measuring direct currents up to any amount, and also conductivities of contacts, fuses, carbons, and materials generally. It comprises a millivoltmeter, contact block with potential points and adjustable straps, and a pair of plug flexibles. In addition a copper standard resistance of twenty microhms, and a pair of spikes are supplied for conductivity tests. A resistance coil, which will increase the range tenfold, is also provided. (Page 297.)

Some new electric portable tools are described in a short article. (Page 297.)

Among the specifications published by the Patent Office on Thursday last was one by C. H. Johnson and A. S. Johnson to prevent damage by water to telephonic apparatus on board ship.—A switch to open or close a circuit at predetermined speeds of a generator is described by S. L. Price.—An improvement in electro-magnetic relays is covered by the Adams Manufacturing Co., and another by E. B. Koopman and Pontelec Welding Patents, Ltd., relates to an improved construction in the secondaries of welding transformers.—A patent, dealing with a process to prevent the oxidation of tungsten powder, has been granted to C. H. Weber in spite of appeal, but no amendment has been allowed. (Page 298.)

A note supplementing the articles we have published with regard to the electrification of the L.B. & S.C. Railway, and the supply of energy to the line, appears on p. 299.

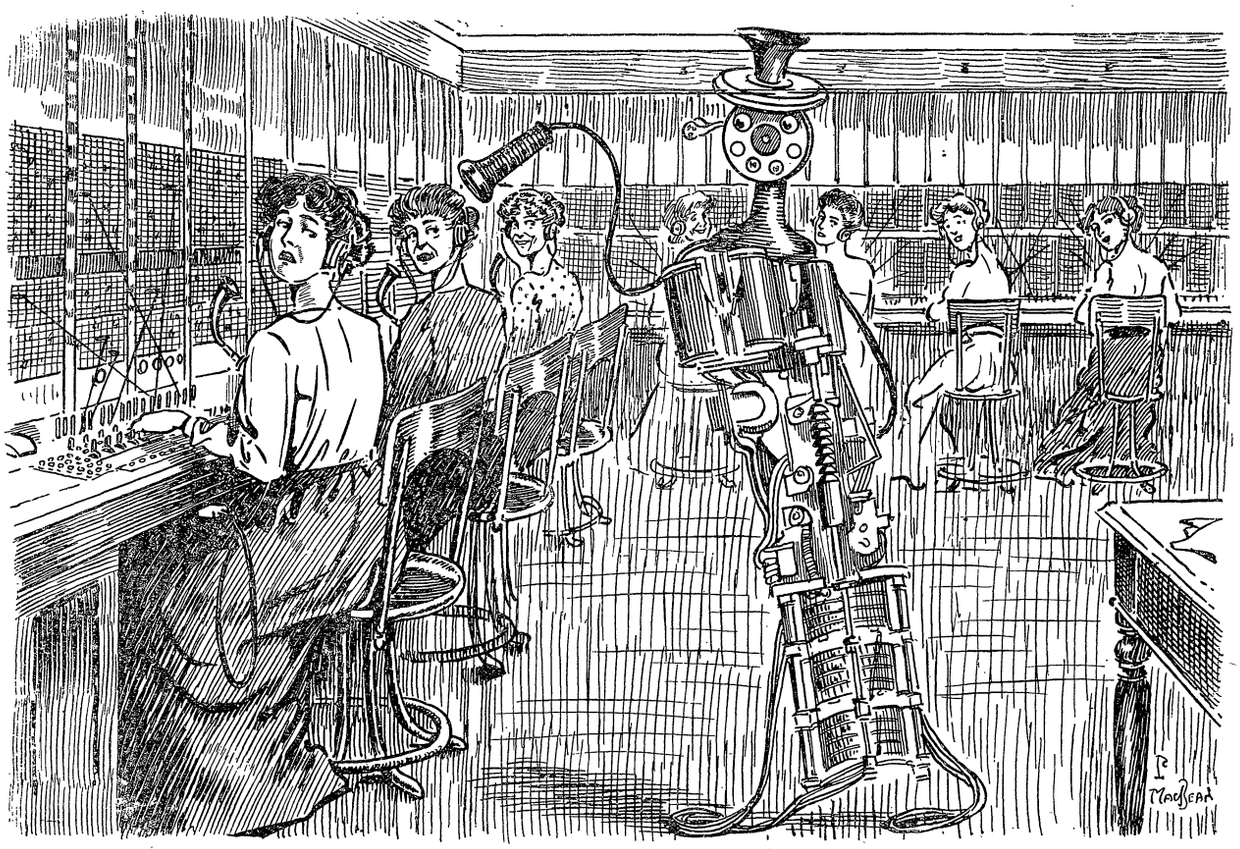
In his annual statement to Parliament, the Postmaster-General outlined a scheme for cheap telephones in farming districts, with five-party lines with a subscription for unlimited service of £3 per annum. (Page 299.)

Mr. A. J. New read a paper recently on the electric lighting of motor-cars, in which he advocated the use of automatically regulated dynamos to keep the accumulators charged. (Page 299.)

The Hastings Tramway Co. propose the promotion of a Bill authorising the abandonment of the Dolter surface-contact system.—The L.C.C. have revised their rules for meter testing.—The Marylebone Council have passed a resolution that the Sales Department must not undertake the wiring of buildings in course of erection without sanction from the Electricity Committee.—A London firm propose to convert the Glasgow subway to electric traction.—There is an estimated profit of £187,844 upon the L.C.C. tramways for the year 1911–12. In presenting their estimates, the Highways Committee comment upon the favourable conditions under which motor omnibuses are allowed to compete. (Page 300.)

Local Government Board inquiries regarding extensions to electricity works have been held as follows:—Derby, £8,500; Heckmondwike, £4,159; Mansfield, £4,000; Rotherham, £27,837. A loan of £5,000 has been granted for free wiring extensions at Beckenham. Electric lighting schemes are under consideration at Oulton Broad, Greetland, and Wood Green. Meters and cables are required at Devonport, and meters, time switches, &c., at Stepney. (Page 301.)

The recent successful patent action by the "Z" Electric Lamp Co. against the agents of the Bergmann Co., of Berlin, cost the latter 150,000 marks.—Messrs. Johnson & Phillips made a net profit of £24,117 last year.—New capital is being offered for subscription by the Torquay Tramways Co., and the Waste Heat and Electrical Generating Stations, Ltd. (Page 302.)



The incursion of the automatic telephone spectre into a London exchange is regarded with slightly contemptuous interest by the operators.

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THE EQUIPMENT OF AN UP-TO-DATE PRINTING WORKS

ELECTRICITY IN THE PRINTING OFFICE

By Frank Broadbent, M.I.E.E.

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PRINTERS were among the first to recognise the great advantages of electricity for lighting and power, and the sign "Electric Printers" adopted by one large London firm when they electrified their new works almost 15 years ago, has been copied by several other printing offices, from which it may be inferred that, in the eyes of the master-printer, electrification is the hall-mark of up-to-dateness.

But a printer does not electrify his works merely to be considered up to date. Like every other shrewd business man, he looks upon all money spent on improvements as an investment which should yield a satisfactory return. The return on the capital sunk in an electric installation is shown in various ways, such as economy in power costs, convenience of working, increased output, cleanliness, &c.

Economy.—The economy of electric driving is most marked in those cases where the machines were originally driven through long lengths of shafting and countershafting, and situated on several floors. Yet, strange as it may appear at first sight, this is one of the conditions under which it is difficult to demonstrate the economy by means of a small trial installation.

A case comes to mind of a printing office where the coal bill for steam driving was about £20 a week; and, in order to test the advantages of the electric drive, two flat bed machines taking about five horse-power each were electrically equipped, current being taken from a public supply. The result of this experiment showed no saving at all in the coal bill, and, as the electricity for the two motors had to be paid for, the cost of running was of course more than before. On the strength of this the owners decided that there was absolutely no economy to be gained by electrical driving, a conclusion which is, perhaps, quite understandable, but was, nevertheless, a wrong deduction. The fact that the removal of two machines out of about twenty made no appreciable effect on the coal consumption proves really that *the bulk of the power was being used to drive shafting and belting rather than to drive the printing machines themselves.* It has been shown by repeated tests that in a works of this character, where considerable amounts of shafting and belting are used, that more than half the total consumption of coal, gas, or other fuel used is run to waste. The works referred to have recently been fully electrified under the writer's supervision, with the result that instead of about £30 a week being spent for coal and gas, the cost of electricity is little more than half this figure; considerable savings have also been effected in labour owing to the shutting down of boilers and engines; and the general appearance of the offices has been improved out of all recognition by the elimination of shafting and belting.

Instances of this kind might easily be multiplied, and it is a simple matter for any printer to get a rough idea of his losses by running his works light for an hour (that is to say, without any printing machines at work), when he will be surprised at the cost of thus running his works idle. By multiplying this cost by the annual hours of running, it will be appreciated what a very large proportion of the total running cost this amounts to. It must be remembered that the dead loss on shafting, belting, engines, &c., is a practically constant loss, whether the machines are running or not, and, in a printing works, machines run very intermittently, and are shut down for considerable periods during making-ready, &c. The all-round losses are, therefore, much more than might be supposed from a comparison of indicator diagrams taken from the engine during working hours and meal times.

Convenience.—The convenience of electrical driving is almost, if not quite, as important as the economies which are effected in the cost of power. The facility with which machines can be started and stopped, and run singly or in groups, quite independently of other portions of the machinery, is an advantage which can only be fully realised by those who have actually adopted individual motor driving. This ability to run machines singly is not only a great convenience, but is a considerable factor in economy also, because there is no need to run a large engine and long lengths of shafting and belting for the sake of one or two machines, which have to be kept going after regular working hours. The cost of doing this is such that work which might be done *to-day* by running one or two machines a few hours' overtime, is oftentimes put off till *to-morrow* because of the necessity under ordinary conditions of running the bulk of the shafting in a works, and keeping a man to attend to the engine. The electric drive, therefore, permits of work being got out more expeditiously than is possible by any other means.

With electrical driving, too, there is no need to consider the position of shafting in fixing the machines. They can be placed in positions which are most convenient for getting through the work, and when new machinery is introduced the electrical system is so flexible that rearrangements of existing machinery are possible which would be difficult, if not quite impracticable, when one is tied down to a hard and fast system of driving by straight lines of shafting.

Another very great convenience is the ease with which the speed of a machine driven by electric motor can be varied to suit the class of work in hand. The nature of the forme, the quality of the paper, and other features, often make it desirable to run at a lower speed than usual, or make it possible to run at higher speeds; but when driven from overhead shafting in the ordinary way it is not possible to get a fine adjustment of speed, and it is generally the case that the machine is run somewhat below its possible speed.

With the most modern system of electric driving, a machine can be started and stopped by means of a push button, and any man who has once got accustomed to the perfect control which is given by such a system would consider it a hardship to have to revert to the old-fashioned method. In making-ready this is

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an immense advantage, as it permits of a fineness of adjustment which is quite impossible by the ordinary belt striker.

Increased Output.—The facility with which the speed of the electric motor may be varied, and the fine gradations of speed which it is possible to obtain, have a marked effect on the output of the presses. It has been found that the adoption of electrical driving has in some instances given an increase of upwards of 25 per cent. in the output of the machines. This is due to the higher average speed which it is possible to maintain with the electric motor, owing to the steady nature of the drive, also to the ability to run each machine at its best speed for the particular job in hand. The steadiness of the drive also has a marked effect on the class of work turned out, and it is recognised by those who have adopted electric driving that they can run their machines at faster speeds than was possible when driven from gas or steam power. This is largely due to the fact that with the latter system of driving the variation in speed, particularly when the machines are at a distance from the engine, and driven through several shafts, is such that accurate register cannot be maintained unless the machines are worked considerably below their maximum. When it is possible to bring up the speed, say, by 25, or 50 copies an hour, the change is so gradual as to be almost unnoticed by the layer-on, and he finds that he can keep better register at the higher and regular speeds than he could maintain formerly at the lower and variable speeds.

The increase in output due to the ease of control, and to the higher speeds at which electrically driven machines may be run, is often more important to the printer than is the actual economy in the cost of power; because it means that the ratio of standing charges to total costs of production is reduced as the output is increased.

Cleanliness.—Every printer knows what an amount of dust is collected on overhead shafts and belts, and what the effect of this is upon his work. With a complete system of electric driving there is an entire absence of overhead gear, and the troubles due to falling dust are completely eliminated. The absence of overhead belts has other advantages, namely, in giving an entirely clear space above the machine, and a continuous view from end to end of the offices, a point which overseers are not slow to appreciate. The improved light on the work due to the absence of shadows from belting and shafting, is also a feature which must not be overlooked. These various points, although small in themselves, mean a great deal in the aggregate, and without doubt tend to better supervision and improved quality of work.

Methods of Driving.—There are two general methods of electrically driving a printing office, namely, the individual system, in which each machine is driven by a separate motor, and the grouping system, in which small groups of machines are driven by one motor. In many cases a combination of both these systems is adopted, the printing machines and the larger of the warehouse machines being driven individually by motor, and the smaller machinery grouped and driven from short line shafts. Whilst no hard and fast line can be laid down, there is no doubt that in order to get the maximum advantage from electrical driving, that the printing machines, at any rate, should be driven individually. An exception might be made in the case of small machines, such as platens, but in some cases it pays to drive even these by separate motors.

Each case has, of course, to be considered on its merits, giving full consideration to the local conditions; the question of capital cost generally enters largely into the consideration of the general scheme, as there is a tendency to keep down the initial cost, even at the expense of increasing the running costs. In an entirely new works, where there is no existing shafting, it pays to drive quite small machines individually, machines, for example, such as stitching and sewing machines, and linotype machines. Take, for instance, the case of a group of sewing or stitching machines. With a small shaft accurately lined up so as to run with a minimum of friction, one horse-power would be sufficient to drive a group of, say, four to six machines. It will be found, however, that the actual power taken by the motor is almost constant, whether the stitchers are at work or not; that is to say, if an ammeter be placed in the circuit of the motor it will be difficult to detect any difference in power whether the machines are running light or stitching. We must agree then, seeing that the machines are run so intermittently, that the bulk of the power taken by such a motor is wasted. If we reckon the cost of a horse-power-year, that is to say, one h.p. running for 50 hours a week and 52 weeks a year, to be £10, we may be quite sure that from £5 to £7 of this is absorbed in running the small shafting idly. The cost can be minimised by switching off the motor when the whole group of machines are idle, but one cannot guarantee that this will be done. If we capitalise this it may be found more economical to put down a small motor to each stitcher, and in doing so, obtain the very great advantages which even in these small machines are gained by individual driving. It is only by considering each set of conditions in this way that one can decide what is the best and most economical method of driving any particular works.

As to the actual method of driving printing machines, belting and spur-gearing are the two chief alternatives, and chain driving is sometimes a convenient method. A few years ago the method of driving by means of spur-gearing was very popular, but there is a tendency nowadays to revert to belt-driving, it being considered that the elasticity given by a belt is better both for the motor and for the machine, and repairs are more quickly effected in the event of a breakdown. Machines such as the Miehle and Century, Furnival two-revolution presses and machines of this character, lend themselves to belt driving, the motor being conveniently fixed under the feeder board. Some other machines, however, such as Wharfedales and litho presses, are more conveniently driven by a spur gear from a motor bracketed to the frame. The driving shaft is fixed at the back of the machine, and to put the motor at the delivery end and drive by belt along the side of the machine takes up more space than can sometimes be spared, and partially blocks up the side of the machine.

Motors can, of course, be fixed on the ceiling, and drive down by belt to such machines, but this renders the motor somewhat inaccessible, a remark which applies also to tucking the motor inside the machine frame and driving by short belt and jockey pulley, as is sometimes done with machines of the Miehle class. This makes, no doubt, a very compact arrangement from the printer's point of view, but from the point of view of the engineer who has to look after the machinery it has its disadvantages, and it must not be overlooked that a machine which is difficult of access is not likely to get the attention of one which is more conveniently situated. Regular inspection and cleaning down is essential to electric motors if they are to run with a minimum of trouble, and it is highly desirable therefore that the motors should be placed where they can be easily inspected and attended to. In the case of some perfectors and most rotary machines, it is generally most convenient to place the motor in a pit below the machine, and drive direct by spur gear. The pit should be roomy so as to allow the engineer to get all round the motor, and a trap door should be

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provided outside the machine frame for convenient access to the pit.

Control.—The method of control may be by hand or by automatic switchgear, as best suits the local circumstances. When there is much "inching" and making-ready, an ordinary hand starting switch is quite unsuitable, unless the motor drives on to the fast and loose pulleys of the machine. This is an uneconomical method, as the motor is generally left running the whole time of making ready, although the machine may not run many revolutions during the day. The machine is struck on in the old way by means of the belt striker, and for "inching," the lever is seesawed to and fro, an operation which is very severe on the motor.

On the other hand, to start and stop the motor each time the machine is moved necessitates special switchgear, of which the most perfect is the automatic type, which is operated by means of push-buttons or a master-switch fixed near the layer-on's platform. This reduces the work of the operator to a minimum, and permits him to concentrate his attention on his proper work. The speed is fixed by the position of the regulator handle, which is set for the most suitable speed for the job in hand. A range of 20 to 30 speeds may be obtained, advancing in movements of say, 25 copies an hour. Automatic switchgear is more expensive than the ordinary kinds, and requires more skilful attention, but the ease of manipulation and time saved in operating the machines are important assets.

The driving of web rotary presses presents a special problem of its own. It is a simple matter to run a press when once it has been started and got up to speed, but it is in starting up slowly enough to permit of the web being threaded between the various rollers and then bringing it gradually to full speed without breaking the web that the difficulty arises. This, in large presses, cannot be accomplished satisfactorily with a single motor and simple starting switch. The starting torque (or turning effort necessary to start the machine from rest) is considerably more than that required to run the press when once it is started; and this starting torque varies very considerably with the temperature and other atmospheric conditions, and is very different, say, on a Monday morning after a cold week-end than it is after the machine has been running a few hours and got thoroughly warmed up to its work. If we attempt to start such a machine with a plain motor we find that it requires an excessive starting current, and then as soon as the machine has once got away the torque goes down and the machine may speed up so quickly as to break the web. If the paper were being led in there would be risk of accident under these conditions. For leading-in purposes it is essential to be able to start up dead slow and to run the press at, say, 5 per cent. of its normal running speed, and this leading-in speed must be quite constant with no tendency for the motor to run away. Various devices have been introduced to accomplish this. In some systems two motors are used, one for the slow speeds necessary for leading in, and a larger motor for bringing the press up to speed and printing. This small motor performs practically the same functions as the so-called "barring engine" used in cotton factories, steamships, &c., for slowly turning round the main engine. In other systems a bye-pass is used on the motor to divert a portion of the current when leading in the web. This has the effect of keeping the speed steady. Such systems are somewhat complicated and expensive, but the ease of control and the fine adjustment of speed which they give are factors which have a large monetary value, more particularly in newspaper work, where every second which can be gained in getting out an edition is of importance.

Electrotyping Work.—Considerable advances have recently been made in electrotyping, and it is possible that the method of nickel-plating the copper shell to produce a hard surface will before long be largely displaced by the process in which a nickel-steel deposit is put directly upon the wax mould. It is clear that whatever is put on the copper face after it leaves the mould, whilst it may harden the surface, cannot add to the sharpness, but rather the reverse. By reversing the process and depositing a nickel-steel film directly on the wax mould, and then backing this with a copper deposit, it is possible to get hardness and sharpness combined. The process has made more headway in America than in this country, and now that the difficulties inseparable from a new system have been satisfactorily overcome, there seems no reason to doubt that the process will become more popular over here in the near future.

For ordinary copper deposition the current density, as is well known, can be considerably increased by agitating the solution. Every plater has his own ideas as to the best methods of agitation, and whilst some stick to the mechanical stirrer, and others prefer to circulate the solution by means of a small pump, there is no doubt that the method which permits of the most rapid rate of deposition is aëration by means of an air compressor which delivers air under pressure to a series of perforated pipes laid gridiron fashion along the bottom of the plating vats. It will be remembered that this system of agitation was used in the Zedenburg zinc-lead accumulator, in which electrically deposited zinc was used as one pole.

The efficiency of low-voltage plating dynamos of the self-exciting type is astonishingly low, the voltage regulation being often obtained by means of a magnetic shunt which short-circuits a portion of the magnetic flux. Such a machine, giving $1\frac{1}{2}$ volts, and, say, 1,000 amperes, may take as much as seven horse-power to drive it, whereas a modern separately excited dynamo should give this output when absorbing about $2\frac{1}{2}$ horse-power. It is clear, therefore, that an old-fashioned plating dynamo may quite easily consume as much energy in a year or two as would pay for a new and efficient machine; or, put in another way, a modern separately excited dynamo would turn out two or three times as much as an old self-exciter for the same consumption of power.

Electric Lighting.—Before the advent of the metallic filament lamp it was difficult to light a printing office satisfactorily on lines of reasonable economy. One sixteen candle-power lamp over the feeder board and another over the delivery was the usual allowance for a flat-bed machine. When new, these lamps certainly lighted the top of the machine if placed fairly close down to the work, so low, in fact, that the light was on a level with the eyes of the layer-on, who generally stuck a piece of paper around the edge of the shade to screen the lamp from his eyes. The general lighting, however, left much to be desired. As enamelled iron shades are generally used, the upper portions of the room are in shadow, and present a most gloomy appearance when this method is adopted. Enclosed arc lamps, whilst very suitable for the warehouse floor, are not so suitable in the machine rooms unless supplemented by incandescents to break up the shadows and to give a localised light over the feeder-boards, so that the layer-on can see his register marks.

Reflected arc lighting was boomed a few years ago for printing offices, a method tried and abandoned in textile factories about twenty years ago. Its chief feature is that it is practically shadowless, and its advocates claimed that it was the nearest approach to ordinary daylight conditions. It is no doubt a very beautiful and uniform light, but the entire absence of shadow is not necessarily an advantage, nor does this characteristic simulate the conditions of natural lighting, which is very far from shadowless. As a matter of fact, to work in a shadowless light for any length of

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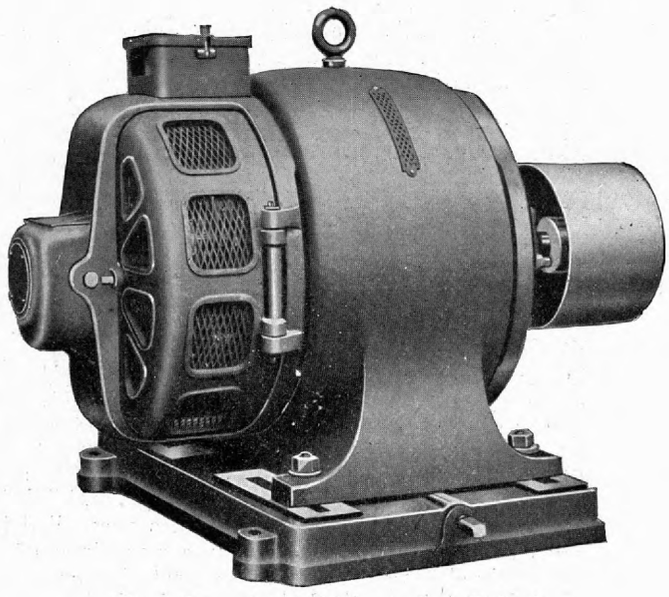
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time is very trying, as the eye can get no relief by turning to a shaded portion of the room, as is possible in daylight. The same remark applies to mercury vapour lighting, which has been tried in composing rooms with a certain amount of success. The peculiar tint of this light is said to be restful and to relieve eye-strain, but this must depend to some extent on the character of the lighting the eye has been accustomed to. Moreover, a certain amount of shadow is an advantage on the type cases.

Very good lighting effects can now be economically obtained, both in machine-rooms and in the warehouse, by means of a carefully thought-out scheme using metallic filament lamps, and the soft shadows produced are a distinct advantage both in the case-room and elsewhere.

Recently, very strenuous efforts have been made to popularise high-pressure inverted gas lighting for printing offices, and a few important offices have given it a trial. In one large office, equipped with electric power under the writer's supervision, an extensive installation of high-pressure gas has recently been put in. The engineers complain because of the constant attention necessary to the mantles, fittings, &c., and the writer has frequently seen the wire guards red hot within a few inches of stacks of paper, due to the fine jets of flame which issue, practically invisibly, through holes or cracks in the mantles. One of the first results was that the excessive heat melted the rollers on one of the web rotaries, and the men complained so much about the heat, that electric light had to be substituted in this department. Then the men in another department complained of this apparent favouritism, and practically insisted on electric light being installed in their room also, and others will, no doubt, follow suit.

THE NEW PRINTING WORKS OF RICHARD CLAY & SONS LTD. AT BRUNSWICK STREET, STAMFORD STREET, S.E.

IN addition to its interest as a fully-up-to-date printing works housed in a fully-up-to-date building, and taking every possible advantage of the latest available methods of electric driving and lighting, the large new works established by the well-known printing firm of Messrs. Richard Clay & Sons will, we hope, be also of some interest to our readers as the place where ELECTRICAL ENGINEERING is printed every week. The building is a fine example of a modern ferro-concrete structure, the lighting, heating, and fire-protection appliances also deserve admiration, and we do not think a better or more complete example of electrical driving of printing and allied machinery could be found.

The firm of Richard Clay & Sons was founded in 1827, and their London works has for many years been in Bread Street Hill, on the south side of Queen Victoria Street. For some time, however, the firm have felt that the works at Bread Street Hill, works employing some four hundred hands (where, up to a few weeks ago, ELECTRICAL ENGINEERING has always been printed), were inadequate to the needs of their growing business, and the decision was come to recently to establish an entirely new works on the south side of the river, the present magnificent establishment being the result.

Messrs. Clay & Sons have also a large works at Bungay, Suffolk, employing some three hundred hands, which was purchased in 1878 from the famous firm of Childs & Son, and was founded by the late Mr. John Childs in the early part of the last century.

The move to the new premises, which involved the transfer of a large amount of heavy machinery and the adaptation of much of it to electrical driving as it was put down in its new home, is now practically complete, and has been carried out with remarkable expedition and without any interruption in the ordinary course of business.

Some idea of the size and the imposing nature of the building itself is obtained in Fig. 1, but the narrowness of the street has prevented the photograph doing it full justice. As we have already said, the structure is entirely of ferro-concrete, and the architectural features of the exterior show how pleasing an effect can be obtained in skilled hands by the development of a style strictly suitable to the material and system of construction.

The architect was Mr. G. F. Collinson, F.R.I.B.A., and Mr. Alexander Drew, M.Inst.C.E., acted as consulting engineer for the ferro-concrete construction, and supervised its erection. The main contractors for the building were Messrs. N. Coles & Co., of Plymouth. Messrs. D. G. Somerville & Co. were the sub-contractors for the ferro-concrete. The latter was designed by the Trussed Concrete Steel Co., Ltd., Caxton House, and is on the well-known Kahn system. Approximately 500 tons of steel bars were employed on the

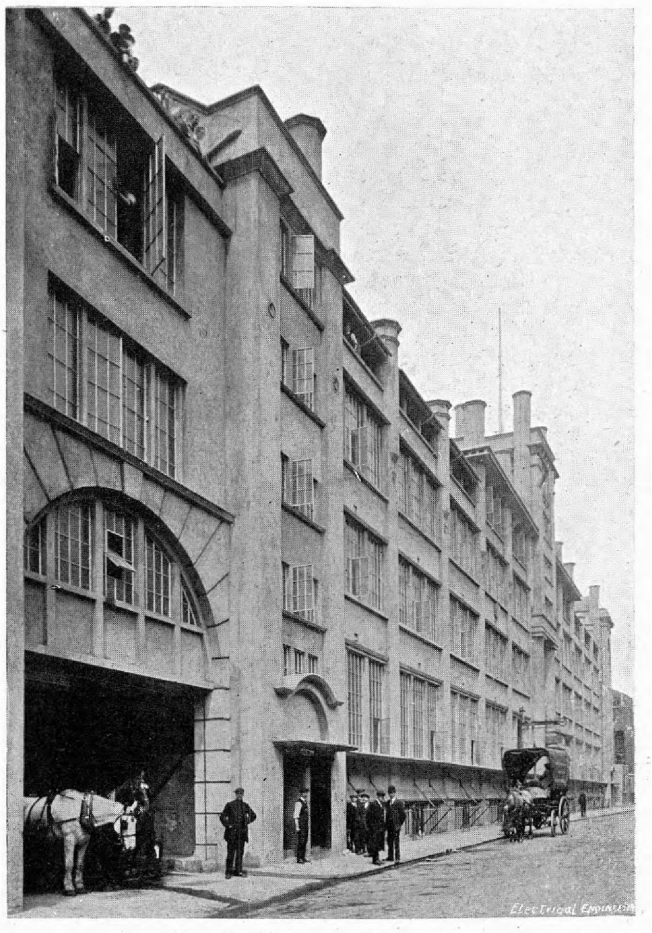


FIG. 1.—FRONT OF BUILDING.

building; 1,050 tons of cement, 2,300 tons of sand, and 5,000 tons of Thames ballast.

The total length of frontage is about 260 ft., and the depth at side at the north end is 96 ft. and at the south end 41 ft. There are, including the basement, four floors all on the same general plan, of which an idea can be obtained from Fig. 2, with rows of bays,

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each about 20 by 26 ft., divided by pillars, and a wedge-shape central space partly used for lifts, offices, &c., near the north end. There are, generally speaking, no main partitions; the main machine-room, for example, is one large shop 250 ft. long, occupying the whole of the ground floor. The London County Council building regulations usually impose limitations in the size of the rooms in such establishments, but in the present case, owing to the completeness of the precautions taken to render the building fireproof, these requirements were modified. The basement is used principally for stores, but a rotary machine-room is also included; the main machine-room, as already stated, occupies the ground floor; the first floor contains what is known as the warehouse, with machines for folding, stitching, cutting, wrappering, &c., and also a considerable number of presses of smaller size than those on the floor below. On the second floor we find the spacious composing room, the linotype machines, the foundry and electrotyping departments, and the general offices.

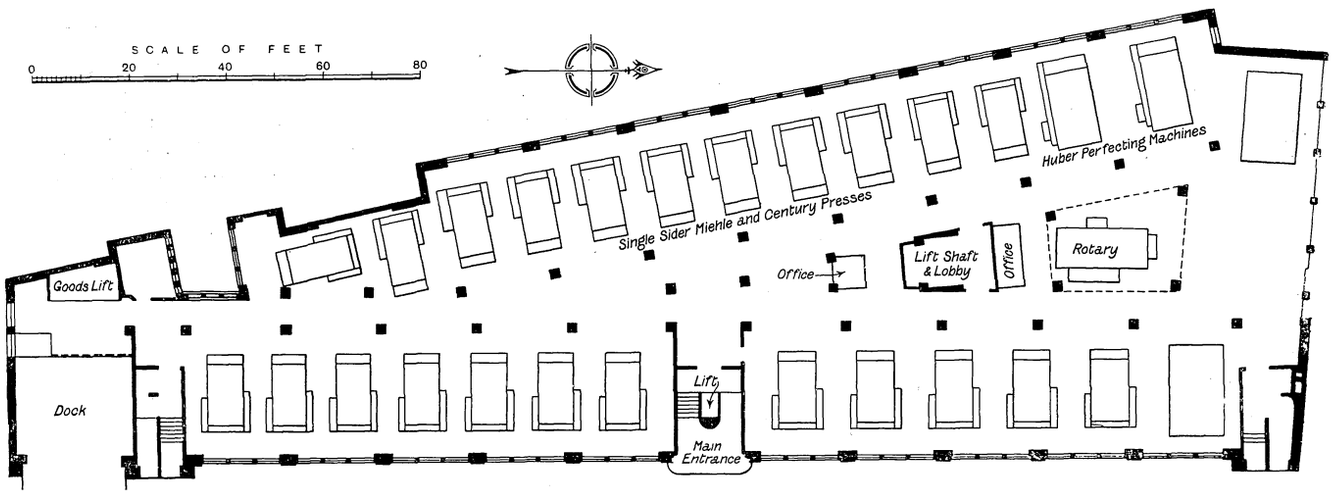


FIG. 2.—SKETCH PLAN OF MAIN MACHINE ROOM.

The sprinkler installation, on the Grinnell system, was installed by Messrs. Mather & Platt, of Manchester. No fewer than 1,100 sprinkler leads are placed at various points in the building. The total length of feed piping, which varies in diameter from $\frac{3}{4}$ in. to 6 in., is about two miles. There are three sources of water supply, viz., a 6-in. connection from the high pressure main of the Metropolitan Water Board, giving over 40 lbs. per sq. in., a 6-in. connection from the low pressure main, and a reserve supply from a tank on the roof, in which an air-pressure of 90 lb. per square inch is maintained by electrically driven pumps. As soon as the action of one or more sprinklers causes a leakage of water from the system, an Ellington ejector, actuated by a jet of water at a pressure of 700 lbs. per square inch from the mains of the London Hydraulic Power Co., comes into action automatically, and maintains the pressure and supply of water, being capable of forcing large quantities of water into the system. This part of the plant was supplied by the Hydraulic Engineering Co., of Chester. The control valve which starts the ejector also starts an alarm gong on the front of the building. Messrs. Mather & Platt also supplied the automatic fireproof sliding doors all over the building. These are of wood, entirely covered with tinned sheet iron. In addition to the sprinkler system, there are hydrants with hoses ready for coupling up, and fire buckets on every floor, and over each wire-glass window at the back of the premises (which face another large works only a few feet away) are automatic external drenchers, fed by a 4-in. direct and separate supply from the high pressure main. Special fire brigade hose connections are arranged, so that the fire engines can pump direct into these drenchers. With a view to preventing risk of frost, the drencher system is arranged on what is called the "dry pipe," or "air" system. A differential air valve is fixed upon the supply pipe, and the piping to the drenchers from this valve are charged with air at low pressure. The differential air valve keeps back the water supply, and in the event of the drenchers being exposed to heat, from a fire in the adjoining premises, the drenchers affected by the heat would open in the same manner as automatic sprinklers open. The air pressure is released from the pipes, and water flows to the particular drenchers which have opened.

A few words may also be said here on the heating and ventilating arrangements before passing on to the printing and electrical equipment. This part of the work was done by Messrs. C. Kite & Co. (132 Euston Road, N.W.) to the designs of their engineer, Mr. M. H. Skelt, M.I.H.V.E.

The installation is capable of delivering into the building 50,000 cubic feet of filtered, cold or warmed, fresh air per minute, and maintaining the temperature at 65° F. during the coldest of weather. The heater, air washer or filter, and an arrangement for moistening the air are placed centrally on the first floor at the base of the light-well; fresh air is drawn from the light-well through the filter and heater by means of two pairs of electric fans, one above and the other under the heater, supplying the top floors and the two lower floors respectively. The air is distributed about the building through galvanised steel shafting having outlets at suitable points fitted with valves. The supply of fresh cold filtered air is controlled by means of louvre valves at the back of the filter, and return air flues are arranged to permit of the air from each floor being re-used if desired. The supply of air to each floor and the temperature can be regulated separately, and the apparatus can be used for one or more outlets, or the whole of any floor; by-pass valves are arranged on each side of the heater to allow of the passage, if necessary, of cold air to the fan chambers for mixing with the heated air or modifying the temperature. The boiler is placed in the basement at the north end of the building, and consists of a new type of cast-iron sectional independent boiler made up of fifty-six sections, fitted together with push nipples and bolts; it has four fires, either of which can be used separately or the whole together, as required. Steam at from 7 to 10 lbs. pressure is conveyed by a line of pipes from the boiler to the heater, and the water of condensation returned automatically to the boiler. Coke is used for fuel.

The lifts are entirely electrical and were put in by the firm of J. Stannah (Skin Market Place, Bankside, S.E.). There are at present three goods lifts and one passenger lift. Two of the goods lifts, as shown in Fig. 2, are in the triangular central space, and the other is at the extreme south end of the building, where space is also left for a fourth lift should this be required in the future. The passenger lift is near the centre of the building by the main doorway and staircase to the offices.

All the lifts are constructed entirely without wood, except for a little hardwood in the cabin of the passenger lift. The cages are of steel, with steel chequer plate floors, and steel guides are used. The entrances to the two north goods lifts are on every floor in a sort of lobby, which can be closed on both sides by sliding fireproof doors completely isolating the lifts. There are also steel roller shutters immediately in front of the actual lift gates, which close automatically in case of fire. Sliding collapsible gates are used to the lifts themselves, and these are interlocked with the control circuit, so that the lift cannot be started unless all the gates are closed, and *vice versâ* no gate can be opened unless the car is at rest opposite it. The control is by a car switch. The passenger lift from the main entrance to the

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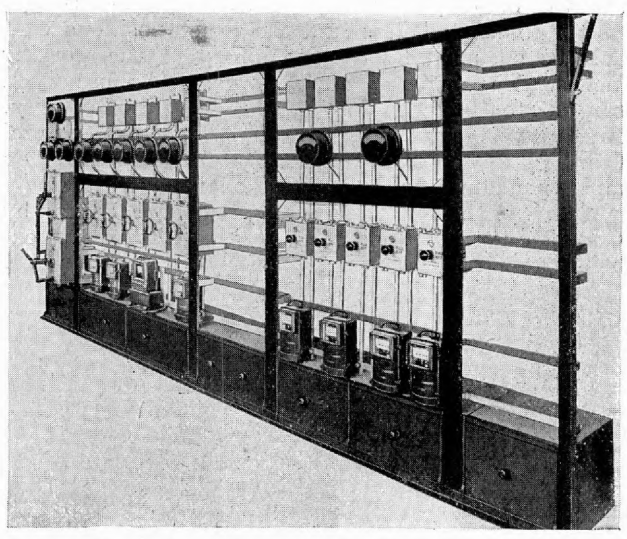
general offices on the top floor is provided with push-button control. Anyone entering the lift can, by pressing a conspicuous push-button, travel to the office entrance, but additional pushes are also supplied by which authorised members of the staff can stop the car at any floor.

Considering the equipment of the building more in detail, and particularly with the electrical features in view, we will draw attention first to the intake or meter room in the basement, whence the electrical supply is distributed. Current is supplied at a special flat rate for both power and lighting by the City of London Electric Lighting Co., Ltd., and a duplicate supply is given over separate feeders connected respectively to the two independent halves into which the Company's Bankside station is divided. Each service affords a three-wire continuous-current supply with 430 volts across the outers. The service cables entering the building are 0·5 sq. in. for the outer and 0·25 sq. in. for the middle wire. Each service has its own main fuses and meters.

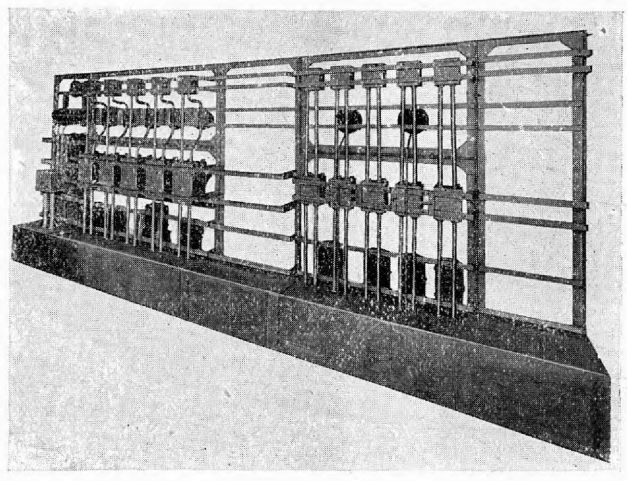
The main contractors for the whole of the electric power equipment were Electromotors, Ltd. (Openshaw, Manchester), who carried out the scheme to the specifications of Mr. Frank Broadbent, M.I.E.E., consulting electrical engineer.

Two independent main switchboards, facing each other on either side of the room, are provided, one for the northern and one for the southern section of the building, and a pair of main D.P. switches is provided on each, so that either supply can be connected to the bus-bars. The switches are so interlocked that it is impossible to put both supplies on at once. Fig. 3 is a view of one of the two boards. They consist of iron frames, on which are mounted the necessary switches, junction boxes, &c. They were manufactured by Messrs. Berry, Skinner & Co. (78 Upper Thames Street, E.C.), and the switches are of their push-in enclosed pattern with fuses inside the cases. The boards were erected by Messrs. Pinching & Walton (52 Cannon Street), who contracted for the whole of the erection of both the power and lighting circuits. The bus-bars run along the bottom of each board in closed chambers, to which access may be had by sliding doors. The end of each board nearest the main switch is occupied by the power panels, connected to the outers only. Each circuit is provided with a Chamberlain and Hookham meter, and generally represents the north or south half of a department, so that each department has its own meter on both boards. There are five of these power circuits on each board, all nominally for 100 amperes. An ammeter is provided on each above the circuit switch, and above this is a connection-box filled up solid with compound, from which run the cables to the power distribution boards; all the conductors on the board itself are enclosed in iron pipes. There is space for further power panels, and beyond this on each board is a group of five lighting panels, arranged alternately on each side of the three-wire system. Two ammeters are provided for the lighting circuit on each board, one on each side of the system, and the total capacity of the lighting circuits on each board is about 150 amperes.

The feeders from the main boards to the various power distribution boards about the works are all 19/14 paper-insulated, lead-covered, steel-sheathed braided cables, and are supported on special racks usually near the ceiling. There are power-distribution boards on each floor. These are of a special pattern, designed by Mr. F. Broadbent and made by Messrs. Spagnoletti, Ltd., as sub-contractors to Electromotors, Ltd. They have cast-iron cases, with sheet steel panels in the doors. Porcelain handle switch fuses of Messrs. Spagnoletti's cartridge type are used, mounted on slate bases and placed horizontally in vertical rows for each pole behind separate doors. The hinge side of each door is in the centre of the case, and an ingenious arrangement of straps prevents both doors being open at once. Below each box is an enclosed double-pole switch, also of Messrs. Spagnoletti's make. There is also a sealing chamber below each board, into which the paper cables from the main board are brought. A very convenient arrangement is provided for reading the current in any sub-circuit at any time. Each fuse has mounted under it, behind the slate panel, an ammeter shunt, and a multiple contact switch below the case enables an edge-wise



Front view.



Back view.

FIG. 3.—ONE OF THE TWO MAIN SWITCHBOARDS.

pattern ammeter mounted above the distribution board to be connected to any one sub-circuit. It is thus possible to ascertain the power any particular machine is taking. As a general rule, the sub-circuits are limited to 25 amperes. The arrangement of boards is practically the same on every floor.

Messrs. Pinching & Walton were the main contractors for the whole of the lighting installation, in addition to acting as sub-contractors to Electromotors, Ltd., for the erection of the power circuits. The wiring of the lighting circuits, including the leads from the main board in the basement, with the various distribution boards, is throughout in solid drawn screwed conduit with special joint boxes of Messrs. Pinching & Walton's own manufacture. The lighting distribution boards were supplied by Messrs. Spagnoletti, Ltd., and are in wood cases with glass fronts. The upper part contains fuses of the ordinary bridge type arranged horizontally, and in the lower part, accessible by a separate door, are the

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switches, all of the tumbler type. The switches to each circuit are on the live side of the fuses, so that the fuse contacts can be made dead for renewal of the fuses.

A few particulars of the lighting arrangements may be given before proceeding to the consideration of the various parts of the works in detail. An important consideration in the scheming of the system to be employed was the provision for obtaining light at practically any point where it is required, as naturally while the building was in progress it was not always possible to know beforehand the exact positions that would be occupied by the machinery or the working benches. The scheme adopted has therefore been arranged to provide for a considerable flexibility. Roughly speaking, the lighting is divided into general lighting by means of 100 c.p. metal filament lamps on simple pendants, with 15-inch opal shades, within about 2 ft. of the roof in each bay, and local lighting by 50 or 32 c.p. metal filament lamps on travelling extensible pendants, designed specially for the purpose,

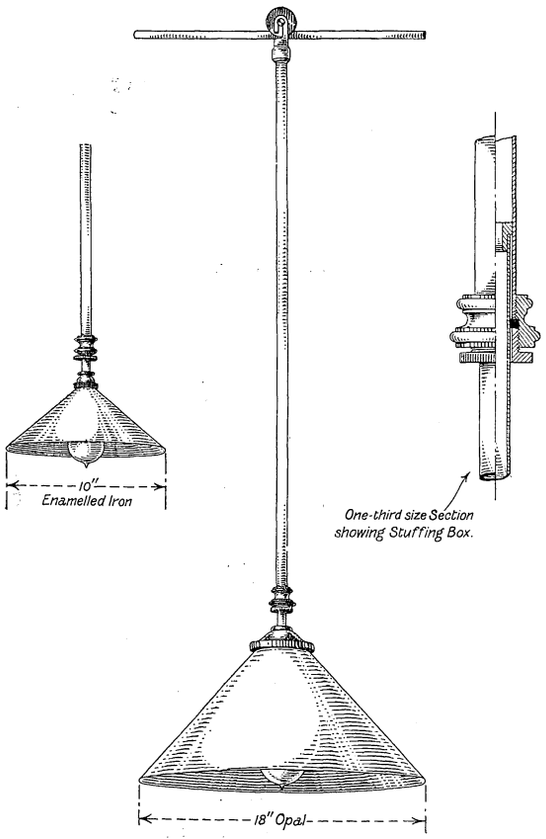


FIG. 4.—TRAVELLING EXTENSIBLE PENDANT.

some with opal and some with enamelled iron shades. Details of these pendants are shown in Fig. 4. Not only are they hung from trolleys running on the actual conduit tubes, which are specially mounted clear of the beams, but as they are telescopic, a vertical as well as a horizontal adjustment of the position of the light is obtained. The leads are brought in by flexible wires from ceiling roses at convenient points in the run of conduit. The 100 c.p. lamps are in some cases also on travelling pendants, but they are quite short, and are not telescopic, nor have as much range of horizontal movement as those for the local lighting. The different nature of the operations in different parts of the works causes variations in the proportion of the general and local lighting required; thus in the warehouse there is little else than general lighting by the 100 c.p. lamps referred to, while in the composing room several travelling pendants are provided in each bay. The wiring is simply and systematically arranged; tubes are run along the beams in every bay in an east and west direction, special connection boxes are used at every junction, and the wiring is entirely without looping in. There are two bays to every circuit from the distribution board, and the switches as a general rule are mounted in groups in iron switchboxes placed on the pillars. We noticed that most of the 100 c.p. lamps were of the "Z" type, but that Tantalum lamps were largely employed on the travelling pendants, work for which the robustness of their filaments renders them particularly suitable. The lighting in practically the whole works is on the system just outlined. Special arrangements here and there will be noticed as we deal with each department in detail.

Returning now to the basement, we find the greater part devoted to stores of various descriptions, and a complete system of runways are provided in connection with the paper stores. The bales of paper are lifted direct from the carts, which back into a sort of dock on the road level, by hand-hoisting tackle, carried on similar runways on the ground floor, and are lowered to the basement, where they are taken up by the trolleys of the basement runway system, carried along the main line running along the centre of the building, and switched on to the branch serving any particular bay. The runways were provided by Messrs. Herbert Morris & Bastert.

The most important feature of the basement stores is the extensive series of steel racks for stereos, blocks, type, &c.

They are constructed with steel lattice uprights, cross-bars or steel rods, and sheet steel shelves folded over the front rods to avoid sharp edges. They were supplied by Messrs. Farrow & Jackson, Ltd. (16 Great Tower Street, E.C.). The six main stereo double racks are each 16 ft. 6 in. long, 2 ft. 4 in. deep, and 10 ft. in height. There are 15 rows of openings, and a total of 1,050 openings. There are also small racks, aggregating 1,239 openings. The four double racks for blocks are 17 ft. long by 10 ft. high, with 336 openings.

One room in the basement has been set apart as a rotary machine room, and will contain two art rotaries for special work, and two web rotaries. These machines are not yet in place, and at the time of our visit the room was being used as a carpenters' shop for the manufacture of racks, compositors' frames, &c. These rotary machines, which are being moved from elsewhere, will be driven on the Holmes-Clatworthy system (see ELECTRICAL ENGINEERING, Vol. V., page 981), and are equipped with 200 volt motors, so a special middle wire will be brought into this room. The hydraulic apparatus mentioned already in connection with the sprinkler system is placed in a corner of this room. Another department at present housed in the basement is the overlay department, where advantage is taken of the latest methods of "mechanical" overlay making by the bichromate process, but considerations of space prevent a full description of this interesting and important work.

To the lay visitor probably the main machine room occupying the whole of the ground floor without partition is the most striking part of the establishment. A ground plan has already been given in Fig. 2., but slight modifications have been made in the arrangement of machines, &c., since this was drawn. A good idea of the appearance of the imposing rows of machines is obtained from the general view in Fig. 5. Every machine is driven by its own motor, and in the case of machines moved from the old works, where they were steam driven, such slight alterations as were required for electric driving were made at the time the machines were erected. There is no shafting whatever, and every machine is driven by a continuous-current motor by a belt of moderate length, and every motor has its base bolted right up to a substantial bracket carried on the frame of the machine. Although at first sight the motors appear to be fixed to the floor, neither they nor the machines are bolted down at all,

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but simply form a self-contained mass standing on the floor, and capable of being moved with comparative ease. In most cases slide bases have been employed for

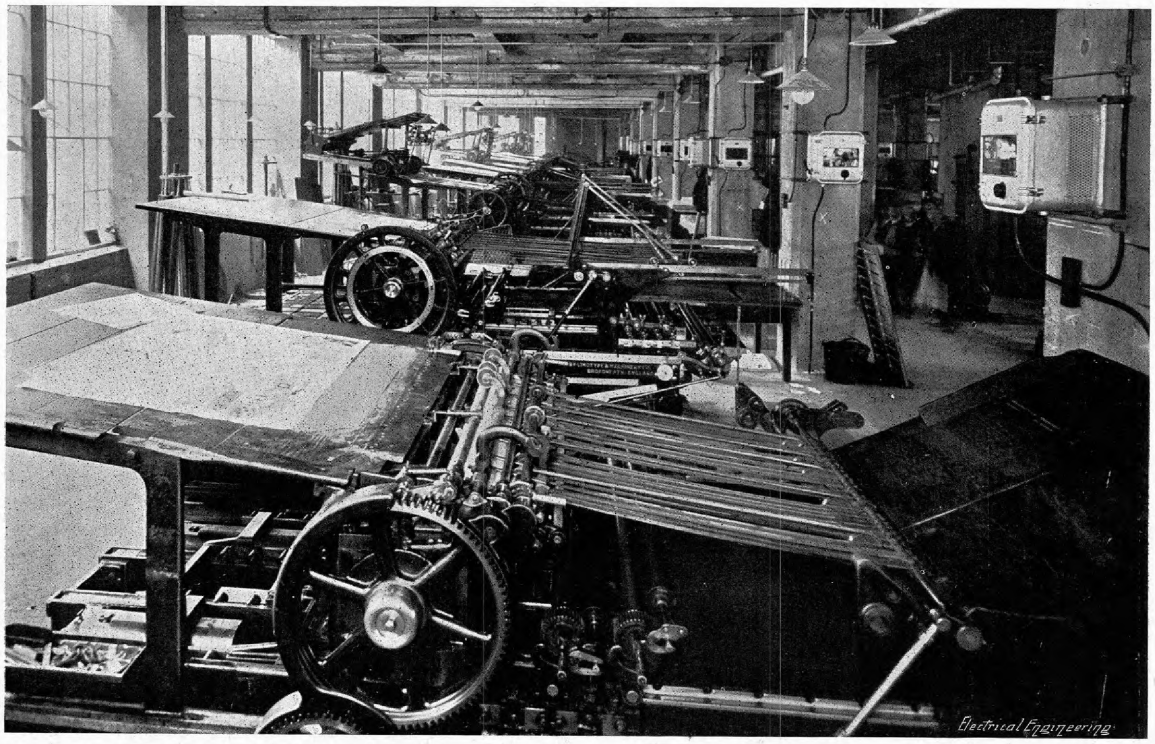
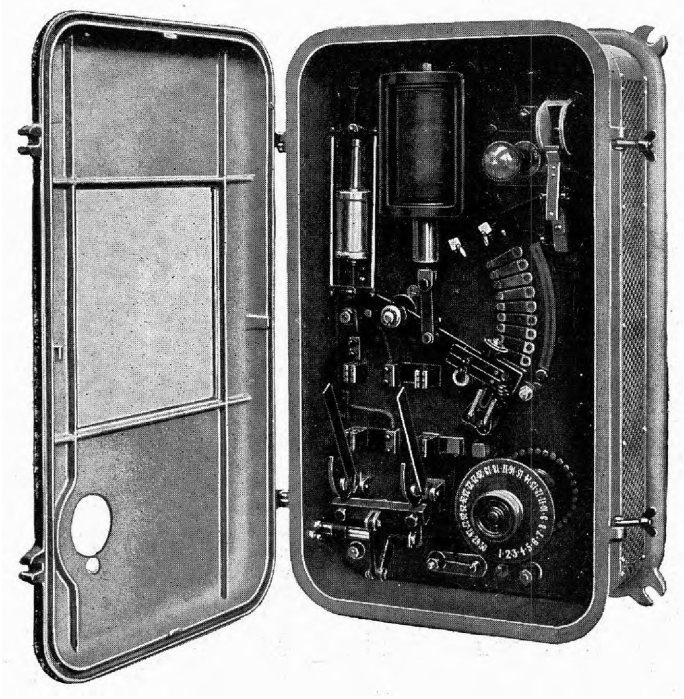
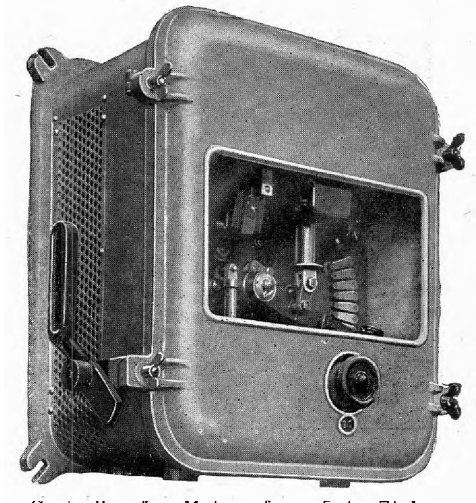


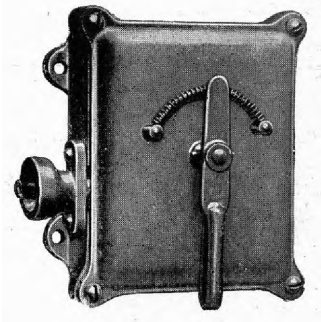
FIG. 5.—GENERAL VIEW OF WESTERN PORTION OF MAIN MACHINE ROOM, SHOWING CENTURY AND MIEHLE MACHINES, AND CONTROLLERS ATTACHED TO PILLARS.



Solenoid Controller for Motors from 10 to 20 h.p.



Controller for Motors from 5 to 7½ h.p.



Master Control Switch Box Mounted on Machine.

FIG. 6.—CONTROLLING APPARATUS FOR LARGE PRESSES.

employed throughout the room, reckoned to give 5 h.p. continuously, with a peak load rising to 7½ h.p. once in each cycle of operation, and occurring as each copy is printed, or, in most of the machines, about 1,200 times per hour. The motors all over the works were manufactured by Electromotors, Ltd. (Openshaw, Manchester), who, as already stated, were the main

the motors, but in some of the machines where the position of the motors for convenience in bolting up necessitated very short belts, jockey pulleys have been adopted. As far as possible a standard size of motor is

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contractors for the electrical power equipment. The motors driving these presses run at the moderate speed of 600 to 900 r.p.m., and are compound wound with commutating poles. They are of the enclosed ventilated pattern, with expanded metal covers, and are provided with special terminal boxes containing six terminals for the armature, shunt field, and series field respectively. The excellent provision is made of a diagram of connections on the inside of the lid. This standardisation of size enables a spare motor to be put down in case of necessity with the minimum of trouble. A few of the machines, however, require larger motors, such as the large "Marinoni" all-size rotary machine, which prints sheets 48 in. by 35 in., driven by a 12 h.p. motor, and the new Huber perfecting machines, referred to in greater detail below, which employ motors rated at 12 h.p. continuously, and a peak up to 20 h.p.

Current is taken from the power distribution boards to the motor controllers by twin, rubber insulated, galvanised wire-armoured cables. The leads to the actual controllers themselves are brought up through the floor right into a cast-iron box on the floor, from which iron pipes carry the wires to the motors with a short length of flexible metallic tubing leading to the terminal box on the motor frame to allow for movement on the slide rails.

The method of controlling the motors is a special feature of the installation, and is on a system devised by Mr. F. Broadbent. The machine-minder has a small box with a little lever fixed ready to his hand, and starts the motor simply by pressing the button, when it automatically gathers speed. To stop he turns the little lever aside. For inching round during cleaning or making-ready he keeps his thumb on the starting button and stops and restarts by deflecting and releasing the lever with his finger. In addition to this, push-buttons are placed at various parts of the machine, by which it can be stopped in case of emergency, but it can only be started from the one point. The controllers themselves, which are fixed on the pillars, were manufactured by the Adams Manufacturing Co., Ltd. (106 New Bond Street, W.). Some are seen in place in Fig. 5, and more detailed representations are given in Fig. 6, where two sizes of controller and a control box are illustrated. One of the control boxes can also be made out in Fig. 7.

Each controller consists essentially of a lever type starter, actuated by a solenoid in conjunction with a dash-pot, and interlocked with an electro-magnetically operated circuit-breaker, with powerful magnetic blow-out. A hand-operated shunt speed control switch is also contained in the same case, as well as a main D.P. knife-switch worked by a handle outside the case. The case at the back, where the resistance is installed, is provided with a perforated sheet covering for ventilation purposes. It may, however, be noted that the perforation does not extend over the top of the case, which protects the interior from dust and dirt which may fall on the top. The general principle of the action is as follows:—When the machines are standing, the main circuit is broken by the circuit-breaker, but the starter arm is in its lowest or running position with all resistance cut out. When the starting button on the machine is closed, the solenoid is energised and draws up the starter arm, the circuit-breaker still remaining open. It is only when the starter arm reaches the top position with all resistance in that the control contacts of the circuit-breaker magnet become closed. The circuit is then made, and the motor starts up with all resistance in. The starting button being then released, the solenoid no longer holds up the starter arm, and it descends slowly as permitted by the dash-pot, cutting out the starting resistance in the ordinary way. The stopping lever simply trips the circuit-breaker, leaving all ready to start again. Should the machine minder keep his thumb on the button, the solenoid holds the arm up in the position with all resistance in, so that the motor runs dead slow, and can be started and stopped for inching round simply by opening and closing the circuit-breaker by the small lever. The speed regulator has from 20 to 30 steps, according to the requirements of the particular machine, and gives speeds corresponding from 800 to 1,200, or 1,000 to 1,500 impressions per hour.

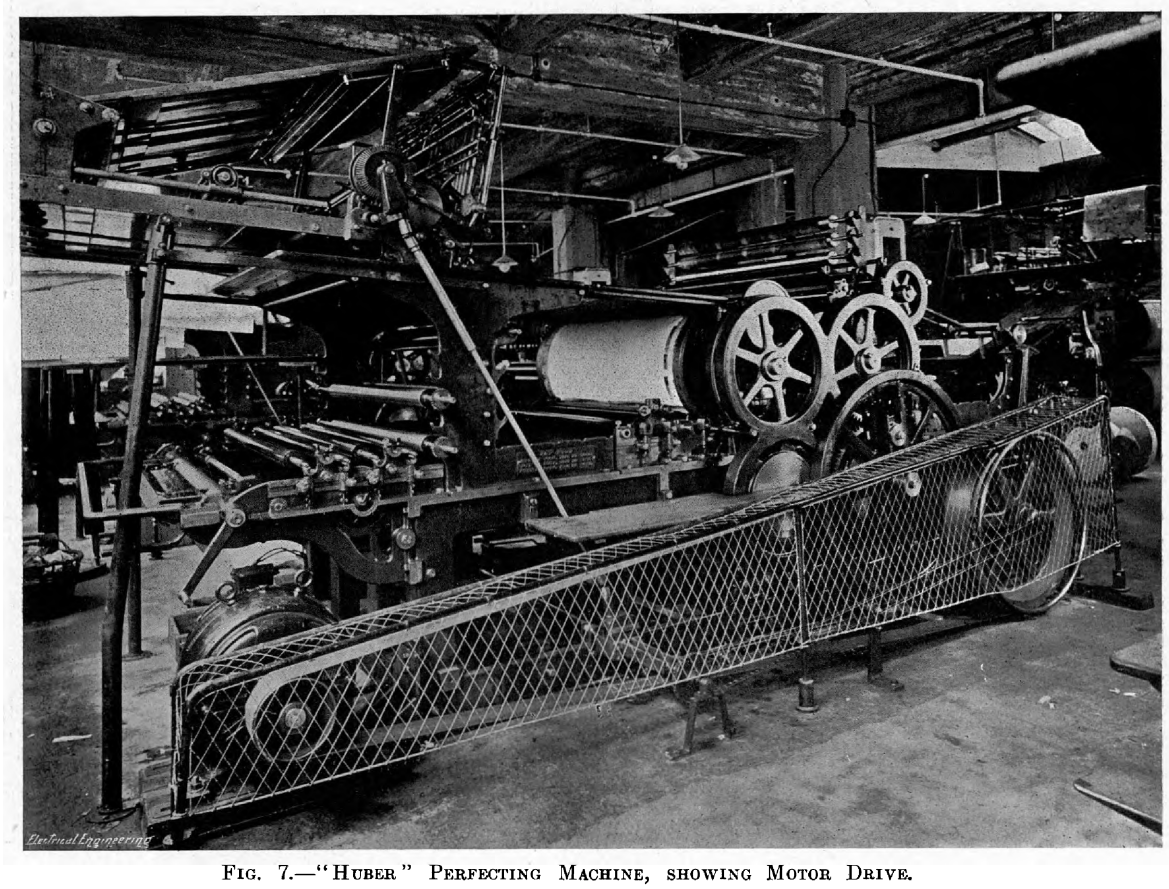


FIG. 7.—"HUBER" PERFECTING MACHINE, SHOWING MOTOR DRIVE.

Taking the printing machines themselves more in detail, we find on this floor only one rotary machine, the Marinoni machine already mentioned. The others are all flat bed machines of various patterns, some new, and some removed from the old works. Particular attention should be called to the two Huber perfecting machines at the north end, one of which is illustrated in Fig. 7. Three of these machines are now in place.

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These were supplied by the P. Lawrence Printing Machinery Co. (57 Shoe Lane, E.C.), and are of American manufacture, embodying to a high degree the perfection of detail attained by the methods of manufacture principally developed in the United States. These are in no way a cheap class of machine, in fact we are informed that the prices are actually higher than those of similar machinery made in this country. Machines of the same design are in use in larger numbers by many other large British printing firms. Messrs. Richard Clay & Sons themselves have also six machines of this pattern at their Bungay works. Machines known as perfecting machines, as is well known, print both sides of a sheet at one operation by means of two cylinders, and the chief difficulties which confronted the early designers were inaccuracy of register of the two sides, and the offsetting of the ink from the side first printed on to the second roller, with consequent spoiling of the work during its passage over the second cylinder. In the Huber perfecting machine, extremely accurate register is obtained owing to the fact that the sheet is positively held during the whole of its travel, and is not released by the first cylinder until it is secured by the second; thus for $\frac{3}{4}$ in. of its travel it is held by both cylinders. Another point is the specially arranged eccentric link drive, which slows down the cylinder speed just at the moment of transfer. The offsetting arrangements with a special arrangement of plush covered rollers, which clean the second cylinder at every revolution by means of a continuously-fed special solution, are particularly effective in avoiding the second difficulty mentioned above. The ample rolling surface of the ink rollers and the reciprocating drive of the bed by a horizontal crank are also special features of the machines. The highest class of illustrated work can be done on these machines, and their capacity is 1,300 impressions per hour with sheets of 60 in. by 40 in. These machines are fitted with automatic feed apparatus by the Cross Feed Paper Co.

A very large proportion of the long lines of other presses on this floor, all of which are "two revolution" or "single-side" machines, were supplied by the Linotype and Machinery Co. (188–9 Fleet Street, E.C.). Among those already in place we counted on the west side six of their 60 in. by 40 in. Miehle machines and two Century machines, while on the east side there were four Miehles and three Centuries. Three of the Miehle machines, which are manufactured throughout by the Linotype Co., are new. We understand that Messrs. Clay & Sons installed their first machine of this type in 1901, and that including the London and Bungay works they have now no less than eighteen. As we shall see later, the Linotype Co. have also some smaller presses of their Centurette type on another floor. A group of Miehle machines is shown in Fig. 8, in which the arrangement of the motors and control apparatus, as well as one of the power distribution boards, can also be seen.

The Miehle machine is chiefly interesting on account of the method of driving the bed. The driving pinion is so arranged that the type bed is out of gear with the other parts of the machine during reverse, but in gear while printing, so that all shock on the gearing at the time of reversal of the travel of the bed and jar to the machine generally is avoided. Another point is the easy accessibility of all parts of the machine during making-ready, whereby great saving of time and trouble is effected. The clamping devices for the overlays are particularly strong and quick to adjust. Attention should also be drawn to the provision of the ink supply at any point while running by a series of thumbscrews at the end of the machine, by which slight irregularities in the rollers can be compensated for. The method of delivery which deposits the sheets printed side uppermost is also a special feature, and an alternative fly delivery is fitted, to which the change can easily be made if it is desired to deliver the sheets the other way up.

A view of one of the Century presses also supplied by the Linotype Co. is seen, as well as a Miehle machine, in Fig. 9, which is reproduced from a flashlight photograph taken while the pages of last week's ELECTRICAL ENGINEERING were being machined on these two presses. We understand that further plant yet to be installed on this floor includes three stop-cylinder presses supplied by Messrs. R. Hoe and Co., and two machines of the Wharfedale type.

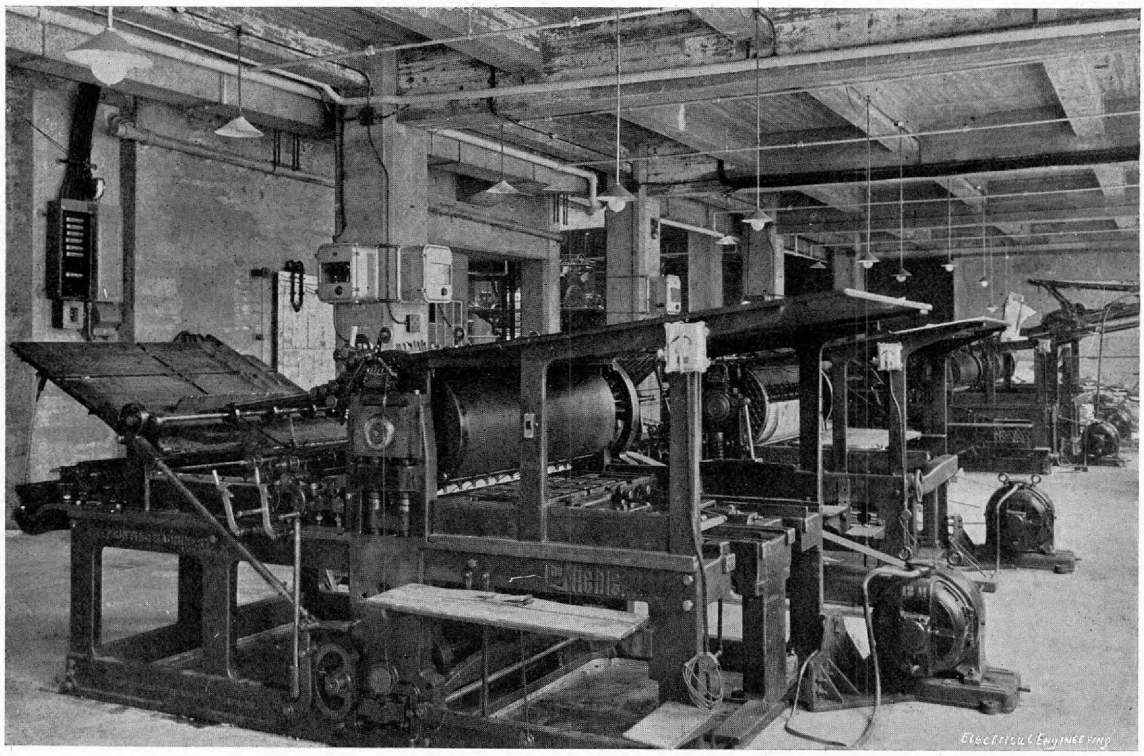


FIG. 8.—ANOTHER VIEW OF MACHINE ROOM, WITH MIEHLE PRESSES IN FOREGROUND.

A subject of almost as much importance as the methods of printing is the consideration of the materials employed, and in this connection a few words on the subject of ink may not be out of place. The whole of the ink with which ELECTRICAL ENGINEERING is printed every week, is supplied by the firm of B. Winstone & Sons, Ltd. (100 and 101 Shoe Lane, E.C.), who are a very old-established ink manufacturing firm, and have long been noted for black ink for book and magazine work, as well as special inks for half-tone illustrations. The firm have also extensive plant for roller casting.

Messrs. Lorilleux (2 McLean's Buildings, New Street Square, E.C.) manufacture very intense black ink for half-tone printing, and also supply a demand which exists for low-priced blacks with rich colouring power. This firm also specialises in coloured ink for the three-colour process, and for posters, and amongst their other special products are copying inks and bookbinders' inks. Their works at Puteaux and Nanterre cover 15 and 25 acres respectively, and they also have smaller works at Dergano and Badalona.

Another firm who supply ink in large quantities to Messrs.

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Clay & Sons are Messrs. Mason & Mason (16 Whitefriars Street), who are, we believe, the oldest firm of ink manufacturers in the country.

Recent developments in the matter of ink have enabled some wonderful effects to be produced, as, for example, the double tone inks, invented and manufactured by the Sigmund Ullman Co., of which Messrs. Borne & Co. (165 Wool Exchange, E.C.) are agents. The double tone inks, which derive their name from the fact that they give two distinct tones in one printing, have the effect of showing the high and medium lights of a half-tone to a very much greater extent than is possible with ordinary printing inks. A further advantage, and one which is immediately apparent, even to a layman, is the richness of tone imparted to the printing by these inks, and their enormous intensity, which combined give the most artistic and beautiful results.

We have already referred to the dock for unloading paper on this floor and the runways in connection therewith, but it should be mentioned here that a complete runway system is also being installed to serve the various machines, with a main line running down the centre of the machine room.

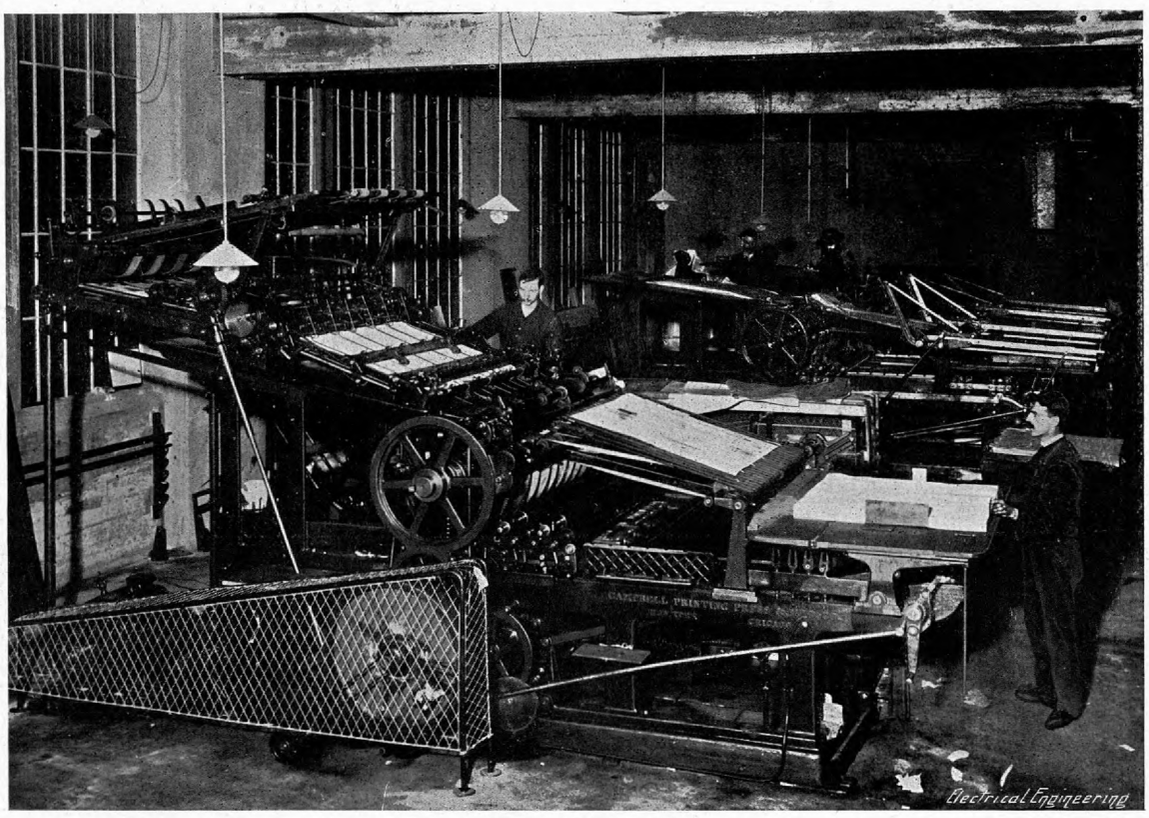


Fig. 9.—Century and Miehle Machines in Main Machine Room Printing "Electrical Engineering."

The greater part of the first floor above the main machine room is taken up by what is known in printing parlance as the warehouse, where the printed sheets are converted into the final form they are to assume when published. There are, however, also quite a number of printing machines of moderate size on this floor.

The warehouse machinery is varied and extensive. All is electrically driven, and individual drive, involving motors from ¼ to 3 h.p., is employed throughout. The motors, like those on the ground floor, are not bolted down to the concrete, but in the case of many are fixed to wooden frames upon which the machines stand. The starting arrangements are particularly worthy of notice. A starter is used which may be described as semi-automatic, and roughly speaking, it is on the same general principle as the automatic solenoid starters used for the large presses, except that the starter lever is raised by hand instead of by the solenoid. Thus, before starting, the handle is in its lowest position, with all resistance out, and, as in the automatic system, the circuit-breaker within the same case is open. The man or girl in charge of the machine draws the handle up when desirous of starting, and, as before, the circuit-breaker closes only when all the resistance is in circuit. The handle is then left to itself, and descends under the influence of the dash pot cutting out the resistance gradually while the motor gets up speed. A small push-button is provided on the top of the case to stop the motor by tripping the circuit-breaker. A small enclosed main switch is provided in each case immediately below the starter. One of the starters is seen in Fig. 10, which is a view of one of the folding machines. These starters, like the larger ones, were made by The Adams Manufacturing Co., Ltd., to Mr. Broadbent's designs. They are all fitted with no-voltage releases, and in the case of the rotary gatherer an overload release is also fitted, as this machine is somewhat liable to be pulled up if overloaded. Owing to the smaller size and greater number of these machines the power circuits are further sub-divided than they are downstairs, and sub-sectional distribution boards are used as well as the regular distribution boards similar to those already described.

The general plan of the warehouse is arranged so that the magazine and newspaper departments are separate, and the machines are arranged in each case so that the sheets can follow the operations in regular sequence. In the magazine department, which is in the east and north portions of this floor, the operations, speaking generally, consist of folding, gathering, thread sewing, wrapping, and trimming. Machines for all these operations are arranged in a regular order, except that the trimming machines are at a greater distance away, owing to considerations of the disposal of the cuttings. Other machines are the wire stitchers. In the newspaper department much of the machinery is similar, except that, owing to the different arrangement of the sheets, there is more handwork in the gathering operation, which is done by the aid of the circular revolving table spoken of above as the rotary gatherer.

Among the various types of folding machines, special attention should be called to the Dexter folders supplied

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by Messrs. T. W. & C. B. Sheridan & Co. (65 to 69 Mount Pleasant, E.C.). Fig. 10 shows one of these machines in use, folding part of the last issue of Electrical Engineering.

The largest of these machines receives a full sheet of 32 pages, made up for two 16's or one 32, cutting it (in folding) into two sections, each section receiving three folds, delivering the

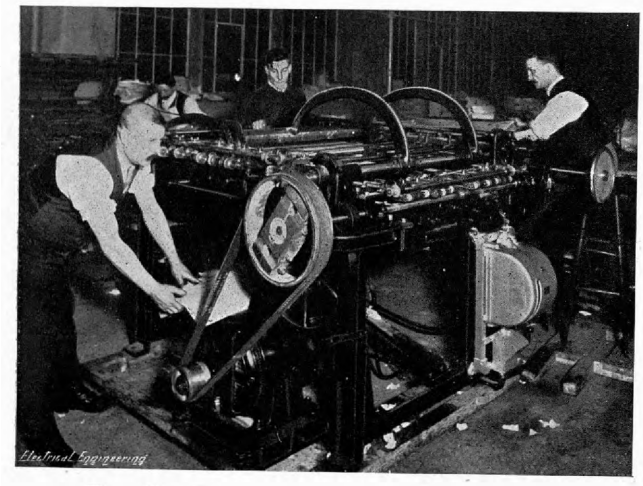


Fig. 10.—Dexter Folding Machine Folding "Electrical Engineering."

two 16's in separate packing-boxes, or one 16 may be inserted within the other, thus delivering a single 32-page signature. A double 32 attachment can be added to this type of machine, which will enable the turning out of two signatures of 32 pages from the one sheet. Other machines in this department supplied by Messrs. Sheridan include a fine book and pamphlet machine, working entirely automatically and capable of placing the paper covers on magazines, pamphlets, &c., at the rate of forty per minute. Messrs. Sheridan have also supplied to Messrs. Richard Clay and Sons a Mercer automatic gathering machine and a number of their new model cutters.

In the N.E. corner of the room is a group of nine thread sewing machines supplied by Messrs. Smyth-Horne, Ltd. (19 Cursitor Street, E.C.) A similar machine to one of these is illustrated in Fig. 11. They are the only type of thread sewer with four-arm feed, and are very much safer to the operator at high speeds than are those of the more usual pattern. These are the smallest machines, from the power point of view, in the works, but they are all belt driven by separate motors without any shafting. Each has a ¼ h.p. motor running at 850/500 r.p.m., started and stopped by an enclosed D.P. switch, but controlled as to speed by a series regulator. The motors are kept running all the time the

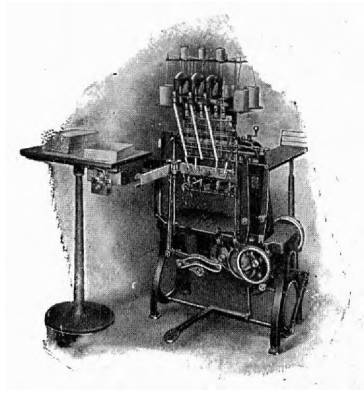


Fig. 11.—Thread Sewing Machine.

machine is in use, and the actual operations are controlled by a mechanical clutch put in action by a pedal. The motors and switches are conveniently mounted under the machines, and slide rails permit of adjustment of the belt. The drive of the wire stitching machines is similarly arranged.

There are several guillotines, each driven by a 3 h.p. motor, and two remarkably fine trimming machines, which trim the three sides of a paper or magazine without moving it in the machine. One of these is the book and magazine trimmer shown in Fig. 12, which was supplied by Messrs. Smyth-Horne & Co.

This machine is the first of its kind to be erected in England. It is a departure from earlier methods in that the bench of work is of considerable length and is moved against the knives while cutting is being effected. The operator's duties are simply to keep the machine in operation, and at the proper intervals to feed a handful of work three to four inches thick to the gate. The machine automatically releases this gate, and the books drop into a work-holder of special design, which supports them at an angle of forty-five degrees. The bench of work is then subjected to a pressure of from three to four thousand pounds, and as a whole moved rearward some seven inches or more against the three knives which are carried by a stationary trimming plate. While this travel and

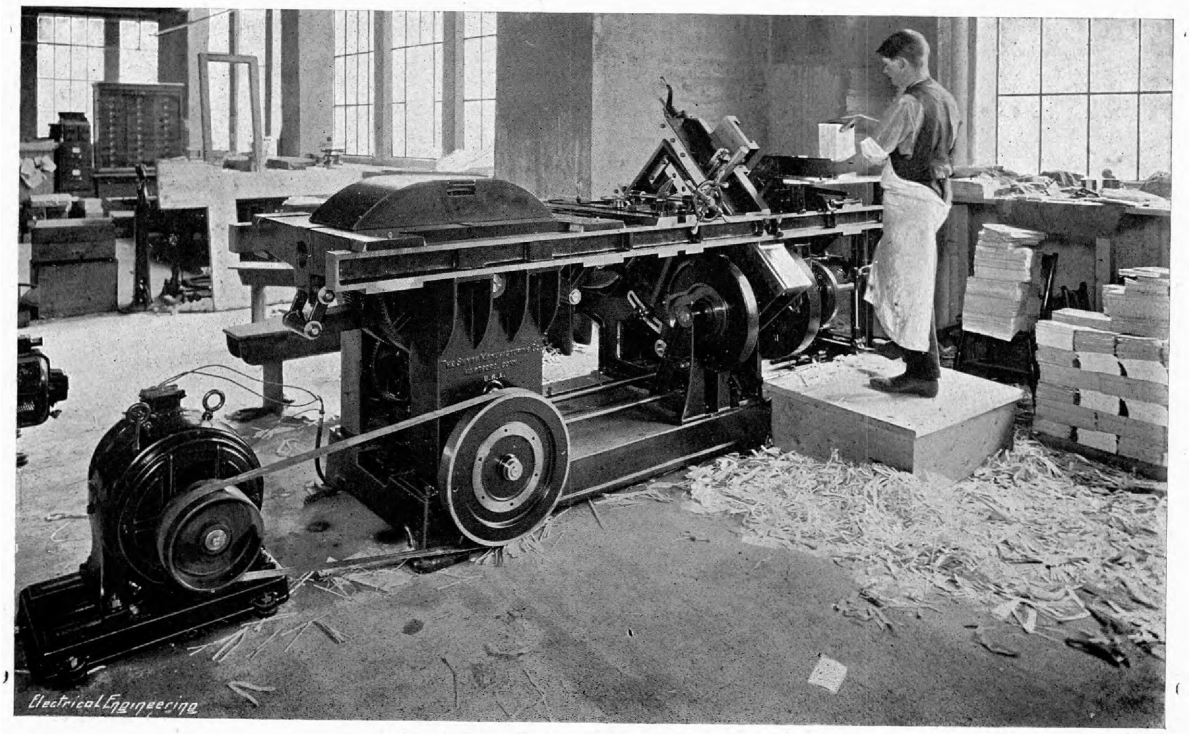


Fig. 12.—Magazine Trimmer at Work.

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cutting is taking place, there is a shearing motion given to all three knives about equal to the travel of the bench of books. The plungers then unclamp and retire, a handful of trimmed work from the rear end of the bench of books is automatically discharged into the receiving trough, the gate released, a new handful of untrimmed work is automatically dropped into place, and the operation is repeated.

The other trimmer to which we wish to call attention is the Krause machine, which can be used for larger-sized pages than that just mentioned, and is the actual machine on which ELECTRICAL ENGINEERING is cut.

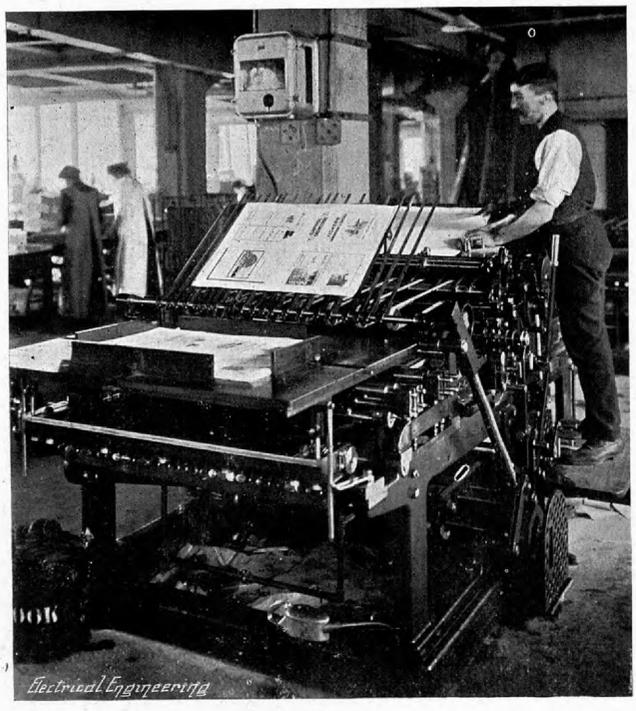


FIG. 13.—MACHINING THE WRAPPER OF "ELECTRICAL ENGINEERING" ON "CENTURETTE" MACHINE.

This machine was supplied by Messrs. Kampe & Co., 2 Sandland Street, W.C., and is adjustable for pages from $2\frac{3}{4}$ in. by $4\frac{1}{8}$ in., to $19\frac{5}{8}$ in. by $22\frac{3}{4}$ in. It will cut up to a height of $6\frac{7}{8}$ in., and as many as six piles can be completely cut on all three sides in one minute, including laying-on and taking away. A powerful automatic clamp holds the work during cutting, and an adjustable back and side gauge, which automatically recedes when the machine starts, facilitates laying on. The motor is conveniently mounted on the top of the machine, and drives through a vertical belt. It runs continuously, and a friction clutch is used to set the machine in action.

An electrically driven travelling band is about to be installed alongside these trimming machines to collect the trimmings and convey them to a chute leading to the basement, where a bundling machine for making them up into bales will be provided.

In the north end of this floor a number of moderate sized printing machines are being put down. Those in place at the time of our visit included a fine full automatic Falcon platen press supplied by Messrs. J. Salmon & Co. This is fitted with a pneumatic paper feed arrangement, which is of considerable ingenuity.

There are also several high-speed flat-bed machines, prominent among which are a group of three Centurettes with a speed of 2,000 to 3,000 impressions per hour. These were manufactured and supplied by the Linotype and Machinery Co. One is shown in Fig. 13 machining the cover of ELECTRICAL ENGINEERING.

The "Centurette" is a small-size high-speed two revolution machine, founded on the experience of the large Miehle and Century machines, and will take a sheet $22\frac{1}{2}$ in. by 35 in., and is of simple and rigid construction. These machines have a short belt drive and spring jockey pulley by 3-h.p. motor.

The only machines with a gear drive are some small machines of the Wharfedale type on this floor, driven through paper pinions. This was chiefly on account of lack of space, and belt drive is used everywhere else. We understand, however, that the result is perfectly satisfactory.

The top floor contains the foundry, with its stereotyping and electrotyping departments; the linotype machines, the hand-composing departments, the readers' offices, and the general offices, board room, &c., of the firm.

At the extreme south end we find the "black shop" of the electrotyping department, with various machines, such as black-leading machines, wax shaver, &c., all driven by separate motors. There is also a fine electrically driven hydraulic moulding press by Messrs. R. Hoe & Co. (Borough Road, S.E.), which is quite self-contained, with its pump and motor mounted on the machine itself. The motor is of Messrs. Crompton & Co.'s manufacture, and was supplied as part of this equipment by Messrs. Hoe. In a separate room in the corner are the electrotyping vats, the dynamo supplying these is belt driven by a 6 h.p. motor mounted on a bracket on the wall above it, and is a machine made many years ago by Messrs. Siemens Brothers & Co. It is a self-exciting shunt machine giving current up to 1,500 amperes at $1\frac{1}{2}$ volts. The regulation of this machine is effected entirely by means of an adjustable magnetic shunt, and naturally the efficiency of the machine does not reach a very high figure. The "black shop" is separated by the stairs from the main portion of the top floor, but otherwise the whole of the western half is without partitions. At the north end is the foundry proper.

The foundry machinery is of varied nature, and need not be described here in detail. Individual drive with motors belted to the machines is adopted, as in the other parts of the works we have been considering, but in view of the wood and metal dust flying about, solid instead of expanded metal covers will be provided to the motors. The controllers, with one exception, are of the semi-automatic pattern already described. The one exception is a horizontal boring machine, which has a special controller, as it requires to run the motor in either direction. This is the only reversing motor in the establishment, and a very neatly designed pattern of rheostatic reversing controller is employed. This machine was formerly driven by fast and loose pulley, and the simplification of the drive by a small motor bolted up to machine, doing away with the countershafts, &c., is most striking. Among other machines are a flat router, driven by a neatly arranged half-crossed belt drive from a $1\frac{1}{2}$ h.p. motor; a "nibbler," for planing the backs of the plates to make them exactly type high; a jig saw, a plane, a rotary "bowler," and several circular saws, all driven by motors from 1 to 2 h.p., of which more than a dozen were in place



FIG. 14.—GROUP OF LINOTYPE MACHINES.

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at one time of our visit. At the end are the gas-heated melting pots, two of which are of the 7 cwt. size and one of the 14 cwt. size. These were supplied by Messrs. R. Hoe & Co., and are heated by a special pressure gas system, employing a small electrically driven rotary blower. They are capable of starting up from cold to their full heat in 25 minutes. Messrs. Hoe also supplied the gas-heated steam drying press in this department.

Passing on to the composing department we are at once struck by the group of 12 linotype machines, some of which are shown in Fig. 14, and it should be mentioned that the columns of ELECTRICAL ENGINEERING are set up entirely on these machines. The whole of these machines were removed from the old works, and the transfer was effected in remarkably quick time. Dismantling was only commenced at Bread Street Hill on a Thursday evening, but the machines were at work on their new site on the Friday night. The linotype machines form the only example of group drive throughout the works. They are divided into two groups of six, in two rows back to back, each driven from a shaft on the floor level under the platform running behind the machines by a 1¼ h.p. motor belted to the end of the shaft.



FIG. 15.—GENERAL VIEW OF COMPOSING ROOM.

It is impossible to describe the Linotype composing machine in detail in the space available. Briefly, it may be said that instead of separate type being used for every letter, each line is cast automatically by the machine in a mould made up of a series of matrices which have been set up by means of a key-board resembling that of a typewriter. The keys control magazines of matrices, and allow the right one to drop out and to be carried by the machine to its proper place in the row which is to form the mould. The details of the methods by which the sequence of operations are obtained, especially the way in which the matrices are distributed, are extraordinarily ingenious. The speed obtainable on these machines is from 6,000 to 10,000 ens per hour.

A departure is made from the usual method of lighting throughout the works in the case of the linotype machines, as it is necessary to throw light into particular parts of the machines. Lamps are therefore provided on flexible leads from ceiling roses, and these can be put anywhere on the machines where they are required.

The hand composing department is beyond, and extensive use is made of the travelling pendants already illustrated, over the compositors' frames, racks, stones, &c. In this case, however, they are provided with key holders so that each single light can be controlled independently. There is also a certain amount of general lighting by 100 c.p. lamps placed high up. In the readers' compartments, which are at the extreme north end, the 32 c.p. tantalum lamps, with enamelled iron shades, are suspended by flexible wires from short brackets of simple design. A view of part of the composing room is given in Fig. 15.

Other machines found in various parts of the establishment include hand-worked proof presses of the "Lightning" type, supplied by Messrs. Soldan & Co. (72-75 Turnmill Street, E.C.) of which there are altogether eight in use. These machines can be used for the finest class of register work, as well as for proofing galleys, and have special provision adjusting the height of the bed with great accuracy. The underbed is fixed, and a series of wedges, actuated simultaneously by turning a handle, raise or lower the overbed. Very even inking is obtained by geared inkers. A steel table and hand roller are provided for proofing in colour without the necessity for cleaning the rollers.

The general offices are, as has already been mentioned, also on this floor, and they occupy a good deal more than half the length of the building. The finest room is the board room, which is handsomely panelled, and has an arched ceiling in three bays of very fine appearance. The whole of the furniture and fittings of this artistically decorated room were designed and supplied by Messrs. F. Collinson & Co. (24 Grafton Street, W.), who, it may be said, make a speciality of high-class furniture for houses, yachts, &c., rather than ordinary office furniture. There are various private offices for the directors, managers, and other members of the staff, all excellently lighted rooms with large windows. The wiring is partly surface pipework and partly concealed. Various special fittings will be made use of, but unfortunately at the time of our visit these were not yet in place. The large counting house is also here, and this is lighted by the same design of travelling pendants as most of the rest of the building.

There is also a pleasantly decorated staff luncheon room, which is connected by a hand service lift with the kitchen on the roof level. This lift, as well as the kitchen ranges and other fittings, was supplied by Messrs. Farrow & Jackson, Ltd., to whose racks in the basement we have already made reference. The principal strong room on the floor is fitted with a special range of racks for the books, fireproof card index boxes, &c., also supplied by Messrs. Farrow & Jackson, Ltd. They are entirely constructed of channel and T steel, and have 19 in. openings for the ledgers, and 16 in. openings for the filing cases. This firm specialise in steel card index and filing cases, and have recently executed an order for 1,400 sets for the Commercial Union Assurance Co. There is also a smaller strong room communicating with the board room, and the offices include a special post room.

The telephone arrangements are very complete, and merit detailed description. There are ten lines from the City Exchange (City 526), and a private branch exchange board is installed dealing with these and 20 extensions to various parts of the building. The board is in charge during the day time of a female operator, formerly in the employ of the National Telephone Co., but at night the lines are plugged through to the gate-keeper and some of the departments.

At present a board is being employed which has been installed temporarily, but it is to be replaced by a larger board with an ultimate capacity of 20 exchange lines and 120 extensions, and entirely automatic signalling. A feature of this board will be that not only is the current for the transmitters and automatic signalling supplied by special leads from the City exchange, but the alternating current for ringing the extensions is supplied in a similar manner. A hand magneto is fitted as a spare. The extension instruments are all worked on the usual C.B. system, with "eye-ball" indicators, which are automatically restored on the insertion of a plug into the corresponding jack. When an extension is through to the main exchange, the current for speaking is supplied direct from that exchange, the energising of a 350-ohm relay in the cord circuit cutting off the local supply. When, however, one extension is through to another, both points are supplied from the Private Branch Exchange switchboard, the 350-ohm relay in this case not being energised, owing to the absence of a socket connection on the extension jacks. We are enabled to give these particulars through the courtesy of Mr. G. F. Preston, manager of the Post Office Metropolitan Exchange System.

In addition to the main telephone system a very complete system of inter-communication telephones, with 25 stations, has been installed by the British Home and Office Telephone Co. (15 and 17, City Road, E.C.).

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This comprises 18 wall sets and seven table sets in the various departments and offices. The instruments are of the 30-line type, so that there is provision for five more stations later. These sets are of simple construction, without outside terminals, and well finished. The handle of the dial switch is turned to the number wanted, the hand combination set is then removed from the cradle, and a push button is pressed in. This connects the battery to the line wanted, and, on releasing the button, the instrument is through to the line. There is no speaking key to depress in the handle of the instrument. On replacing the hand-set the instrument is automatically connected to the "home" line, no matter what position the dial switch occupies. The system is a central battery one, and the battery consists of two sets of four "sack" type Leclanché cells connected in parallel. These have flat glass covers in which are holes for the passage of the carbon rod and the strip attached to the zinc cylinder, and the carbon rod passes through the sack and rests in a depression in the centre of the bottom of the cell, so that both elements are held in their proper positions without the usual tendency to slip about as in the ordinary Leclanché. The multiple cable connecting the stations is rubber and cotton insulated, and braided overall. Wires of 22-gauge copper are employed for the lines, and two No. 18 wires for the battery leads. It is drawn into ¾ in steel barrel fixed to the surface of the concrete walls with clips screwed into hardwood plugs.

The greater part of the roof is flat, and makes a pleasant promenade, but on the roof are also situated the men's dining rooms and kitchens, and covered ways lead to these from the top of the stairs. The water tanks for the sprinklers are also on this level.

In speaking of the building in general, mention must not be omitted of the ranges of lavatory basins along the wall at the south end of each floor adjoining the men's staircase. The basins themselves were supplied by J. Tylor & Co., the sub-contractors to Messrs. Jennings & Co., who were the main contractors and carried out the plumbing work in this connection. Above each basin is a spherical pivoted container or dispenser containing a special form of liquid soap, which pours into the hand when the container is inverted. This soap is supplied by the Horton Liquid Soap Co. (245 Shaftesbury Avenue), and two varieties, one of the nature of a toilet soap, and one specially intended for the removal of grease, are in use. About 40 of these liquid soap containers are fixed in various parts of the establishment. The supply of liquid soap for factory purposes is quite a new development, so far as we know. It is estimated that each container holds a supply of soap for 200 or 300 people, and the soap can be used up to the last drop.

We have endeavoured in the above description to give some idea of the magnitude, the up-to-dateness, and the completeness of the works and its plant. It now only remains to add that both the quality and the quantity of the work carried out there are equally worthy of note. It may be mentioned that in addition to ELECTRICAL ENGINEERING, Messrs. Richard Clay & Sons carry on at Brunswick Street the printing of such well-known journals as *The Lady's Pictorial*, *The Illustrated Sporting and Dramatic News*, *Nature*, *The Musical News*, *The Nursing Times*, *The Boot and Shoe Trades' Journal*, *The Shooting Times*, *T.P.'s Magazine*, *The Woman at Home*, *The Fortnightly Review*, *The School World*, *The Journal of the Chemical Society*, *The Journal of Hellenic Studies*, *The Economic Journal*, *The Journal of the Board of Agriculture*, *The Journal of the African Society*, *The Journal of the British School at Athens*, *The Journal of the British School at Rome*, and *The Statesman's Year Book*. Messrs. R. Clay & Sons also printed a considerable portion of the new edition of the *Encyclopædia Britannica*.

To change over the whole of this work from its old to its new quarters without any interruption was no light task, but we are pleased to say that, judging by our experience with ELECTRICAL ENGINEERING, the success of the arrangement, were perfect. No one outside Messrs. Clay's own staff was put to the slightest inconvenience, no hitch occurred, and ELECTRICAL ENGINEERING on the week of the move was turned out with all the smoothness and punctuality which have always characterised the work that Messrs. Clay & Sons have done for us.

Before concluding we wish to express our appreciation of the courtesy shown us by the directors in connection with the preparation of this description, particularly by Mr. Cecil Clay, who at a time of great pressure of work took considerable personal trouble in the matter, and spared much of his valuable time. We also wish to thank Mr. Frank Broadbent, consulting electrical engineer to the firm, for explaining to our representative the electrical features of the establishment, and the various contractors who afforded us facilities for obtaining information regarding the plant which they supplied.

ELECTRIC POWER PLANT AT MESSRS. RICHARD CLAY & SONS' COUNTRY WORKS

THE works of Messrs. Richard Clay & Sons, at Bungay, have been driven by electric motors for some years past, but the extensions that have been made from time to time in the works have outstripped the capacity of the original generating plant. A new power house is now being put down to the designs and specifications of the firm's consulting engineer, Mr. Frank Broadbent, M.I.E.E.

The power house will adjoin the old gas engine house, and will contain two 24 ft. Lancashire boilers, made by Danks and Co., of Oldbury, fitted throughout with corrugated flues. Mechanical stokers of the Underfeed type will also be provided, and the fan for the forced draught will draw its air through an air heater placed in the flues so that hot air will be delivered to the furnaces. Superheaters of the Furguson sectional type will be fitted at the back of the boilers, and the piping will be so arranged that either saturated or superheated steam may be delivered to the engines. The feed water which is pumped direct from the river will pass through a water softener and oil eliminator of the Paterson type, the feed water being heated and partially softened by means of a branch from the exhaust steam pipe. Some further particulars of this plant are given on another page. In winter the exhaust steam will be used to heat the works.

The power plant will consist of two Belliss & Morcom enclosed compound engines, each of 150 h.p. capacity when supplied with superheated steam at 140 lbs. pressure. These will be fitted with automatic expansion governors in order to work with maximum economy under the fluctuating loads to which they will be subjected. Specially heavy fly-wheels are also being fitted to ensure steady running. Multipolar continuous-current, compound-wound dynamos made at the Witton Works of the General Electric Co., who are sub-contractors to Belliss & Morcom, will be coupled direct to the engines. The main switchboard forming an extension of the switchboard used in connection with the gas driven dynamo, is being made by J. H. Holmes & Co., of Newcastle-on-Tyne, and will be fitted with overload and return circuit-breakers for the dynamos which will work in parallel, and will contain separate panels dealing with the power and lighting loads.

A new brick chimney is being built by the Alphons Custodis Co. Mr. Broadbent, the consulting engineer, went very carefully into the merits and comparative costs of brick and steel for the chimney, and considered that for this particular case a steel chimney offered no advantages, either in the first cost or otherwise.

It is confidently anticipated that very great economies will be effected by the use of such an up-to-date installation.

Supply Station Engineers and others requiring copies of this issue of "Electrical Engineering" for distribution in quantities should apply at once to the Publishers, the Kilowatt Publishing Co., Ltd., 203, Temple Chambers, Temple Avenue, E.C. Price 1d. per copy (carriage free, 1½d.).

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WATER PURIFICATION PLANT AT MESSRS. R. CLAY & SONS' WORKS AT BUNGAY

BRIEF reference is made on another page to the combined exhaust heater, softening and oil eliminating plant, which the Paterson Engineering Co., Ltd. (Amberley House, Norfolk Street, Strand, W.C.), have in hand for Messrs. R. Clay & Sons' works at Bungay. We are able to give here an illustration of the general arrangement of the plant.

The hard water supply, controlled by a float in the feed-pump suction tank, enters the chemical regulating apparatus, which measures in continuously in its passage through a narrow vertical discharge weir. A large float controls the position of two long tapered valves, discharging the softening reagents. The level of these is kept constant by ball-cocks connected to the chemical storage tanks. The hard water and reagents are well mixed before passing through a water seal into the heating chamber.

The exhaust steam enters a preliminary grease separator, for the removal of the black oil; then the heating chamber, passing through the trays in a counter-flow direction, finally escaping to atmosphere. The heating trays, constructed of light sheet steel, can readily be withdrawn for cleansing purposes.

The water from the distributing box falls into the centre of the top tray. Owing to its great length, the water overflows the edges in exceedingly thin films, which cling to the underside, dropping from the centre into the middle of that immediately below. After working its way to the edges of No. 2 tray, it again overflows on the underside and drops into the middle of No. 3, and so on. By this means the exhaust steam comes into film contact with the water, and removes the temporary hardness without the aid of chemicals, by driving off the carbonic acid gas and precipitating the lime salts.

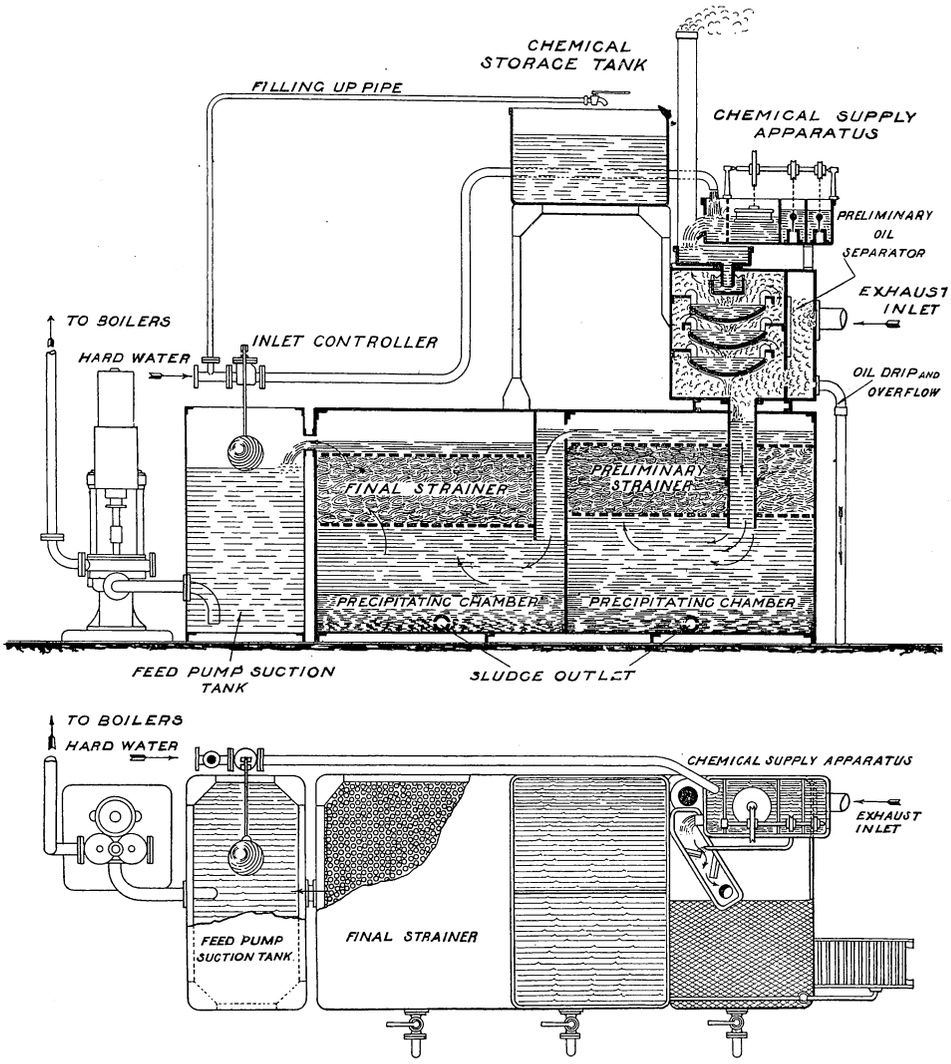
The reaction is as follows :—

Bicarbonate of lime		Carbonate of lime	Carbonic acid	Water
$CaH_2(CO_3)_2$	=	$CaCO_3$	CO_2	H_2O
Soluble		Insoluble	Gas	Water

For the removal of the permanent hardness sodium carbonate is necessary, and by means of the Paterson Patent Chemical Supply Gear this is added in accurate proportion to the amount of water passing. The reaction then is :—

Sulphate of lime		Carbonate of soda		Carbonate of lime		Sulphate of soda
$CaSO_4$	+	Na_2CO_3	=	$CaCO_3$	+	Na_2SO_4
Soluble		Soluble		Insoluble		Soluble

The heated and softened water passes into the precipitating chamber, where the bulk of the impurities settle. Final purification is effected by double filtration through wood fibre. The purified water flows into the feed-pump suction tank.



GENERAL ARRANGEMENT OF PATERSON COMBINED EXHAUST HEATER, WATER SOFTENING AND OIL ELIMINATING PLANT.

The Vogtlandische Maschinen Fabrik, of Plauen, whose advertisement appears on another page, is one of the largest builders of rotary machines on the Continent. The firm specialises principally in rotary machines for newspapers and illustrated magazines, and claims to be the first house to have developed and put into practical working a process for printing newspaper illustrations direct from half-tone blocks. The Vogtlandische Maschinen Fabrik has also invented the "Rotoplate," a machine for automatically casting and finishing plates for rotary machines. Two of these, we understand, have already been installed in German newspaper offices.

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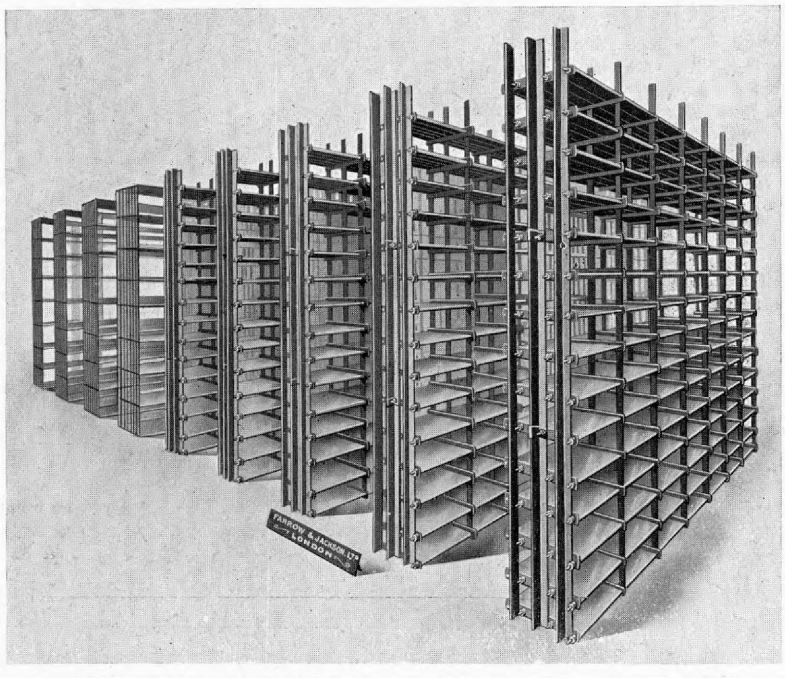
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AUTOMATIC v. MANUAL TELEPHONE EXCHANGES

LAST Thursday, Mr. W. Aitken (of the British Insulated and Helsby Cables, Ltd.) read a exceedingly interesting Paper before the Institution of Electrical Engineers on "Automatic Telephone Exchange Switchboards." He commenced by alluding briefly to the increase in the automatic features employed on manual boards, and then explained in detail one of the most recent of these, namely, the keyless ringing junctions, by which the ringing key on the incoming junction board is rendered unnecessary, and the actual insertion of the plug in the wanted subscribers jack causes a relay to connect up the ringing circuit, and again to interrupt it (as with the ordinary automatic ringing key) when the wanted subscriber takes down his receiver. This enables the number of incoming junction per operator to be increased from 27 to 36.

On small private branch exchanges with too few extension lines to render the employment of a permanent operator necessary, trouble is frequently experienced by the office boy or clerk responsible for the manipulation of the board omitting to clear the extension at the conclusion of the conversation, so that the exchange line is left connected to the extension instead of to the switchboard or the service instrument. The British Insulated and Helsby Cables, Ltd., have lately introduced small cordless switchboards of Mr. Aitken's design in which the connections are made manually by a rotating multi-contact switch, which is held electrically and is automatically released when the extension subscriber hangs up. In a modification of this, the switch is released through a slow acting relay, so that the extension is not disconnected by the subscriber pumping his switch-hook to call the exchange.

Mr. Aitken then proceeded to the main part of the Paper, on the full automatic switchboard. Most of the leading telephone manufacturers are now busy developing automatic systems, but, practically, there is only one system in common everyday use—that of the Automatic Electric Company, of Chicago. It is claimed by this Company that there are 300,000 telephones working on their system, San Francisco, Oaklands, Los Angeles, Columbus, Grand Rapids, and Chicago, being among their largest installations. San Francisco and Los Angeles are both laid out on a basis of 100,000 lines. The former has already four exchanges with three at Oaklands, across the bay, most of them of 10,000-line capacity. Los Angeles has six main and four branch exchanges equipped for 25,700 lines. These exchanges are on the common battery system. The Chicago system just being brought into use, is to be suitable for 1,000,000 lines.

The greater number of exchanges are on what is known as the 3-wire system, the signalling being over the two wires alternately with earth return, but in San Francisco, and other later exchanges, all signalling is effected by the intermittent opening of the circuit at the subscriber's instrument. This has greatly simplified the subscriber's instrument.

All the facilities given on a manual exchange are now repeated on the automatic, and in some instances with a greater degree of flexibility. Junction working is practically eliminated. The ringing of the called subscriber is automatic. Calls are metered or registered (the system, however, gives free or unregistered calls when talking to officials, etc.). Party lines are efficiently dealt with, and also private branch exchanges.

Fig. 1 shows a subscriber's instrument with the small circular switch for opening the line only. Under each of the finger holes is placed a figure, 1 to 9, then 0, and any number is made up by inserting the finger successively over the figures that go to make up the number wanted and pulling the dial round until the finger comes against a stop. In the 3-wire system this dial, as it revolves, intermittently earths one or other of the wires, and thus completing a circuit from a central battery causes step by step electromagnetic mechanism to perform certain functions. In the later system these functions are now performed by the dial simply intermittently opening the circuit which has been completed by lifting the receiver.

Fig. 2 shows a general view of a "connector" (the essential piece of mechanism of an automatic exchange). A small exchange might be composed only of connectors, one being provided for each line. On a frame of non-magnetic material a vertical shaft is mounted, free to lift upwards and revolve. The upper part of the shaft has teeth cut round it, and below this are other teeth in the line of shaft, 10 teeth in each case. The shaft is raised and rotated by electro-magnets. One called the vertical magnet, acts on the teeth surounding the shaft, and lifts the shaft to a height corresponding to the number of impulses sent, and the number of impulses depends on the second last figure of the number required, *e.g.*, if the number were 67, then the shaft would be raised to the height of 6 teeth. Another magnet would then be switched into action and it would act on the teeth in the line of the shaft and rotate it, the distance depending again on the number of impulses sent; in the case of the number 67 the shaft would be rotated a distance of 7 teeth. The shaft at the bottom has attached to it, and insulated from it, and from each other, contact springs or wipers, which, brush fashion, wipe over contacts associated with the lines to be called. These banks of contacts are arranged in an arc of a circle, and each line bank has ten pairs of springs

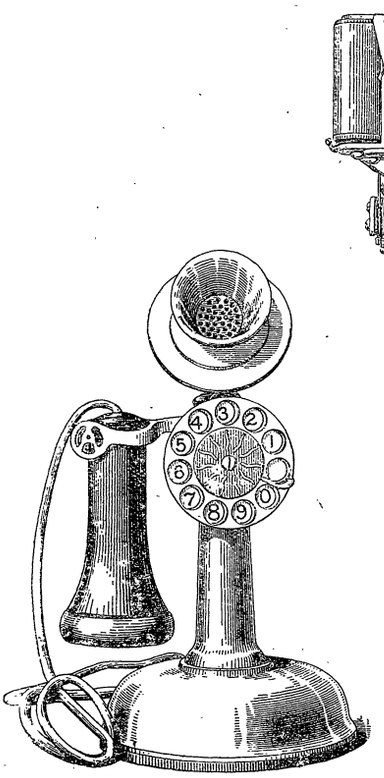


FIG. 1.—TABLE PATTERN INSTRUMENT.

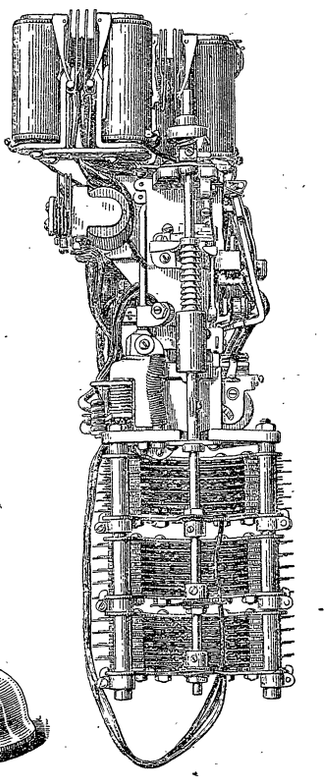


FIG. 2.—COMMON BATTERY CONNECTOR.

in the height, usually in two groups, and 10 contacts horizontally in the arc, wiped over by two twin contact arms. In these contacts are terminated 100 lines. A second bank is placed above this having 10 contacts in the height and 10 in the arc. These are connected to the tests, or line engaging circuits which are purely local and correspond to the wires connecting the jack bushes together in a manual exchange. As the shaft rises vertically step by step, the wipers come to rest in line with the contact levels, so that when the shaft is rotated the wipers brush over the intervening contacts in the arc, until the wipers come to rest on contacts of the line required. When the receiver is replaced after a conversation, both lines are earthed simultaneously, or the circuit is opened, allowing a release magnet to operate on the "dogs" (which maintained the shaft in the position brought about by the electromagnets already described), when the shaft is rotated in the reverse direction by a coiled spring until it is free to fall by gravity to the normal position.

The Author then described the complicated mechanism and connections in considerable detail, explaining the methods employed for giving the "engaged" signal automatically, the automatic connection of the junction circuits, etc.

On the question of cost, he claimed that although in small exchanges it is much more with automatic than manual, as they increase in size they approach nearer until at about 10,000 lines they are equal in cost.

For operating, repairs, and maintenance, Mr. Aitken quoted figures showing £1 5s. per line per annum for a 5,000-line

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manual exchange, as against 8s. 10d. for an automatic exchange of similar size; and for a 10,000-line exchange £1 13s. 6d. and 9s. 4d. respectively. He also stated that the Automatic Electric Company have lately published a certificate over the signature of the President of the Citizens Telephone Company, Grand Rapids, that the cost of replacing parts, due to defective workmanship, or material, or ordinary wear and tear, during seven years, amounted to $962·62, an average of $137·52 per annum, or 1·8 cents per line per annum, for the average of 7,500 lines in service. This sum included central equipment, except power plant, and also the dial switches in the telephones.

DISCUSSION.

Mr. J. E. KINGSBURY first referred to the question of nomenclature, and suggested that the modern C.B. manual board, sometimes called automatic, should be called "machine switching," and that full automatic systems should be described as "machine calling and machine switching." Mr. Aitken might be right in his belief that anything else than the full automatic could be other than transitory, but there was no material put forward, based upon accomplished facts to permit of a judgment yet. Telephone engineers must not be led away by the enthusiasm of inventors or manufacturers. It was the duty of all responsible for the management of a telephone service to see that it was a perfect one, and not to seek to evade any responsibility themselves by putting it on to the subscriber.

Mr. F. GILL (Chief Engineer, National Telephone Co.), said that the National Company had always felt that the function of the private branch exchange operator was very important indeed, and that this operator could not be got rid of by any automatic gear. Mr. Aitken had taken 22½ calls per junction per busy hour, but this American figure would not apply in London, where the duration of the conversation was very much longer. Another figure, upon which maintenance costs were erroneously based, was that of one man per thousand lines; and he investigated this in the States, and had found that it meant one man continuously working, so that, assuming eight-hour shifts, three men per thousand lines must be taken. No general conclusion could be come to as to the application of automatic telephony, but it was necessary to study each area separately.

Mr. A. W. WHALLEY said he had studied five different systems in the United States, and they had filled him with astonishment and admiration at the results accomplished. When a system had been evolved, after 10 or 15 years hard work and in connection with which 300,000 telephones were in use, there must be something in it. Mr. Whalley pointed to the saving of time by the fact that the disconnection of exchange lines was practically instantaneous on the automatic exchange, whereas in a manual system most conversations were carried through two exchanges, and each operator had 17 pairs of cords, and had to attend to between 100 and 200 subscribers, so that there must be a delay in disconnection after the completion of a conversation. Another claim for the automatic system was that it took less time on the average for the calls made by subscribers to get through to the man wanted. Mr. Whalley also complained that in this country telephone engineers had been brought up in the catechism of the best and standard American practice, and, apparently, if any new thing had not been proved in America, it was quite impossible for it to be tried here and developed on our own lines. On the other hand, he said that it should not be considered sufficient to send an engineer every two or three years to America to report on developments there, but a man should be sent actually to live in one of the cities where the system is in use.

Mr. M. S. CONNER said that although he had not yet made a very extensive investigation into the matter, he believed the automatic system was a successful one for giving telephonic service, and after having interviewed several hundred subscribers, he had come to the conclusion that they liked it. It resolved itself into a financial question. Whilst the expense of operators was less than that of an ordinary telephone system, the cost of maintenance with the automatic system was more, owing to the number of parts. He could hardly accept the figure of maintenance given in the paper of two cents per line per annum. The audited balance sheet of an automatic system did not show a greater earning power than a manually operated system. At the same time, whilst the expenses were small, there were large additions to the capital expenditure, and the capital value per station increased each year. Taking this into consideration, it was evident that an automtic system had not yet been devised to give a reliable telephone service at the same expense that a corresponding service could be given by a manual equipment. The question of depreciation also had a bearing on the matter. He disagreed with the author that the life of a manual switchboard was only 10 years, nor with the assumption that 12 years would be the life of an automatic exchange. There were a large number of common battery switchboards in use to-day that had been in operation for more than 15 years, and he believed that the Postmaster-General was expected to acquire a large number of National exchanges in London which had been in operation for more than 10 years. With the manual system, the life for springs, jacks, plugs, &c., had been greatly prolonged by improved material during the past few years, and he did not think he was far wrong in saying that a multiple switchboard could now be obtained in which the plugs, cords, &c., had a life of 25 years. On the other hand, there was no experience to show the real life of an automatic system. Systems installed 14 years ago had passed away long since. In the later systems, the switching mechanism underwent considerable wear, owing to its cycle of operations, and he imagined that the vertical shaft would have to be replaced fairly frequently. There might be hopes for the automatic system if the number of parts could be reduced, and the remaining ones made in a more robust and scientific manner, so that the cost of maintenance would be decreased. But when it was considered that the original Strowger patents were taken out in 1888, and that in 25 years enormous sums of money had been spent to bring that device to perfection, they must get a little discouraged as to any advantageous outcome.

Mr. R. SCRUBY expressed his opinion that the Automatic Electric Co. of the United States had certainly shown that entirely automatic telephone systems are feasible and economic. About sevn years ago he went to Albuquerque, New Mexico, to see one of the first automatic telephone exchanges which had been put in. This was of about 200 lines, had been working six years, was giving entire satisfaction to the users, and was a financial success. At Grand Rapids a 10,000 line exchange was installed, and was giving thorough satisfaction to the subscribers, and was also paying good dividends even before the advent of the Keith line switch and the common battery two metallic line instruments. The Keith line switch opened up greater possibilities, and allowed much greater economy in the automatic telephone system, and he was sure that the system in Chicago would show that there was practically no limit to the number of lines which can be used on the automatic telephone exchange system. About eight years ago in Los Angeles there was the finest independent manual exchange in the States, but only a year or two after that date all extensions were on the automatic system, and now one of the largest automatic exchanges in the world exists there. At Dayton, Ohio, where there was a manual exchange and a 10,000 line automatic exchange, the public were very much in favour of the latter. The cost would be reduced when more firms were employed in the manufacture of automatic exchanges, and when repetition orders were placed on the scale as that of orders for manual exchanges at the present time. Although England, as compared with the United States, was not manufacturing an enormous number of telephones, nevertheless, there were one or two telephone manufacturing companies in England turning out better work than any of the foreign works, and these would be a considerable help to the English telephone system when they decided to commit themselves to automatic telephony.

Mr. AITKEN, in reply, said he had no idea of doing away with the operator in private branch exchanges. It was due to these that the number of operators of automatic systems was recorded in statistics as so large. Contrary to Mr. Conner, he felt quite encouraged with the progress and prospects of automatic telephony, especially when an independent company could go into competition with a manual system in a great place like Chicago. On the question of maintenance, he contended that there were very few wearing parts in the automatic system, and said that the wipers were the only parts which had to be renewed at all frequently.

Course of Lectures.—A course of five lectures on the application of hyperbolic functions to electrical engineering problems is to be given under the auspices of the University of London at the Institution of Electrical Engineers by Dr. A. E. Kennelly. The lectures are addressed to advanced students and others, and admission will be by ticket, obtainable on application to the Secretary of the Institution of Electrical Engineers. The lectures will commence at 5.30 on the following dates:—May 29th and 30th, June 1st and 2nd.

Parliamentary Intelligence.—The South Lancashire Tramways Bill was read a third time in the House of Commons on Thursday.

A House of Commons Committee last week passed the Metropolitan Electric Tramways Bill, the main object of which is to construct a new bridge over the River Lea, and to join up the tramways of the Walthamstow Council and the Middlesex County Council.

The Metropolitan District Railway Bill has been passed by the Unopposed Committee of the House of Commons. It provides for certain widenings of the Company's railways, the construction of a new station in Farringdon Road, and a subway for foot passengers at Edgware Road.

The Unopposed Committee of the House of Lords last week passed the Bill of the London Electric Railway Co., which provides for the transfer of the Lots Road power station of the Underground Electric Railways Co. of London to a joint committee consisting of representatives of Metropolitan District Railway Co., and the London Electric Railway Co.

Middlesbrough, Stockton, and Thornaby Tramways Bill, and the London Electric Railway Bill were read a third time and passed in the House of Lords on Tuesday.

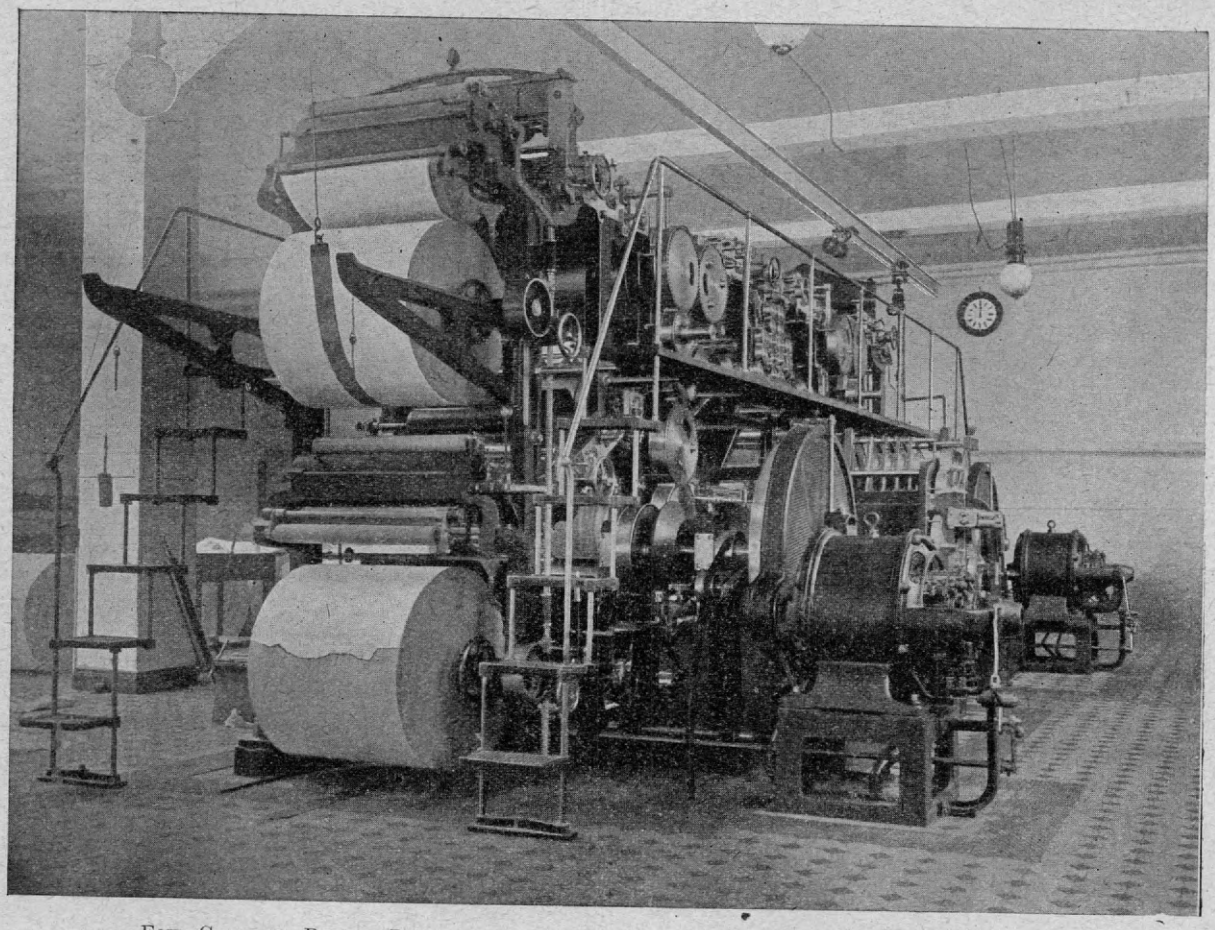
The Macclesfield & District Railless Traction & Electric Supply Bill has been read a second time in the House of Lords.

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A NEW A.C. MOTOR FOR DRIVING PRINTING MACHINERY

ALTERNATING-CURRENT motors of the ordinary induction type cannot be adapted in the same way as direct-current motors to the exceedingly severe conditions which the driving of modern printing presses entails. Messrs. Brown, Boveri & Co., however, have sent us some particulars of a new type of alternating-current motor, which, they claim, fully meets the requirements of printing work, and for this purpose it has largely been employed on the Continent. It is a single-phase motor of a special repulsion type, the stator of which carries a simple single-phase winding, while the rotor is wound in a similar manner to a direct-current aramature, and is fitted with a commutator. The rotor, however, is not electrically connected in any way with the stator, and the pressure across the brushes is so low that perfect commutation and entire safety in handling are ensured. For each pair of poles there are two sets of brushes, one of which is fixed and one movable. The whole control of the motor is effected by varying the position of the movable brushes on the commutator, no starting or regulating resistances being required; in fact, the only accessories to the motor are a double-pole switch and fuses. The makers inform us that any speed can be obtained between the slowest possible speed for "inching" and the speed of synchronism, and that the direction of the motor can be reversed simply by altering the position of the movable brushes. The starting torque is about 2·5 to 3 times the normal, while the running characteristic of the motor is similar to that of a direct-current series machine. The motors, which are made in sizes from 2 to 80 h.p., can also be arranged for either mechanical or push-button control, without any complication of apparatus, and they can be adapted for three-phase supply by connecting them across the phases.

The accompanying illustration shows a four-cylinder rotary press with a capacity of 10,000 32-page sheets per hour, driven by two single-phase commutator motors, each rated at 25 h.p. The press can either be run as one machine or as two separate machines, which can be run at different speeds independently of each other. The movement of the brushes to control the speed is done by means of small hand levers, which are situated at five different points on the machine, and connected together by means of rods, so that the motor can be stopped, started or regulated from practically any part of the machine. The main switch for each motor is fitted on the stator frame, and is operated by means of rods in the manner previously indicated. The normal working speed of the motor can be varied between 600 and 1,050 r.p.m., no starting or regulating resistances whatever being used. Messrs. Brown, Boveri & Co. inform us that up to the present time they have delivered, or received orders, for over 22,000 h.p. of motors of the above type for driving printing and other types of variable-speed machinery.



FOUR-CYLINDER ROTARY PRESS DRIVEN BY TWO 25 H.P. SINGLE-PHASE COMMUTATOR MOTORS.

Turin International Exhibition.—The British Section of the International Exhibition at Turin was informally opened to the public on Friday, May 19th. The official inauguration of the section will take place later.

Trolley Omnibuses.—The Bill of the Aberdare Council, which proposes to use trolley omnibuses on certain routes feeding the tramway system, has been under consideration by a House of Lords Committee during the past week. Mr. Stephen Sellon gave evidence on behalf of the Corporation, and estimated the cost of overhead equipment for the trolley omnibuses at £13,420. Mr. J. B. Hamilton, General Manager of the Leeds Corporation Tramways, and Mr. I. E. Winslow, both gave evidence in support of the proposal, and regarded a district like Aberdare as admirably suited to the use of railless electric traction. The scheme was strongly opposed by the Taff Vale Railway Co., for whom Mr. R. Hammond gave evidence to the effect that in his opinion the receipts from these lines had been largely over-estimated, and the expenditure under-estimated. He did not think trolley omnibuses could possibly be made to pay in a place like Aberdare. The opposition of the Taff Vale Railway Co. was mainly from the point of view of competition, but objection was also taken to the trolley omnibuses using certain level crossings, which, it was argued, would be dangerous to the public. For the Council, however, it was suggested that arrangements could be easily made by which the shutting of the level crossing gates would cut off the current from the overhead line. Eventually the Committee decided to allow the Bill to proceed.

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MOTOR BOGIES

A PAPER by Mr. G. L. Drury on the construction and maintenance of the motor bogies of electric railway coaches was read before the Dublin Section of the Institution of Electrical Engineers on April 6th. After commenting upon the unusually severe stresses to which the frames are subjected on account of the high acceleration, &c., of electric trains, the author describes the three more usual types of motor bogies. The cast-steel pattern represents American practice, and has been adopted on many lines in this country. Those made up of pressed steel of channel section are slightly heavier. Bogies constructed of steel plate and angles are heavier still, and are suitable for the most severe service. The two large rectangular spaces without cross members give a bogie a tendency to twist, which is shown by the gusset plates and rivets becoming slack. Springing of the axle-box guides caused by the thrust of the motors is prevented by bringing the side frame down to a point below the centre of the guides and by tying both pairs of guides together. The most suitable wheelbase appears to be 8 feet, as any further increase reduces the angle of skew between the rail and the bogie very little. The addition of a third rubbing casting in the centre to transmit the thrust of the motor through the nose bracket directly to the centre bearing of the bogie considerably reduces the stresses on the transom. The bogie centres should be larger than is usual for carriage stock, and full provision should be made for oiling them. Axle-box guides should have detachable brass liners. The stress in axles should not exceed 7 tons per sq. in. In a certain case the stress was seldom less than 8½ tons per sq. in., due to overcrowding of the coaches, and after about 100,000 miles the axles started to fail regularly, and all had to be replaced. These axles were subjected to an additional torsional stress of over one ton per sq. in. Referring to axle-boxes, the author emphasises the importance of an oil-tight construction, stating that an axle box with an oil-well capacity of a quart should run without examination for at least two months, and for four months without oiling. Wheel centres of the solid-disc type are less noisy than spoked wheels, which are also liable to fracture. A motor tyre should not be permitted to wear down so thin as a trailer tyre. The tyre on the gear side always wears faster than that on the other side, due, probably, to the reaction of the gears driving the axle on the skew. The double gears sometimes adopted for tramway work to overcome this cannot be used in railway work, owing to the larger motors employed. Nickel-steel studs with nuts at each end are more satisfactory than bolts for split-gear wheels. An oil-tempered pinion recently introduced is said to give a life equal to that of the gear-wheel. Worn gearing does not appear to raise the current consumption appreciably, and the life is thus only limited by mechanical strength.

Turning to the motors, Mr. Drury states that the frames should be of the box type in preference to the split pattern, as the latter are difficult to keep tight together at the bearing ends. The breaking of binding wire is a serious difficulty, and the maximum coasting speed of the motors should be specified, as this is often greater than the maximum working speed. A special No. 15 S.W.G. tinned steel binding wire broke at 1,070 lb., or 118 tons per sq. in., and gave a torsion test of 30 turns on 8 miles. Flashing over at the commutator has been known to be caused by a deformation of the commutator at high speeds, which resulted in the brushes being jerked up by a projecting bar. Tightening up of the commutator will prevent this.

Finally, the author points out that reduction of the weight of the bogies is highly important. For example, a line running 3,000,000 coach miles per annum at a current consumption of 80 watt-hours per ton mile, with current at 0·5d. per unit, every hundredweight per coach of extra weight added will cost for haulage £25 per annum. Tests made to determine the difference in current consumption between a coach with a worn motor bogie and another with one newly overhauled and fitted with new bearing liners, gears, and pinions, showed that the latter resulted in a saving of 17·5 per cent. in current consumption.

DISCUSSION.

Mr. WM. TATLOW (Chairman) asked whether leakage of oil from the bearings was due to porosity of the metal. He had come across cases where leakage was not due to cracks in the casting, but to percolation through the metal. He suggested that trucks could well be built of some of the new light steels or of a new alloy of aluminium. The specific gravity of the latter was 2·8 as against 2·7 for ordinary aluminium, but it compared well with steel for strength.

Mr. P. S. SHEARDOWN (Chief Electrical Engineer, Dublin United Tramways Co.) said that heavy railway work was quite different from ordinary street tramway work, but on the latter systems they had considerable trouble due to the heavy shocks rolling stock received. On some of their American trucks they had had the rivets pull and shear off, and had found it advantageous to replace them by ordinary bolts and nuts, even though these had to be tightened up periodically. He had noticed leakage of insulating oil through the casing of transformers. The cost of energy for the working of tramway systems was an important matter. In many towns the consumption was on the increase, due to heavier cars and higher speeds. Heavy trucks tended to greater wear and tear, both of rolling stock and permanent way.

THE TELEPHONE TRANSFER

LORD DESBOROUGH was in the chair at a meeting of the London Chamber of Commerce last Thursday, when Mr. F. Faithful Begg gave an address on the coming transfer of the telephone service. The object of the address was to support the views of Mr. H. Laws Webb referred to in ELECTRICAL ENGINEERING of February 23rd, p. 98, that a public telephone authority should be established, composed of experts in the telephone business, who would be responsible for the financial result, and at the same time financially independent of the Treasury, which should be governed by representatives of the Government, stockholders, municipal authorities, and Chambers of Commerce. This would free the service from political control. He was anxious that there should be no confusion between the telegraph and telephone accounts as had occurred in the past in the Post Office Department, or that the present annual loss on telegraphs should not be put upon the telephone revenue. The telephone, he said, had never had fair play; the Post Office in its action always being governed by fear of injury to the telegraph revenue. It was pointed out that the working cost per telegram, in spite of all the improvements in telegraphy, was more now than it was 40 years ago. The ratio of the expenditure to gross revenue in the case of the Post Office telephone system was 74·4 per cent., against 58 per cent. in the case of the National Telephone Co., and, further, the Post Office only earned 3½ per cent. on capital employed, whereas the National Telephone Co. earned 8·9 per cent. Comparison was made with the working of the United States of America, and it was shown that the recent development of trunk wires in the States was nearly double that in the United Kingdom; and in regard to the telegraph stations the United Kingdom was in arrears to the extent of 2,554,000 stations. It is suggested that this difference is due to the more efficient working in the States. Considering the recent rate of progress in America, it is estimated that in the next ten years a million pounds will be required to develop the telephone in Great Britain, and this, the author contends, is far too great an undertaking for the Government in view of the provisions which would also have to be made for telegraphs, letter post, &c. In conclusion, he said the question was of the utmost importance, and unless some plan were devised other than that of transferring the whole system over to the Post Office, all development would be hindered, commercial interests vitally affected, and there would be no facilities for business and rapid communication, which were of vital importance, and the only solution to the problem is to avoid the paralysing influence of a state monopoly and to establish a telephone authority representing all interests and controlled as advocated by the London Chamber of Commerce.

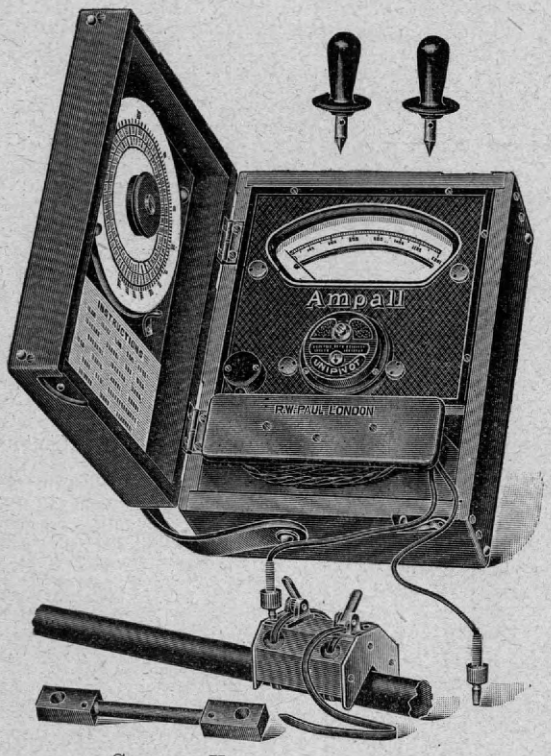
"The Central."—The May issue of the magazine of the Old Students' Association of the City and Guilds of London Central Technical College is largely devoted to Indian matters, containing articles on Indian industrial problems, life in India, and Indian railways. Other articles deal with engineering work in Mexico and South America, and there are the usual features of news regarding the college and those connected with it, and reviews of books.

Fire Protection.—Messrs. Merryweather & Sons (Greenwich) have recently put in a very complete fire protection plant at Lincoln Cathedral, consisting of one of their electrically-driven "Hatfield" pumps, with upwards of thirty new hydrants of their improved Metropole pattern. With the pump in operation sufficient pressure can be secured to enable powerful jets to be thrown from any of the hydrants, which are so distributed that a fire can be attacked in any part of the Cathedral where it may break out, whether inside or outside. The pump also gives pressure to feed a system of sprinklers which have been fixed in the south-west tower above the bells. The installation is fed from a large tank in which is stored rain water collected from the cathedral roofs. This holds some 10,000 gallons, a quantity which would supply the pump for about an hour. When the supply is exhausted the mechanism can be almost instantaneously switched on to the town mains. The pump is designed to deliver 200 gallons per minute at a pressure of 140 lbs. During official tests of the equipment, a jet of water was thrown well over the apex of the roof from the ground, and at the roof of the central tower there was sufficient pressure to reach the highest pinnacle.

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THE AMPALL

We recently had an opportunity of inspecting this instrument, designed by Mr. Robert W. Paul (33 Leicester Square, W.C.), to measure direct currents up to any value met with in practice. It comprises a millivoltmeter, a contact block with potential points and adjustable straps, and plug leads for connecting up the millivoltmeter. The latter is adjusted to read 1,000 divisions on the scale for two millivolts, and the potential points of the contact block are so spaced as to give a drop of two millivolts along a conductor carrying 1,000 amperes per square inch, so that the current density is measured directly by the deflection. To make a test the contact block is strapped to a clean part of the conductor of any shape, and connected to the instrument, then the product of the reading and the cross section (square inches) will give the current in amperes. This can be done on the round slide rule which is provided, the fixed scale corresponding to that of the millivoltmeter, and the movable disc is graduated in cross sections from 0·01 to 1 sq. in., and is also marked with the sizes of stranded cables. Low resistances, such as conductors, carbons, joints, or switch



General View of Instrument.

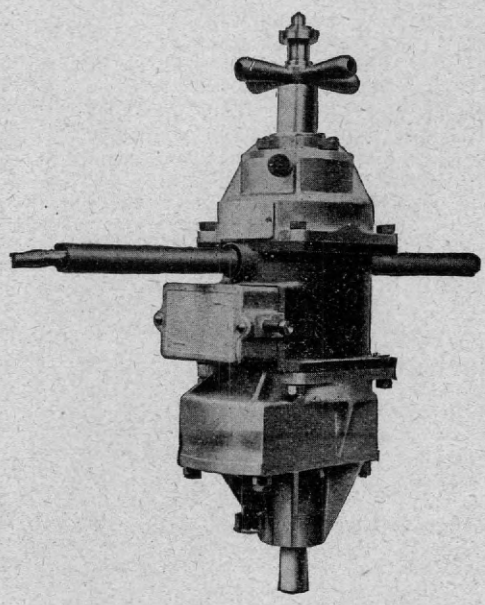
contacts, can also be measured. For this purpose, a copper resistance of 20 microhms is used as a standard, and a pair of spikes are supplied. The copper resistance is connected in series with the unknown resistance, and a steady current of about 20 amperes is passed through both. The current is then adjusted by means of a rheostat until the scale reading is 200, when the flexibles are transferred to the steel spikes which are pressed on the ends of the resistance to be measured, and the reading, divided by 10, gives the value of the resistance in microhms up to 0·00015 ohms. Should the resistance be greater, or the current unadjustable, the spikes must be pressed first on the copper resistance, and then on the unknown resistance, and multiply the ratio of the deflections by 20 and the result will give the resistance in microhms. This method is very useful for quickly testing the conductivities of contacts, joints, fuses, etc., on a switchboard. A certain length of copper on the board is taken as a standard, and the ratio of this deflection to that at the contact, joint, etc., multiplied by 20 gives the result in microhms. To extend the range tenfold, a resistance coil is provided, which can be plugged in the millivoltmeter leads.

Forthcoming Books.—The Cambridge University Press are shortly bringing out two books belonging to the series of Cambridge Manuals of Science and Literature, entitled, "Aerial Locomotion," by E. H. Harper and Allan Ferguson, and "Electricity in Locomotion," by A. C. Whyte. Both books will be published at the price of 1s. net.

ELECTRIC PORTABLE TOOLS

Amongst a list of Witton-Kramer portable tools, which has just been issued by the General Electric Co. (67 Queen Victoria Street, E.C.) is the "Runthru" drilling machine, shown in the accompanying illustration. It is a thoroughly well designed piece of apparatus, and the utility of this tool is shown by the following performance obtained under test by a $1\frac{1}{4}$ in. direct current drill.

A hole of diameter $1\frac{1}{4}$ in. and depth 1 in., was drilled in steel in two minutes, and in cast iron in half this time. Another of diameter 1 in. and depth $1\frac{1}{4}$ in. was drilled in steel in one minute twenty-five seconds, and in cast iron in one minute, and a $\frac{7}{8}$ in. diameter hole $1\frac{1}{4}$ in. deep was drilled in steel in one minute, and in cast iron in the same time. The time given is that taken to drill holes from start



"Runthru" Electric Drill.

to finish, and it will be seen that results will be more favourable in proportion as the depth is increased.

Many other drills with the single or double pillar are included for working in mines. Amongst the grinders dealt with are a tool post grinder, and a long snout grinder for external or internal work, and for commutators of large generators, and is supplied with a cross and longitudinal traverse. Various transportable equipments for grinding and drilling are also shown, and also one for tube cleaning, which provides a motor, flexible shaft, and a tube cleaning head of special design, consisting of three sets of cutters, with teeth of uneven pitch, and the head is of conical shape. The scale is attacked gradually along the conical surface, and all the cutters perform an equal amount of work. By means of springs, the cutters are enabled to pass easily round curves, and so clean the tube thoroughly. The majority of these tools can be had for an alternating supply of from 40 to 60 cycles or for direct current.

Wireless Telegraph Notes.—The Wireless Telegraph Ordinance, 1910, of British Guiana, provides that no wireless telegraph apparatus shall be worked in any place or on any British ship registered in the Colony except under licence granted by the Governor-in-Council. The wireless telegraph station at Slangkop, near Cape Town, is now working, and messages have been exchanged with vessels 1,500 miles at sea.

Electric Furnaces and the Law of Copyright.—At the Sheffield County Court on Friday, Mr. T. Scott Anderson, an electrical engineer, of Sheffield, claimed £100 damages against Verdon Cutts and Ernest Hoult for the publication of a pamphlet entitled "The Electrical Manufacture of Steel in the Verdon Cutts and Hoult Electro-Bessemer Furnace." It appears that Cutts was, until recently, in the employ of Anderson, and it was admitted that much of the information contained in the pamphlet complained of had been obtained whilst he was with Anderson, and was paraphrased from pamphlets issued by him. This fact was admitted, and Cutts and Hoult, after consultation with their legal advisers, did not defend their position. It was agreed that all remaining copies of the pamphlet should be destroyed, and £10 paid as damages, together with costs.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published May 18th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

18,869/10. **Dynamo and Accumulator Switches.** S. L. PRICE. A switch of the type in which a rotatable insulated disc is provided with a contact plate in combination with an arm rotating thereon, and carrying a contact member adapted to slide over the disc contact plate radially by centrifugal force against springs, is covered by this invention, which provides the arm with two contact carriers and two springs, one contact for cutting in the circuit at a predetermined minimum speed of the generator, and one to cut out the circuit when the speed exceeds a certain maximum. The arm is adjustable on the rotary member for adjusting the tension of the springs. Five figures.

21,359/10. **Telephonic Apparatus.** C. H. JOHNSON and A. S. JOHNSON. This invention relates to telephonic apparatus for use chiefly on board ship, where it is likely to be damaged by water. The transmitter and receiver, placed side by side, or one above the other, are each made with a front flare-ended cone in the inner end of which is inserted a plug valve for controlling the openings communicating with the diaphragms of the instruments. The valve spindle is fitted with an operating handle the rotation of which is limited by stops. The handle is spring controlled, so that nominally the valve is kept in a position, closing, and thus protecting, the openings to the diaphragms from injury from water. The apparatus can be arranged so that when the valve is closed the instruments are out of circuit. When the instruments are required a movement of the handle opens the valve and puts the transmitter and receiver in circuit. Four figures.

1,930/11. **Electricity Meters.** ALLGEMEINE ELEKTRICITÄTS GES. This relates to meters where the consumption above a certain energy is registered by means of parts which rotate in the same direction, and being driven respectively by the meter and by a constant force corresponding to a determined maximum energy, in the improved meter two registering counting mechanisms are provided, one of which continually registers by an amount corresponding to the determined maximum energy, whilst the second only increases by this amount when the consumption is below the maximum energy, whereas on exceeding this the total consumption is registered, so that the difference of the results of the counting mechanisms shows the amount in excess of the determined maximum energy. One figure.

2,249/11. **Electro-magnetic Relays.** ADAMS MANUFACTURING CO., LTD. (*Cutler Hammer Manufacturing Co., Ltd.*) In alternating-current relays, the windings, which attract a number of cores in a longitudinal direction to actuate a pivoted switch member, are by this invention made to actuate a pivoted member which carries a switch and also a number of cores. The windings are arranged on a frame of conducting material to which one terminal is connected, the other end being taken to the supply, so that each winding is connected in a different phase of the polyphase supply which energises the relay. When an abnormal current flows in the circuit the pivoted arm is actuated to open or close the switch to control the required apparatus. The pivoted member may be normally held in this position, so that its contact switch engages with the stationary contacts by a tension device adjustable to vary the conditions under which the pivoted arm is actuated by the windings. Two figures.

4,911/11. **Electric Transformers.** E. B. KOOPMAN and PONTELEC WELDING PATENTS, LTD. This patent deals with the construction of the secondary of transformers of the **U** type, for heating and welding purposes, and instead of effecting the movement of the parts by removing material from the bend and thus securing a springing action at the free ends, the secondary is formed in separate parts, each being provided with a work-holder and arranged to move in relation to the other, and so move the work-holders to and away from one another. Six figures.

5,247/11. **Cooling of Rotors.** SIEMENS SCHUCKERTWERKE GES. In providing for the cooling of cylindrical slotted rotors the conditions for effective cooling require that the air shall be brought into as intimate contact as possible with the windings to be cooled, and also that the amount of cooling air passing shall bear some relation to the heat generated at that point. Now the heat generated in these kind of rotors is a minimum about the magnetic axis, and a maximum about the axis at right angles to this, and this patent provides ventilating ducts in close proximity to the slots, which are near the axis at right angles to the magnetic axis. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: WALTERS [Stage arc lamps] 11,559/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: WESTERN ELECTRIC CO. (*Western Electric Co.*) [Hygroscopic shield for suspended conductors] 24,123/10; PAUL [Overhead transmission] 28,687/10.

Dynamos, Motors, and Transformers: VON ZWEIGBERGK [Dynamos] 10,970/10; ALLGEMEINE ELEKTRICITÄTS GES. [Compensation of polyphase commutating machines] 26,685/10; HOLT [Dynamo machines] 26,880/10; SIEMENS BROS. DYNAMO WORKS (*Siemens Schuckertwerke Ges.*) [Power factor of repulsion motors] 27,170/10.

Electric Ignition: PRESTWICH [Electric ignition of miners' lamps] 26,892/10; FLETCHER [Magneto machines] 2,436/11.

Electrometallurgy and Electrochemistry: SEWARD, VON KUGELGEN and VON BIDDER [Electrolytic production of light metals, particularly sodium] 11,175/10; FUSS [Ozonising apparatus] 2,618/11; BRAUN and SCHNEIDER [Galvanic gas cells] 25,879/10.

Heating and Cooking: MURRAY [Electric radiators] 11,013/10.

Incandescent Lamps: HARRISON [Manufacture of] 10,869/10; CARANGELO, 21,740/10.

Instruments and Meters: H. ARON ELEKTRIZITÄTSZAHLERFABRIK GES. [Prepayment electric meters] 3,450/11.

Switchgear, Fuses, and Fittings: ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Circuit controllers] 10,772/10; KESSLER and KESSLER [Magnetic separators] 18,253/10; JAHDE [Lamp reflectors] 13,931/10; CROSSLEY and HAMER [Cord grips for lamp-holders] 11,385/10; WIDMER [Waterproof protector for electric lamps] 24,909/10; CROMPTON & CO., MACFARLANE, BURGE and WILLIAMS [Regulating electric driving systems] 29,728/10; BROWN and TRAPAGNA [Switches for lamps of illuminated signs] 1,370/11.

Telephony and Telegraphy: MARCHANT [Telephonic transmitters] 24,390/10; SIEMENS and HALSKE AKT.-GES. [Automatic exchange circuits] 2,733/11.

Traction: MUNRO and RAILLESS ELECTRIC TRACTION CO. [Trolley poles] 11,157/10; [Electric traction systems] 17,874/10; HEISSE and SCHULTE [Elevated cable traction] 355/11.

Miscellaneous: LEMMENS [Thermopiles] 8,559/10; LIDDLE [Motor-driven capstans] 10,748/10; BOULT (*Rumely*) [Carburetters] 20,421/10; ELEKTROMECHANISCHE WERKE GES. [Rectifiers] 27,060/10; GODFREE [Electro-mechanical selector] 10,706/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, &c.: MENDIZABAL and BERTRAND [Motors] 20,143/11.

Electric Ignition: MAHER [Spark plugs] 7,108/11.

Telephony, &c.: TELEPHON APPARAT FABRIK, E. ZWICTUSCH & CO. GES. [Automatic telephone exchanges] 10,238/11.

Electrochemistry, &c.: PÖRSCKE and ACHENBACH [Secondary cells] 9,944/11.

Miscellaneous: ALLGEMEINE ELEKTRICITÄTS GES. [Coin feed mechanism] 9,942/11.

Opposition to Grant of Patents

16,328/09. **Tungsten Filaments.** C. H. WEBER. This patent has been granted in spite of the appeal referred to in ELECTRICAL ENGINEERING, Sept. 8th, 1910, p. 582, but no amendment is allowed. An abstract of this patent appeared in ELECTRICAL ENGINEERING, Jan. 6th, 1910, p. 16.

28,274/09. **Electrical Fans.** A. H. MIDGLEY and C. A. VANDERVELL. This patent has been granted in spite of opposition, and covers an economical method of constructing the blades to give a high propelling efficiency uniformly over the area traversed by the fan.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: F. M. LEWIS, 2,609/03; D. BALLARDIE [Lamps burning solid hydrocarbons] 2,050/05.

Distribution Systems, &c.: H. H. LAKE (*C. A. Gould*) [Electric distribution] 2,403/03.

Dynamos, &c.: W. A. JOHNSON [Electric dynamos] 2,339/05; M. W. W. MACKIE [Electric dynamos] 2,364/06.

Instruments, &c.: BRITISH THOMSON-HOUSTON CO., LTD., and F. HOLDEN [Electricity meters] 2,039/05.

Switchgear, &c.: W. E. GROVES [Electric junction boxes: couplings: and cut-outs] 2,512/04; A. W. TURNER, H. J. PEERS and H. J. W. RIDLEY [Relays for wireless telegraphy] 2,485/06; E. G. ANNESS and C. W. DENNY [Electric cut-outs] 2,777/06.

Telephony, &c.: SIEMENS BROS. & CO. (*Siemens and Halske Akt.-Ges.*) [Telephone systems] 2,266/05.

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ELECTRIFICATION OF THE CRYSTAL PALACE SECTION OF THE LONDON BRIGHTON AND SOUTH COAST RAILWAY

DURING the past fortnight the Press has published many articles with regard to the extension of the L.B. and S.C. Rly. to the Crystal Palace, all couched in strong language of approval and appreciation of the action of the Directors, the eminently successful work of the Company's Electrical Adviser, Mr. Philip Dawson, and the thoroughness of the overhead construction, &c., carried out by Messrs. R. W. Blackwell & Co., and the good working of the Winter Eichberg motors. We heartily endorse all that has been said, and the praise is none the less sincere for the fact that the articles in question are all based on a pamphlet issued by the Railway Co. and written in such a way as to show that the Company are thoroughly satisfied with the work of their advisers and contractors. But there seems to have been practically no reference to one of the most important factors which has contributed to the success of the whole scheme, viz., the supply of current by the London Electric Supply Corporation. We recently published two long articles by the Company's engineer-in-chief, Mr. G. W. Partridge, describing the system of generation and supply, and those who have read these articles will agree that this part of the work is by no means negligible. The variations of load are considerable, as may be gathered from inspection of the diagram in Mr. Partridge's article, and on a system such as this there are always a certain number of heavy short circuits, which have caused considerable trouble in the generating stations of single-phase railways abroad. The Brighton Company, however, have had the benefit of the London Electric Supply Corporation's twenty years' experience to assist and to guide them, and the result has not only been an immunity from breakdown, but also a constancy of pressure, which has had a great deal to do with the success of the system and the proper working of the motors. Any variations of load called for by the Brighton Company (and they have not been inconsiderable) have always been coped with by the boiler plant at the supply station.

We feel compelled to put in a word for the Supply Company, as this is, with the exception of the Heysham line, in which the conditions were comparatively simple, the first large electric installation for supplying single-phase current for traction purposes in this country; and we think that the excellent results obtained by the Company, which have spared no expense in bringing their plant to perfection, should be accorded more than passing recognition.

ELECTRIC LIGHTING FOR MOTOR CARS

A PAPER entitled "The Electric Lighting of a Motor-car" was read by Mr. A. G. New at the Royal Automobile Club on May 10th last. The author emphasised the advantages of electrical over other methods of lighting for motor-cars. For a complete equipment, two lamps of from 16 c.p. to 32 c.p. were needed for the headlights, with two side lamps of 4 c.p. to 9 c.p., and interior and back lamps of 4 c.p. each. It was, however, seldom necessary to have head lamps and side lamps on at the same time. Thus for travelling in open country some 72 c.p. is necessary, and for standing idle about 16 c.p. These outputs are rather large for batteries of moderate size to maintain for any great length of time, and the author regards a self-containing means for charging the battery as practically essential. Quite a small battery can then be carried. The various dynamos which have been designed and put on the market were then considered. Some are merely modified from the constant speed form of construction by having permanent field magnets. These make no direct attempt to obtain any very close approximation to a constant rate of charge at all speeds, though they reduce the degree of deviation sufficiently to permit of full range use. Others still retain the old constant speed characteristics, but are furnished with mechanical-governor contrivances of one sort or another which either control the speed of the dynamo (friction-clutch fashion) so that it does not attain a high speed, whatever the engine may do that drives it, or which cut it out of action when its speed exceeds that which can safely be used. Others, again, are so constructed electrically that they automatically tend to keep down their powers of generation and thus aim at constant current production irrespective of speed. Just as there are numerous methods in vogue for regulating the output of the dynamo to prevent overrunning and to give it variable speed characteristics, so quite a number of different principles have been adopted to cut the dynamo in and out of circuit at minimum speed. Some are mechanical, taking the form of switches, operated by a governor mounted upon the revolving shaft; others are electrical in their action, controlled by the current itself passing through electromagnets that actuate the necessary contact-making arm; and there is one well-known system in which the use of any automatic cut-out at all is dispensed with by the employment of a free wheel clutch which permits the dynamo to continue revolving as an electric motor driven by the battery when otherwise it would be brought to rest while still in circuit, and so caused to consume a very undesirable amount of current. The author was in favour of the control being as automatic as possible. Further points dealt with included the method of fitting these dynamos to existing cars, and very satisfactory experience with some of these car lighting systems was recorded.

THE POST OFFICE AND THE TELEPHONE SYSTEM

IN asking the House of Commons on Thursday to vote £21,082,445 for the purposes of the Post Office during the coming financial year, an increase of 1¼ millions over last year, the Postmaster-General pointed out that this large growth was chiefly due to the taking over of the National Telephone Co. at the end of the present year. The working expenses of the company's system for the first quarter of 1912 would amount to £480,000, whilst the preliminary expenses in relation to the purchase of the plant would bring this sum up to £798,000. The remainder was accounted for by an enormous increase in Post Office work.

Speaking of the future of the telephone system, Mr. Samuel said he proposed to introduce within the next few weeks a Telephone Transfer Bill, which would give an opportunity for the whole policy regarding the telephone system of the country to be discussed. After pointing out that the number of Post Office telephones had increased by 13 per cent. during the past year, and the number of trunk conversations by 13 per cent., and referring to the laying of the new cable between England and France in which loading coils were made use of (ELECTRICAL ENGINEERING, Vol. VI., March 17th, 1910, p. 179), the Postmaster-General alluded to a scheme for promoting the use of the telephone among farmers. He is offering to instal telephones in farming districts upon an unlimited rate of £3 per annum on the party line system, where there are not less than five subscribers to each line. A large number of agricultural societies heartily support this reform, and there is every prospect of a big development in this direction.

Dealing with wireless telegraphy, a word of praise was given for the wisdom of Mr. Samuel's predecessor in purchasing the coast stations from the Marconi Co. and Lloyd's. During the past year the number of British ships equipped with wireless telegraphy has increased from 130 to 290. It is proposed to establish a new station near Newcastle to deal with the North Sea, and another on the Isle of Valentia in connection with the increasing traffic in the south-west of Ireland.

ARRANGEMENTS FOR THE WEEK

(TO-DAY), THURSDAY, MAY 25TH.

Electro-Harmonic Society.

6.30 p.m. Annual general meeting at Institution of Electrical Engineers, Victoria Embankment.

National Telephone Co.

7 for 7.30 p.m. Annual Dinner at Hotel Cecil.

Institution of Electrical Engineers.

8 p.m. "The Heating of Cables with Current," by S. W. Melson and H. C. Booth.

FRIDAY, MAY 26TH.

Physical Society.

3 p.m. Visit to National Physical Laboratory.

Institution of Electrical Engineers.

4.30 p.m. Annual General Meeting.

SATURDAY, MAY 27TH.

Association of Mining Engineers.

3.30 p.m. *Notts and Derbyshire Branch.* Annual meeting at University College, Nottingham. "Some Notes on the Use of Turbine Pumps in Collieries," by R. H. Willis.

5.30 p.m. *Warwickshire and S. Staffs. Branch.* At Imperial Hotel, Birmingham. Discussion on the New Rules relating to Electricity in Mines.

MONDAY, MAY 29TH.

University of London.

5.30 p.m. At Institution of Electrical Engineers. Lecture I. :—"The Application of Hyperbolic Functions to Electrical Engineering Problems," by Dr. A. E. Kennelly.

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CATALOGUES AND PAMPHLETS RECEIVED

INSTALLATION MATERIAL.—A pamphlet in German from the Allgemeine Elektricitäts-Gesellschaft gives an interesting account of the principal features of the installation material supplied by the firm from the point of view of safety, convenience, and economy.

BOOKS.—Messrs. W. & G. Foyle (135 Charing Cross Road, W.C.) send us a copy of their catalogue of technical and other literature and reference books, nearly all of which are duplicated with second-hand copies.

CARBON FILAMENT LAMPS.—We have received from the British Thomson-Houston Co., Ltd. (Rugby), a pamphlet giving the prices per dozen of their surplus stock of carbon filament incandescent lamps. They are fitted with E.S. or C.C. terminals, but they can be re-capped with standard bayonet caps without extra charge. A reduction of ¼d. per lamp is made for 500 lots in one delivery, or ½d. per lamp for 1,000 lots in one delivery, and for minimum lots of 25 in one delivery, any of the lamps can be frosted and artificially coloured red, blue, green, amber, or opal. All orders will be treated in rotation. The same firm send an illustrated list of electric illuminated devices for the Coronation.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

MOTORS AND DYNAMOS.—We have received from Messrs. Wright & Wood (Century Works, Halifax) their latest price sheets relating to D.C. motors and dynamos, and two or three phase induction motors. In many cases, owing to improved design and the large quantity manufactured, the prices have been reduced.

ALUMINIUM.—The British Aluminium Co., Ltd. (109 Queen Victoria Street, E.C.), have sent us a leaflet with instructions for polishing, satin finishing, and frosting aluminium.

PRIMARY BATTERIES.—A fully illustrated booklet has been issued by The India-rubber, Gutta-percha & Telegraph Works (Silvertown, London, E.) dealing with Leclanché cells chiefly of the agglomerate type, which they have improved by using six agglomerate blocks. The usual types of Poggendorf, Bichromate, Bunsen, Minotti, Grove, and Daniell cells are shown, and also the Bleeck-Love battery, which has an E.M.F. of 2·7 volts, a low internal resistance, great current capacity, and is very constant under varying loads. Two of the cells on one charge will run a 7-in. fan for 36 hours, or will light a 4-volt 4-c.p. lamp for 18 hours, or charge a 20-ampere hour 4-volt accumulator in 16 hours.

GUTTA-PERCHA, INDIA-RUBBER, WIRES, &c.—The same firm also sent a price list of gutta-percha, india-rubber, silk, and cotton-covered wires, jointing tools, and materials.

SWITCHBOARDS.—A copy of a catalogue of the Witton switchboards is to hand from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), describing and illustrating their standard switchboards, and also a number of separate panels. Customers can therefore purchase either a complete switchboard, or the panels, which can be assembled to form the switchboard, or in conjunction with the firm's meter (m) and switchgear (x and y) sections of catalogues, the switchboard can be built up.

TRANSFORMERS.—The Foster Engineering Co. (Morden Road, Wimbledon, S.W.), who were so successful some years ago with the small type of "Foster" transformer, have issued a leaflet illustrating the larger units which they are now making a special feature of. A 35 kw. three phase, 40 cycles, primary 2,500 volts, secondary 220 volts, also a 50 kw. single phase, 50 cycles, primary 2,000 volts, secondary 100, 200, or 400 volts, both being air cooled and double wound, are shown. The types made are step-up or down, single or poly-phase (air, water, or oil cooled), stationary or portable, either to the firm's design or to the specification of their clients.

SOLDERING MATERIALS.—A pamphlet from Bi-metals, Ltd. (30A Southwark Street, S.E.), contains a reprint of an article by Mr. A. H. Hiorns on solders, which calls special attention to the combined solder and flux known as "Tinol."

SUPPLY ADVERTISING.—Several new circulars are to hand from the Electric Supply Publicity Committee. These include a series of leaflets on electric service for printers, bakers, electroplaters, sawmills and woodworking shops, and engineers' workshops respectively. Other leaflets are addressed to builders, landlords, and property owners. Further pamphlets are entitled "Electric Light: The Safe Light," and "Electricity in the Nursery."

LOCAL NOTES

Bradford: *Tramway Accounts.*—The Corporation's tramways accounts for the year to March 31st show a net profit of £39,374, an increase of £7,010 over the previous year, which was itself a record. The sum of £22,000 is to be paid over to relief of rates.

Brighton: *Trolley Omnibuses.*—Although the Brighton Corporation were refused permission by the House of Lords Committee to oppose the preamble of the Brighton Railless Electric Traction Bill, which has passed, authorising the Brighton, Preston and Hove Omnibus Co. to run trolley omnibuses between Brighton and Rottingdean, a petition is to be presented in Parliament in opposition to the Bill when it comes before the House of Commons Committee.

Canada: *Toronto Power Scheme.*—The Toronto municipal electric light and power scheme was inaugurated last week. The municipality take current from the Ontario Government power plant at Niagara. It is stated that one effect of the municipal competition has been to force the Toronto Electric Light Co. to discontinue charging meter rates.

Utilisation of River St. Lawrence.—It is stated that the Canadian Light and Power Co. propose to dam the River St. Lawrence in order to utilise the water for the generation of electrical energy. The proposed spot for the dam is at the head of the river at the rapids, and the works contemplated involve an expenditure of between £3,000,000 to £4,000,000. A Government Commission is to be appointed to investigate the scheme.

Ceylon: *Electric Supply.*—The Government technical advisers have been investigating the possibilities of the Elfindale Falls in the Lower Maskeliya district, with a view to their utilisation for supplying electric power for all Government purposes in Colombo.

Clitheroe: *Lighting Order Revoked.*—The Board of Trade have revoked the Clitheroe electric lighting Provisional Order granted in 1904.

Coventry: *New Plant.*—A new 3,330 k.v.a. two-phase fifty-period turbo-alternator, with direct-coupled exciter, which has been supplied by the British Thomson-Houston Co., Ltd., of Rugby, has been put into operation. An additional set of the same capacity will be installed by September.

Dundee: *Tramway Accounts.*—The gross revenue from the tramways for the year ended May 15th was £61,522, which is an increase of £213 over the receipts for the previous year. The number of passengers carried, viz., 17,032,500, was an increase of 188,591. The Tramway Manager has been requested by those hitherto using the workmen's cars to reconsider the decision for a universal penny fare, but as this new system has been fixed for one year, he is unable to open the matter.

Exeter: *Electricity Accounts.*—There is a net surplus from the past year's working of the electricity department of £2,333 after meeting capital charges. The Electric Lighting Committee recommend that the charge for current for lighting to private consumers be reduced from 4½d. to 4d. per unit.

Meters on Tramcars.—The Tramway Manager calculates a saving of £467 last year by the use of meters on the cars.

Glasgow: *Electrification of Subway.*—It is stated that a London company is negotiating for acquiring the Glasgow Subway with the view of converting it to electric traction, and at the same time constructing two additional tubes.

Grimsby: *Electricity Accounts.*—The net profit from the electricity undertaking for 1910 amounts to £4,586, an increase of £700. The works' cost per unit have been reduced to 0·871d., which is the lowest yet achieved since the opening of the works. The Electricity Committee recommend that £500 be contributed to the rates and the balance transferred to reserve fund. There was an increase in the supply of energy for power purposes during the year of over 30 per cent., the motors connected to the mains now amounting to 1,298 h.p.

Hastings: *Dolter System.*—The Hastings and District Electric Tramways Co. have been petitioned by four thousand ratepayers to substitute the overhead trolley system for the Dolter surface contact system along the sea-front. The Company have written to the Corporation stating their willingness to promote a Bill with this object in view, but before doing so they ask for the Corporation's comments upon the proposal.

India: *Electric Lighting.*—A scheme for the electric lighting of Lahore is under consideration. The proposal comes from a private company.

Leicester: *Extension of Electric Lighting Area.*—The Corporation Electricity Department is canvassing all the outlying districts with a view to extending their mains.

London: *Meter Testing.*—In January, 1907, the London

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County Council made new rules and fixed a scale of fees with regard to the testing of electricity meters. These rules have not yet been approved by the Board of Trade, and the Highways Committee have therefore taken the opportunity of revising them with a view to enabling the Council to charge reduced fees in respect of meters submitted in batches at the same time by an owner or firm, or in other exceptional circumstances. In connection with the general question of testing, in October, 1910, a new order was proposed by the Board of Trade in pursuance of section 11 of the Electric Lighting Act, 1909, and of the substituted section 50 of the schedule of the Electric Lighting (Clauses) Act, 1899, defining the limits of error to be allowed for electricity meters. A conference, at which the County Council was represented, was subsequently convened by the Board for the purpose of discussing the proposed order. As an outcome of this conference and subsequent consideration of the matter, the Board on March 8th, 1911, forwarded a copy of the rules and scales of fees submitted by the Council in January, 1907, as amended, including the provision of the Board's proposed new order, and several smaller points which had arisen during the course of the discussion, and the Council are now asked to approve of these.

L.C.C. Trams.—In presenting their estimates with regard to the tramway system for 1911–12, the Highways Committee call attention to the competition of motor omnibuses and the favourable conditions under which these companies are able to carry on their business compared with tramways. Whereas the omnibus companies pay nothing for the use of the roads nor for their upkeep, it is calculated that the rating of the tramways in London represents an average relief to the rates of over ½d. in the £. Again, the cost of maintaining the whole of the track by electric tramway authorities is regarded as inequitable, in view of the fact that, unlike the old horse-cars, in connection with which this system first came into use, electric cars entail no wear and tear except upon the rails, nor any expense in cleansing. Neither do the omnibus companies grant cheap workmen's fares. Whilst no definite suggestion is made in this connection, the Highways Committee ask the Council to bear these facts in mind when making comparisons. The net profit on the Council's undertaking for 1911–12 is estimated at £187,844 after meeting capital charges and interest, and after transferring the full allowance to renewals fund, a balance of £49,574 is added to general reserve. The total capital expenditure to date is £11,600,000, and it is estimated that a further sum of £2,400,000 will be required to complete the work of electrification and the construction of authorised lines.

Marylebone: Sales Department.—At last Thursday's meeting of the Marylebone Council, Councillor Duncan Watson complained that the Electricity Department had undertaken the wiring of a building in course of construction in Portland Place, and that as the building would have had to be wired in any case, the work should have been left to an electrical contractor. In the course of the discussion Councillor Hopkins, Chairman of the Electricity Committee, stated that the cost of wiring would be about £2 per point. A motion, prposed by Councillor Fettes, that the Electricity Committee should direct their officers not to undertake installation work in buildings in course of construction without the express approval of the committee, was accepted by the Chairman of the Electricity Committee and agreed to.

Norwich: *Proposed Purchase of Tramways.*—A committee has been appointed to consider the offer of the Norwich Electric Tramways Co. to sell their undertaking to the Corporation.

Truro: *Electric Lighting.*—The Town Clerk has been instructed to inform Mr. Swarbrick, of Leigh (Lancs), that the Council are not prepared to allow him to submit a scheme for supplying electricity in the district. Messrs. J. B. Saunders & Co., who have the scheme in hand, have asked the Council to guarantee them the public lighting for a term of years.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Derby.—A Local Government Board inquiry was held on Thursday concerning a loan of £8,500 for electrical extensions.

Devonport.—Tenders are invited for a twelve months' supply of direct-current meters, paper insulated cables, rubber-covered wires, and general engine-room stores.

Greetland.—The Council, which is being advised by Mr. W. Emmott, has a scheme of electric supply under consideration. It is possible that a supply will be given by the Yorkshire Electric Power Co.

Heckmondwike.—A Local Government Board inquiry was held last week concerning a loan of £4,159 for electrical extensions. This amount is made up as follows, condensing plant £3,000, cables £1,013 10s., service and mains £200.

In putting the Council's case before Mr. H. R. Hooper, the inspector, the Town Clerk stated that although £40,000 had been spent upon the undertaking, only half that sum had been authorised. The inspector expressed his dissatisfaction with the method of carrying on the undertaking, and, in going through the items of excess expenditure, took exception to a large number of them, and struck off £2,950.

Hemsworth.—An electric lighting installation is required for the new Hippodrome. Architect, W. E. Richardson, Rothwell, Leeds.

London: *Hackney.*—Mains extensions, at an estimated cost of £267, are recommended.

Loughborough.—A Local Government Board inquiry was held last week concerning a loan of £2,310 for extensions at the generating station. The Town Clerk asked for the loan to be repaid in thirty years, but Mr. T. C. Ekin, the Inspector, refused to recommend such a long period. Attention was called by the Inspector to the fact that the Borough Electrical Engineer, a salaried officer, was to receive consulting engineer's commission at the rate of 5 per cent. on the capital outlay, but he was informed that the Council's view was that the engineer could not be expected to design extensions at his ordinary salary.

Mansfield.—A Local Government Board inquiry was held last week concerning a loan of £4,000 for electrical extensions. The extensions include an additional generating set.

Oulton Broad—The Council have had a report prepared by a consulting engineer upon the proposal of the East Anglian Ice Co., to supply electricity in the district from a generating plant on the company's premises. It had been proposed to apply to the Local Government Board for a loan of £4,000, but at the last meeting it was decided to refer the matter back to the Electric Lighting Committee for further consideration.

Rotherham—An inquiry was held last week into an application by the Corporation for sanction to borrow £27,837 for electric extensions.

Russia.—According to the *Board of Trade Journal*, a British electrical engineer has applied for permission to promote a scheme for utilising some of the river and lake waters of the Highland districts of the Caucasus for the generation of electricity. A Technical Commission appointed by the Russian Government have approved of an undertaking of this character, and have prepared conditions under which a concession should be granted. The name of the engineer and the London address of the firm of which he is a member may be obtained by British manufacturers at 73 Basinghall Street, E.C.

Uruguay.—A Bill has been promoted by the Government for an expenditure of 115,000 pesos upon an electric light and power installation at the Monte Video harbour.

Wood Green.—An electric lighting scheme at an estimated cost of £20,000 is under consideration. A poll of the ratepayers is being taken to ascertain what support the scheme is likely to receive.

WIRING

Belfast.—Offices and stores for the Belfast Mineral Water Co. Architects, Moore & Flannigan, 35 Royal Avenue, Belfast.

Electric lighting of two villas on Purdysburn Estate. Asylum Committee. Tenders to Town Clerk by June 12th.

Falkirk.—Re-erection of premises for the Camelon Co-operative Society.—Considerable additions to Camelon fever hospital.

Glasgow.—Granary for Clyde Navigation Trust at Partick.

Leith.—Proposed elementary school at North Junction Street.

London.—New County Council fire station at Shooter's Hill.



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It is stated that the London County Council will invite tenders from selected firms for the wiring and fitting of the new County Hall, and will not invite open tenders.

Maidstone.—Tenders have been accepted for the erection of new county offices.

Southampton.—Electric lighting of Great Hall at County Council Offices.

Swansea.—Three new elementary schools.

MISCELLANEOUS

Beckenham.—The Local Government Board have sanctioned a further loan of £5,000 for free wiring.

Grimsby.—The Council invite tenders for the electric lighting of all public streets not lighted by electricity. Particulars from the Borough Surveyor.

Stepney.—The Electricity Supply Committee invite tenders for meters, demand indicators, timeswitches and carbons. (See an advertisement on another page.)

TENDERS RECEIVED AND ACCEPTED

Argentine.—Messrs. Drummond Brothers, Ltd., of Guildford, are supplying the State railways with one of their universal machines for turning, boring, drilling, screw-cutting, milling, and gear-cutting, known as the "Drummond-Barreto."

Greenock.—The Electricity Department have placed the following contracts in connection with the extension to Dellingburn power station: 2 water-tube boilers with chain-grate stokers, also coal and ash bunkers and conveying plant, Babcock and Wilcox; one 2,000-kw. turbo-alternator with condensing plant, and 500-kw. rotary converters, British Westinghouse Co.

Gloucester.—The following tenders are recommended for acceptance. Steam turbo-generator, Willans & Robinson, £3,498; motor-generator, Phœnix Dynamo Manufacturing Co., £394; switchgear, British Westinghouse Co., £138.

Hindhead.—The D. P. Battery Co. have secured the contract for a new battery at the power station of the Hindhead and District Electric Light Co., Ltd.

Leek.—The tender of Messrs. Crompton & Co. has been accepted for the extensions of the switchboard at £65.

London.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained the contract for the illumination of the Piccadilly Hotel. The wiring will be carried out by Messrs. Duncan Watson and Co.

London: *L.C.C.*—The following tenders have been received for the supply of electrical fittings for the second section of the Bow car-shed and the third section of the Hammersmith car-shed:—Brecknell, Munro & Rodgers, £76 18s. and (alternative) £83 6s.; Estler Bros., £81 7s.; W. Wood & Co., £90 6s.; A. Wiseman, £91 3s.; Dick, Kerr & Co., £95 19s.; British Insulated and Helsby Cables, £108 16s. The first tender has been accepted.

APPOINTMENTS AND PERSONAL NOTES

Mr. George Tate, who has fulfilled the position of Works Manager to Messrs. Arc Lamps, Ltd., for the ten years since the Company's formation, has now severed his connection with them. Communications for Mr. Tate should be addressed to 3 Blenheim Road, St. Albans.

Mr. H. W. Butler has resigned his position as Chief Engineer to the Electrical Power Storage Co., Ltd.

Automatic Electric Fire Alarm Systems.—An amalgamation is to be effected between the Pearson Fire Alarm, Ltd., and the May-Oatway Appliances, Ltd., and for this purpose both companies are to be wound up voluntarily.

Osram Lamps.—We are informed by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.) that the ironclad *Verité*, upon which the President of the French Republic shortly starts upon his voyage, is entirely illuminated by Osram lamps.

Yorkshire Local Section of the Institution of Electrical Engineers.—At the annual general meeting of the Yorkshire Local Section of the Institution of Electrical Engineers, held last week, the following gentlemen were elected for the ensuing session. *Chairman:* Mr. T. Harding Churton (second year of office); *Vice-Chairmen:* Wilson Hartnell (second year of office), and Walter Emmott; *Honorary Secretary:* H. Dickinson; *New Members of the Committee:* Messrs. G. D. A. Parr, H. Visger, W. N. Y. King, and E. S. Rayner. At the meeting sympathetic reference was made by the chairman to the death of Sir Nathan Bodington, Vice-Chancellor of the Leeds University, and a vote of condolence passed to Lady Bodington in her bereavement.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 15s. to £57 5s. per ton (last week £55 15s. to £56 5s.).

Westinghouse Turbo-Plant.—The British Westinghouse Electric and Manufacturing Co. (Trafford Park, Manchester) call our attention to the fact that they are now fully equipped for supplying complete lines of turbo-generators, turbo-compressers, blower pumps and auxiliaries, without the necessity for subcontracting.

Carbon Lamps for Illuminations.—The Electrical Co., Ltd. (122–124 Charing Cross Road), are making a special offer of large quantities of standard quality of carbon lamps at 3s. 4d. per dozen.

Canadian Agency.—A well-known firm, manufacturing electrical insulators in stone-ware and porcelain, also conduits, cable racks, etc., for electric power stations, requires the names of Canadian importers. Further particulars can be obtained from the Board of Trade Intelligence Department, 73, Basinghall Street, E.C.

Liquidation.—A meeting of creditors of the Australian Electrical Co., Ltd., will be held at 20 Copthall Avenue, London, E.C., on May 29th, at 3 p.m. Notices of claims should be sent to E. Pears at the above address not later than June 20th.

Bankruptcies.—The first meeting of creditors in the bankruptcy of J. D. Carlmark, electrical engineer, 402 High Street, West Bromwich, will be held on Friday next, at 191 Corporation Street, Birmingham, at 11.30 a.m. The public examination will be held on June 2nd, at the Law Courts, West Bromwich, at 10.30 a.m.

The last day for receiving proofs in the bankruptcy of W. H. Illingworth, trading as the Yorkshire Metal Filament Lamp Co., Halifax and Leeds, is May 31st. The trustee is W. Durrance, 12 Duke Street, Bradford.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Hastings & District Electric Tramway Co.—The scheme for reducing the capital of this company by writing down £4 10s. each on the ordinary shares has been sanctioned by the courts.

Bergmann Electrical Co.—At the annual meeting of this company, which was recently held in Berlin, it was stated that the patent action with the "Z" Lamp Co. had cost them 150,000 marks. It will be remembered that the "Z" Lamp Co. proceeded against Messrs. Marples, Leach & Co. (now the Adnil Electric Co.), as agents of the Bergmann Co., for infringement of certain of their metal filament lamp patents, and succeeded.

Johnson & Phillips.—The accounts for 1910, after charging £5,337 for maintenance of buildings, plant, &c., show a net profit of £24,117. After writing off sums for depreciation, &c., the balance of £2,154 is carried forward. The net profit shows an increase of £7,815 over the previous year.

Waste Heat and Gas Electrical Generating Stations.—An issue is being made of 160,000 £1 shares at 21s. per share. The new capital is required in connection with the construction of the new power stations which the company's expanding business have rendered it necessary to erect.

Torquay Tramways Co.—An issue is being made of 60,000 5 per cent. prior lien debentures at 95. This capital is required in connection with the reconstruction of the tramways for the overhead traction, and also for the extensions to Paignton.

The Lots Road Turbines.—Before a Divisional Court yesterday, consisting of Mr. Justice Pickford and Mr. Justice Lush, the British Westinghouse Manufacturing & Electric Co., Ltd., sought to have set aside the award of the Hon. Alfred Lyttelton, K.C., in the arbitration between the company and the Underground Electric Railways Co. of London, Ltd. It will be remembered that the original Westinghouse turbines installed in the Lots Road power station did not fulfil the contract conditions, and it was agreed that they should be displaced by Parsons machines. Arbitration was resorted to in order to determine the basis upon which the Underground Co. should be paid. After a direction from a Court consisting of the Lord Chief Justice, Mr. Justice Hamilton, and Mr. Justice Avory, the arbitrator decided that the Underground Railways Co. should be paid the full price of the Parsons machines, plus the cost of the difference between the actual steam consumption of the Westinghouse machines and the contract figures during the time these turbines were running. The Westinghouse Co. contest this on the ground that it is a misconstruction of the Arbitration Acts. When the case came on yesterday, their Lordships intimated that they would feel bound to adopt similar views to those expressed by the Lord Chief Justice and Justices Hamilton and Avory, and in the circumstances it was agreed to take the case direct to the Appeal Court.

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ELECTRICAL ENGINEERING

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ELECTRICAL ENGINEERING.

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SUMMARY

Our monthly Supplement on Electrical Engineering in Mines is included in this issue. It opens with a report of a Paper by Mr. H. J. S. Heather on the driving of winding engines by induction motors, discussed at a recent meeting of the Institution of Electrical Engineers. Notes are given of the principal patents relating to electrical mining work published during May, and attention is drawn to some of the exhibits at the recent mining exhibition in Manchester. A publication on modern mining switchgear is reviewed, and a short article deals with a new system of electric winding. Notes are also given on some recent accidents. An illustrated article gives particulars of some new mining switches, and a report is included of a meeting of one of the Scottish branches of the Association of Mining Electrical Engineers.

The annual meeting of the Institution of Electrical Engineers was held last Friday, when the premiums &c., awarded were announced. The Council have under consideration the holding of informal meetings and of provincial summer meetings, and arrangements for the giving of special lectures at ordinary meetings. The holding of examinations for associate membership has been decided upon, and increases in the subscriptions and entrance fees are contemplated. (Page 305.)

The next action brought by the Osram Lamp Works, Ltd., for alleged infringement of their patents, will be against the "Z" Electric Lamp Manufacturing Co., Ltd., and may be expected to come on after the long vacation. An application in the Chancery Court on Friday showed that the latter Company is anxious that the action should be brought against the Company itself, and not against its agents or customers. (Page 305.)

Among the specifications published by the Patent Office on Thursday last was one by W. Walters, for a means for rendering stage arc lamps independent of one another in the circuit, and one by W. J. Marchant relating to an improved telephonic transmitter to increase the efficiency of the receiver in combination with it. The following patents expire after a full life of fourteen years: C. O. Bastian, dealing with electrolytic meters; G. Page, describing electric switches; two by the British Thomson-Houston Co. (E. D. Priest, New York), on motor controllers and open-circuit controllers, and another by the same firm covering an induction motor meter. (Page 306.)

Judgment was given on Monday on the two preliminary points raised in connection with the transfer of the National Telephone Co.'s business to the State. Two members of the Railway and Canal Commissioners gave judgment in favour of the Company in regard to the meaning of the word "unsuitable," holding that it only related to the character and quality of the plant and not to the quantity. The same two Commissioners also held that part of the notices of objection to plant given by the Postmaster-General was good and part bad. The third Commissioner, however, dissented on all points, holding that the whole of the notices were good, and that the word "unsuitable" had a quantitative as well as a qualitative meaning. As the majority of the Commissioners gave judgment in favour of the Company on all matters except one set of notices, the Postmaster-General is appealing against their decision. (Page 307.)

A correspondent refers to the origin of the governors referred to in Mr. Partridge's recent article on the single-phase plant supplying the L.B. & S.C. Railway. (Page 307.)

At the seventeenth annual staff dinner of the National Telephone Co., the Rt. Hon. Herbert Samuel, Postmaster-General, spoke of one or two new clauses to be shortly introduced by him in the Telephone Transfer Bill in the House of Commons. (Page 308.)

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THE Brighton tramway accounts show a net profit of £137, and the electricity accounts a net profit of £4,751. —Owing to a pickaxe being driven into a cable at Aberdeen, it was found necessary to shut down the electricity works for a short time.—The Blackburn tramway manager is not prepared to recommend the adoption of meters on tramcars.—There was a net profit on the Stepney electricity undertaking last year of £1,760. (Page 308.)

NEW generating plant is required at Accrington, and boiler extensions at Hammersmith.—Local Government Board inquiries have been held at Barnstaple, £1,442; Hull, £99,000; Loughborough, £9,143; St. Helens, £10,800.—The Salisbury (S. A.) Council propose to borrow £120,000 for electricity purposes.—Time switches for public lamps are required at Hammersmith, and a new boiler at Shrewsbury. (Page 308.)

A 10 PER CENT. dividend is recommended by the Chloride Electrical Storage Co., Ltd., and a similar dividend, with a bonus of 5s. per share, by Callender's Cable & Construction Co.—A receiver for the debenture holders of Messrs. Cowans, Ltd., has been appointed.—The Brush Electrical Engineering Co.'s accounts for 1910 show a loss of £10,780. (Page 310.)

Guard Wires on Electric Tramways.—The revised regulations and memorandum of the Board of Trade regarding guard wires on electric tramways and light railways laid on public roads, dated March, 1911, are given in the June number of the *Journal of the Tramways and Light Railways Association*. There are a few alterations since the last edition. The regulation is now worded to include "telegraph, telephone, or *other* wires, unprotected with a permanent insulating covering," and applies now to "railways" as well as "tramways." The most important alteration in the memorandum is the provision that "each guard wire erected after the date of this memorandum should be well earthed at each end, and at intervals of not more than five spans." Short guard wires were formerly only required to be earthed at one point.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JUNE 1ST.

National Electrical Manufacturers' Association.

2.30 p.m. Council Meeting at Balfour House, Finsbury Pavement, E.C.

THURSDAY, JUNE 8TH.

Royal Institution.

3 p.m. Afternoon Lecture on "Practical Progress in Wireless Telegraphy," by T. Thorne Baker.

ANSWERS TO CORRESPONDENTS

Correspondents must in all cases send their names and addresses with their queries, and, if they do not desire the reply to be published after their own name, should add a "nom de plume." Questions should be addressed to the Editor, ELECTRICAL ENGINEERING, *203-6 Temple Chambers, Temple Avenue, London, E.C. The Editor will not guarantee to answer all questions in this column, and the enclosure of a stamped and addressed envelope is therefore desirable. Books recommended will be forwarded on receipt of a remittance for the amount mentioned.*

G. F. C. (Paignton).—This is usually a matter of arrangement. The prevailing custom is to charge at power rates, but the supply authority has the power to charge at lighting rates.

New Ventilation Scheme for the Central London Railway.—It has been decided to apply the Ozonair system of ventilation to the whole of the stations and tunnels of the Central London Railway, and an order for a complete ventilating and air-purification installation has been given to Ozonair, Ltd. (96 Victoria Street, S.W.). In the Ozonair system of ventilation the air passes into an inlet chamber, where it can be heated or cooled, and is then drawn through a filter, which removes all smuts and at the same time absorbs deleterious gases such as ammonia and sulphurous acid. It then passes through the ozone generator to a distribution fan and mixing chamber, and is delivered where required in a clean and sterilised condition at a suitable temperature. The ozone is produced electrically, and the proportion mixed with the air can be regulated. A complete plant will be fixed in each of the thirteen stations of the railway, and the total capacity of the thirteen plants will be ninety million cubic feet of air per day. Over two miles of ducts will be employed.



Mr. Flecks tests the electric miner's lamp which he was proposing to submit for the Home Office competition.

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"Electrical Engineering"
June 1, 1911.

ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

THE DRIVING OF WINDING ENGINES BY INDUCTION MOTORS

A PAPER on the use of induction motors for winding purposes was read at a meeting of the Institution of Electrical Engineers on Thursday, May 18th, by H. J. S. Heather. Hoisting and winding, he said, is usually done by continuous-current motors, either on the Ward-Leonard control system, with or without the Ilgner flywheel. In these the winding motor with a constant field is electrically connected to a direct-current separately-excited generator, which is driven by a motor, the latter motor being connected to the mains, and the torque exerted by the winding motor is proportional to the current flowing in its armature, and a reversal of one causes a reversal in the other. If the torque is in the direction of the motion of the motor, mechanical work is given out, but if they are opposed the winding motor becomes a generator and drives the machine that was formerly a generator as a motor, and the motor which was connected to the supply mains also generates and supplies current to the line, so that the control is regenerative. The separately-excited machine is controlled by a starting lever, which can be moved backwards and forwards, the former reducing or reversing the torque.

The only simple method of speed control in an induction motor is to insert resistance in the rotor circuit, and this is comparable to the rheostatic control of the separately-excited field of the generator in the Ward-Leonard system, and power is absorbed in resistances in each case, and the two systems are therefore similarly wasteful. Regenerative control is also a feature of the induction motor. When lowering above synchronous speed, the machine acts as a generator and supplies current to the mains.

Fig. 1 shows three torque-slip curves: Curve 1 with no resistance in the rotor circuit; Curve 2 shows the effect of

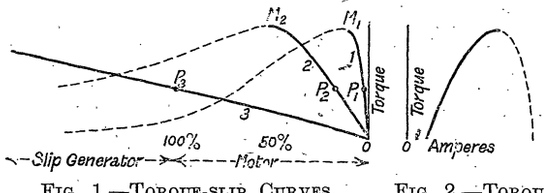


FIG. 1.—TORQUE-SLIP CURVES.

FIG. 2.—TORQUE-AMPERE CURVE.

inserting resistance in the rotor, viz., spreading out the curve and obtaining the normal full-load torque at a much higher slip; finally, if further resistance be added, Curve 3 is obtained, and the full-load torque (P_3) is seen to occur at standstill or 100 per cent. slip. Curve 3 also shows that there is no limit of speed at which the braking action can take place, since any torque up to the maximum can be secured at 100 per cent. slip.

Having shown that it is equally possible to use either system, the author next considered the question of power taken from the mains. When lifting, the current derived from the mains is got by dividing each ordinate above the zero line of the working diagram by an efficiency factor, and when regeneration takes place by multiplying each ordinate by a corresponding factor to get the power returned to the mains. The full consumption diagram for the Ward-Leonard system is shown in Fig. 3. In the case of the induction motor, the action of the motor under a reverse current at speeds below full speed must be remembered. The power taken from the mains for a given torque is now independent of the speed and also of the direction of the torque, and is determined by dividing the power put into

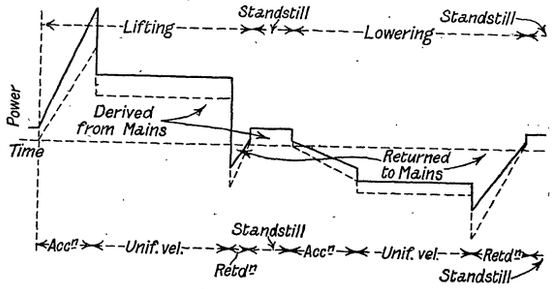


FIG. 3.—POWER CONSUMPTION CURVE FOR THE WARD-LEONARD SYSTEM.

the winding drums at full speed by the efficiency of the motor, and adding to this, for the lowering trip, the product of the power given out by the drums and the corresponding efficiency factor. This is shown in the power-consumption diagram, Fig. 4, derived from the torque-time diagram. In each case the full line represents the power consumed, the dotted lines showing the power given into and coming out of the drums.

It is easy for the driver to know when to increase or decrease the rotor resistance by using an ammeter as a torque indicator.

Returning to Fig. 1, it will be seen that so long as the full portion of the curve is worked on, an increase of resistance always reduces the torque, and a decrease of resistance always raises it. Again, there is only one torque ampere curve to all torque speed curves, and Fig. 2 shows that the amperes increase from zero torque to a maximum torque, and reach a maximum when the slip is infinite. The dotted part of Fig. 2 corresponds

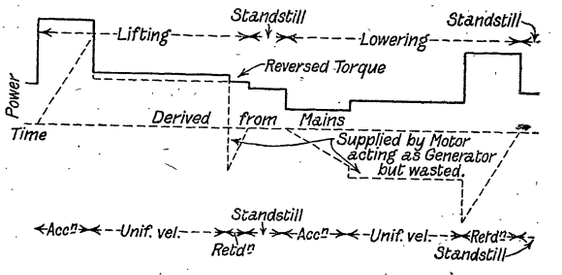


FIG. 4.—POWER CONSUMPTION CURVE FOR INDUCTION MOTOR DRIVE.

to those in Fig. 1, so that as long as the amperes are kept within a certain maximum value, which can be fixed for any motor, it can be ensured that the full live portion of the curve is being worked on. In conclusion, the author points out that although the power-consumption is much higher, where much lowering has to be done, the arrangements for the induction motor are simpler and safer, besides being cheaper, and where large plants are available for obtaining cheap power, the induction motor-drive would be advantageous.

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DISCUSSION.

Mr. W. H. PATCHELL, who read the Paper in the absence of the author, who is in South Africa, also read a letter from Mr. Heather, in which he stated that his firm, Messrs. Eckstein, were putting down induction motors for driving winding engines to the number of 160, ranging from 400 h.p. to 1,500 h.p., several of which are already running with satisfactory results. The difference in capital cost as compared with the Ward-Leonard system had not been worked out, but the total cost of the induction motor system would not be less than £50,000. Electrical energy is purchased at a fairly low rate. Mr. Patchell then showed some slides of the winding plant at the Ferndale Colliery, which is on the Ward-Leonard system. The flywheel weighs 30 tons, and has a diameter of 12 ft. and a width of 2 ft. 6 in. The normal speed is 500 r.p.m., and it is allowed during winding to vary 15 per cent. There is enough energy in the flywheel to do four complete winds should the supply fail, and there is a battery in the power station to look after the excitation. Incidentally, Mr. Patchell mentioned that a particularly efficient mechanical safety appliance was used on this winding plant, and it was of the type in connection with which the Prussian Government allowed higher speeds when lifting men than when steam winding is used.

Mr. W. C. MOUNTAIN (Messrs. Ernest Scott & Mountain) said that if winding could be done by means of a direct-coupled motor, and the complications of the Ilgner system dispensed with, it would be a distinct step forward, owing to the very considerable reduction in cost. He believed that small winders with helical gearing between the motor and the drum would find very considerable favour for small collieries; they were less expensive, and the helical gearing was very efficient. On the other hand, even at the Carville power station they felt the effect of a particular winder having a 700-h.p. induction motor, which required 1,700 h.p. at the moment of acceleration. The figures he had recently taken out were for a shaft 780 ft. deep, the weight of coal to be wound was 2 tons 4 cwt., the main rope was 4 inches diameter, and the balance rope was slightly larger. The time allowed for winding was 40 seconds, and for banking or change, 15 seconds. The acceleration was 2·73 ft. per sec. per sec., the maximum velocity 23·2 ft. per sec., and the rate of retardation was 5·8 ft. per sec. per sec. With the induction motor system the horse-power required for acceleration was 440, whilst on the Ilgner system the mean horse-power required, or input into the motor driving the generator, was 210, or about half. With the induction motor, however, there was a complete stoppage between each wind, and hence with this system only 2·3 units per wind were required, as against 2·7 with the Ilgner system. In these estimates he had assumed an over-all efficiency of 70 per cent. for the Ilgner system. There was also an objection to the complication of the Ilgner system. It had occasionally happened in the North of England that the plant was laid up for six weeks entirely through the motor on the Ilgner set failing. Finally, Mr. Mountain mentioned that motors should be wound in such a way that they can be simply and quickly repaired in case of accident. He advocated that a winding engine motor should be wound at low voltage, with plain copper bars in the stator, running in mica tubes, with the simplest possible connections at the end, and that a transformer should be used to reduce the line voltage.

Mr. G. STJERNBERG (Lahmeyer Electrical Co., Ltd.) said that the efficiency of any system should be calculated upon the rapidity of the wind as measured by the ratio between the average speed of winding and the time allowed for the wind, and not by the average speed or the maximum speed alone. This ratio varied very considerably in various mining districts. In England it reached about 0·3 metres per sec. On the Westphalian coalfields it rarely exceeded 0·25, and in South Africa it was rarely more than 0·15; 0·06 was quite a usual figure. He put the over-all efficiency of the Ward-Leonard system at about 73 per cent., and for the resistance control system 88 per cent., but as the ratio of the average speed to the total time increased, the efficiency dropped off at a different rate. For the Ward-Leonard system it dropped off slightly, whilst with the resistance control it dropped off quickly. The lower limit of efficiency for the Ward-Leonard control he put at 55 per cent., excluding shaft losses and mechanical losses. With winders driven by induction motors and resistance control as advocated by the author, the corresponding lower limit of over-all efficiency would be 35 per cent. These figures referred to winders with balance ropes, which, as a matter of fact, were not used on the Rand, and without balance ropes the limits within which the induction motor drive was efficient would be narrower still. On the Rand they had reduced the rope weight to the smallest possible value, working with a factor of safety of 7 against 9 to 12 in this country. Further, they did not wind coal on the Rand, but ore with a higher specific gravity, which made the rope weigh relatively less as compared with the weight of the load. In other words, the conditions on the Rand were exceptionally favourable for the use of induction motors with resistance control, and he thought Mr. Heather was to be congratulated on having adopted it under those conditions. He thought more might have been said on the question of the simplicity of the two plants as regards switching connections during winding. With the Ward-Leonard system there was no connection at all in the main circuit; no circuits transmitting energy were broken, but with the resistance control method there were a number of contacts. He preferred mechanical braking designed to allow of any degree of adjustment, with perhaps electrical braking with counter-current as an extra safeguard. If one relied entirely on electrical braking, the winder was entirely without control, when the supply failed.

Mr. GERALD STONEY referred to the Harton winder, the first one mentioned by Mr. Mountain. The maximum demand of 1,700 h.p. distinctly affected the Carville power station, in spite of its 30,000-kw. capacity. He had never been able to ascertain whether this load came on and went off at a good power factor or a bad one, so that part of the drop in voltage was due to part of the load coming on with a rather poor power factor. Winders in any numbers were the source of considerable fluctuations upon a power station, and he did not think that the induction motor system was likely to come into use with public power stations supplying both lighting and power, for, as Mr. Mountain had pointed out, it would be necessary for the stations to be capable of dealing with about double the load compared with the Ward-Leonard system. At the same time he understood that the cost of the induction motor system in a certain case would be £1,150, against £1,600 for the Ward-Leonard. In conclusion, he suggested that instead of having two cages in the shaft going up and down, there should be four. On the average, the time of retardation and stoppage at the top or bottom of the shaft was equal to the time accelerating. Therefore, if two loads were superimposed, one over the other alternately, they would get a very fairly uniform load on the generating station, when the induction motor system was used.

Mr. C. H. GADSBY asked what was the rope velocity in the Ferndale installation, and what was the number of revolutions per minute of the induction motor. He had been going into the question, and had come to the conclusion that with a large winding drum there was an enormous rope velocity with any ordinary speed of induction motor.

Mr. W. H. PATCHELL, in closing the discussion, said that there were not many cases in which one would care to put down a private supply station big enough to supply a big winder on an induction motor. Mr. Heather purchased his power from the Victoria Falls Power Co. Stage winding, so much used in South Africa, introduced different conditions to those common in this country, as it involved the use of two or three separate engines to wind from the bottom to the surface, and, on account of the space which was available for the engine-house, the induction motor presented considerable advantages as compared with the larger space taken up by Ilgner sets. Mr. Heather had mentioned that the balance rope was not used very much in South Africa. In England also its use had been somewhat restricted, due, to a very large extent, to the irregularity of the driving of the steam winding engines. But electric driving got over the whole of this difficulty, and the balance rope would come more into use with the gradual extension of electric winding. In reply to Mr. Gadsby, he said that the diameter of the Ferndale drum was 16 ft. on the tread. The maximum speed was 63 feet per second, and it was winding from a depth of 516 yards, 3 tons per wind. The output in the day of 9 hours was 1,800 tons. It was a new plant, and at the present time there was not space enough at the bottom of the pit to handle this quantity, but the plant had been tested at rather over 200 tons an hour, and it operated with the greatest steadiness.

ELECTRICAL MINING PATENTS OF MAY

AMONG the patents published during the past month of interest to electrical mining engineers, was one (No. 2382 of 1910), by H. W. LEE, and G. H. WEEDMAN, of Mount Morgan, Queensland, Australia, relating to mine alarm instruments, which are constructed of a wire circuit and several telescopic jointed pipes of size and description to suit drives, where there is likely to be danger from the roof creeping. The slightest movement can be immediately signalled by alarm bells or electric lights, or by both, to various parts of the mine.

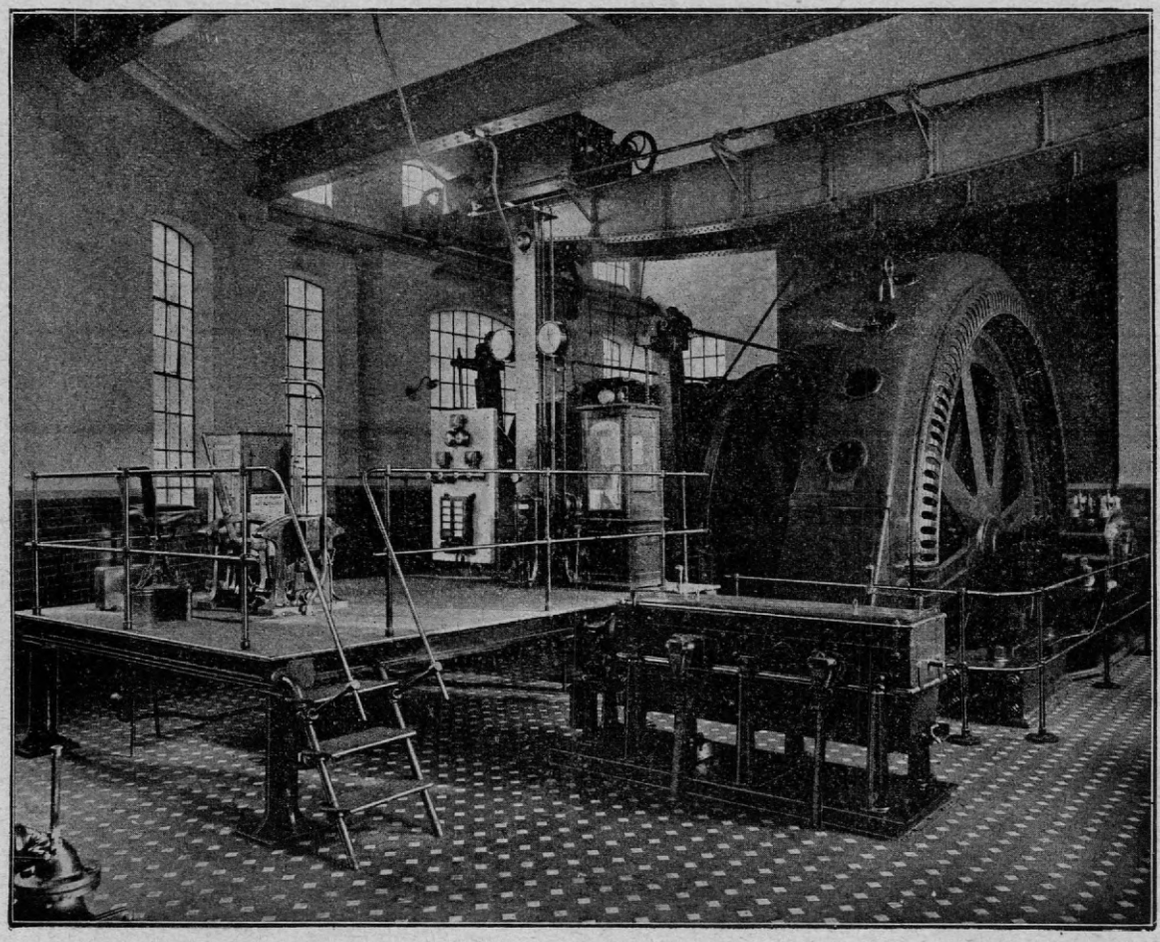
Specification No. 25974 of 1910, by W. E. LAKE, of London, covers certain improvements in mining machinery, consisting of a conveyor for transferring material, and a supplementary conveyor mounted upon a truck for transferring material from the mining machine conveyor to a certain point. The supplementary conveyor is so mounted that it can slide laterally on the truck, and can also be brought into or out of alignment with the mining machine conveyor.

Specification No. 26892 of 1910, by J. PRESTWICK, of Eccles, Lancashire, describes a means of electrically igniting miners' safety lamps of the class in which a low voltage current causes platinum or other material to incandesce, so that any authorised person in any part of the mine can light the lamp from an ordinary portable storage battery.

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THE COLLIERY EXHIBITION AT MANCHESTER

THE colliery and general mining exhibition which was open at the City Exhibition Hall, Manchester, for a fortnight during last month and closed its doors last Saturday, was not so rich in exhibits of electrical plant as that of more general nature, and perhaps this is not to be wondered at considering the forthcoming electrical exhibition this year at Olympia. Reference may be made here, however, to one or two items of interest to mining electrical engineers.

Arc lamps were represented by the regenerative flame lamp of the Jandus Arc Lamp and Electric Co., Ltd., various forms of which have been described in ELECTRICAL ENGINEERING from time to time, and the only exhibit of incandescent lamps was by the British Westinghouse Co., whose "Auriga" metal filament lamp also illuminated the exhibitors' club.

Turning to more purely mining matters, we find a display and good show of electric coal long wall coal cutters, both for three-phase and continuous currents. Another exhibitor of coal cutters were A. Hirst & Son, of Dewsbury, makers of the "Crescent" coal cutters, drills, &c.; both disc and chain-type machines are made with continuous- or alternative-current motors, but examples of the disc-type only were shown. These cutters were also shown in operation on the stand of the Harland Engineering Co. (196 Deansgate, Manchester), together with an electrically-driven turbine pump and a number of ironclad fuseboards, joint boxes, and accessories, designed to meet the new Home Office rules. Electrically-driven pumping plant also figured in the exhibits of Tickle Brothers (Wigan), Mather & Platt (Manchester), and W. H. Baily & Co. (Salford). The last mentioned also showed electrically-driven air-compressors of the "Köster" two-stage type, and air-compressing machinery was also conspicuous on the stands of John Wood & Sons (Wigan), Matthews & Yates (Manchester), and Tilghman's Patent Sand Blast Co. (Manchester). An interesting demonstration of the Pittler rotary air-compressor was also given, and a display of electric fans was given by Musgrave & Co. (Manchester).

Electric safety lamps were shown by Ackroyd & Best. Their lamps were fitted with Hailwood's patent magnetic lock and lens in top so as to give good roof light, also with water protector to prevent flame from communicating from burst bulb with gases of the mine if the outside glass is improperly fastened. This firm also exhibited safety underground relighting apparatus for oil-lamps, constructed in such a manner that the lamp must be enclosed in flame proof, fool proof chamber before the current can be switched through the lamp and same lighted. Special care has been taken to see that in this machine all the joints are such that they cannot be left improperly fastened, and cannot get out of order. Magnetic unlocking machines were also shown. Another firm showing electric lighting and locking appliances for safety lamps was The Protector Lamp and Lighting Co. (Eccles).

Electric shot firers were shown by the Cotton Powder Co., and electric shot firing was also represented on the stand of the British Electric Detonator Co.

Among the more general exhibits attention may be directed to that of the Lea Recorder Co., whose newest "Midget" design of well-known integrating recorder, with capacity up to 20,000 lbs. per hour, was on view, as well as other patterns. This is a self-contained instrument, which can be set down anywhere and coupled up for boiler and engine testing. Two well-known systems of water softening plant were represented on the stands of Messrs. Lassen & Hjorth and W. Boby.

MODERN MINING SWITCHGEAR

THE British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester), have issued a pamphlet entitled "Electricity in Mines," which should be of use to mining electrical engineers. It opens with a reprint in convenient form of the report of the Departmental Committee on the special rules for the use of Electricity in Mines, with an appendix including the new regulations, the various forms of notice, model daily log sheet, and the "memorandum" containing the comments and recommendations of the committee on practical points arising in connection with the rules as regards constructional and technical details. In the centre of the pamphlet is an illustrated supplement dealing with some of the latest forms of switchgear, specially designed for the company in accordance with mining requirements, and known as type S. & S.R. ironclad switchgear. The automatic features of the gear are first explained, including the loose-handle control, no-voltage and overload releases, and time-limit attachments. Other special features which can be applied are a "no-volt no-close" device, remote mechanical or electrical trips, and a leakage current trip. Somes notes follow on instruments for use with this switchgear, including ammeter voltmeters and ground detectors, the last mentioned consisting of an instrument of the milliammeter type for pressures up to 750 volts; or, again, an electrostatic instrument where the voltage is higher. In the case of three-phase circuits this has a single moving part which is attracted to any one of the three fixed shields connected to the three phases. A copious series of illustrations are given of the various forms in which these switches, &c., can be made up. The switches can be arranged for mounting on the wall or on pillars, with or without isolating boxes interlocked with the switches, and in all cases the working parts, although normally most securely enclosed, are easily accessible for inspection. The whole switch case can in many cases be withdrawn bodily, being fitted with knife plug contacts, and a useful feature is a door for enclosing these contacts after the switch has been removed. These main oil switches and pillars are standardised up to 6,000 volts, and at this pressure have additional oil tanks for the shunt transformer and its fuses. Special motor control pillars are made up in a similar way with enclosed star-delta, auto and other forms of starter, or full oil-immersed controllers. Indeed, the gear can be arranged in almost any combination. Typical illustrations of other patterns of colliery switchgear, main, switchboards, &c., are also included in this interesting pamphlet.

THE C.M.B. AUTO-CONVERTER FOR WINDING PLANTS

A NEW pamphlet from Messrs. Crompton & Co., Ltd. (Salisbury House, London Wall, E.C.) deals with the various uses to which their "C.M.B. Auto-converter" can be put. This apparatus, which is a machine with a single revolving armature, practically does for continuous current circuits, what the auto-transformer does for alternating current circuits and renders available currents much heavier than that drawn from the line at reduced voltages. The principle of working was fully explained in ELECTRICAL ENGINEERING, Vol. V. page 629, July 8th, 1909, and the machine can be used to give a secondary voltage practically constant for any value of the secondary current, for automatically converting from constant potential to constant current or for balancing a three-wire system. The principal features of the machine have also been applied to the control of motors requiring to run at varying speeds and to give a varying torque in order to meet special working conditions such as colliery winding gears, rolling mills, pumps and air compressors, printing presses, electric railways and tramways, and electric omnibuses with portable storage batteries.

An example of a winding gear of this nature is that supplied to South Kenmuir Colliery, near Glasgow. In this case, as the supply is three-phase (from the mains of the Clyde Valley Electrical Power Company), the machine takes the form of a motor generator on the C.M.B.-system which delivers continuous current to the main winding motor at varying pressure. It gives the large currents required for starting without drawing undue power from the line, and dispenses with any resistances in the motor circuit. Control is effected of a regulator in the field circuit of the converter properly interlocked with the reversing switch. The winder in question is designed for a depth of 160 fathoms, but is at present only working from the 70 fathoms level. Each cage carries 17 cwt. of coal, and 55 tons of coal per hour can be dealt with. Tests have shown that the maximum demand does not exceed 120 kw., and the consumption during an hours of 65 winds works out at 1·4 units per ton raised.

ELECTRICAL MINING ACCIDENTS

AT the end of February an inquest was held at Ystradgynlais on a motor-man named David Jones, employed at the Ynyscedwyn Colliery, who died from the effects of an ignition of firedamp in an underground motor-house. The accumulation of gas was due to the air current having been reversed by the leaving open of a door communicating with old workings, but the ignition was directly due to sparks from the motor or its starter.

A young miner named McPherson was found dead at Lumly Colliery, Durham, on May 13th, near the starter of a conveyor motor. He had previously complained of shocks from the switch handle. The inquest was adjourned pending the results of a post mortem.

An accident occurred on May 17th, on one of the 3,000 volt transmission lines of the Powell Duffryn Co., near Abercwmboi. Two men at work on the line were found dead near a pole which has just been set on fire by an arc caused by a broken insulator. It is presumed that the line came in contact with a stay wire not making a good earth, which was touched by the men. The leakage was not, however, sufficient to operate the relays in the power station.

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ELECTRIC LAMPS FOR MINERS

THE Secretary of State for the Home Department announces that in order to encourage the production of safe and efficient types of electric lamps for miners, a colliery proprieter has placed at his disposal the sum of £1,000, to be offered as a prize for the best lamp or lamps fulfilling the requirements specified below. In our issue of May 4th an article appeared on electric safety lamps. It was the general opinion that an ordinary oil safety lamp was the cause of the explosion and fire in the Wellington Pit of the Whitehaven Colliery, and a more extensive use of electric safety lamps was recommended. We also quoted a note by Mr. R. Nelson (H.M. Electrical Inspector of Mines), which should be valuable information to those entering for the above competition. The conditions of the competition are as follows :—

The competition will be open to persons of any nationality. It will be in the discretion of the judges to award the whole of the prize for the lamp which they consider to be the best; or to divide the prize; or to make no award if no lamp appears to them to be of sufficient merit. Lamps must be addressed care of C. Rhodes, Esq., at the Home Office Testing Station, Rotherham, and must reach the testing station not later than December 31st next; a spare globe should accompany each lamp.

The following are among the requirements which should be fulfilled by lamps submitted :—

The lamps should be constructed so as to withstand rough usage, to be easy to maintain in good order and repair, and to render impossible the ignition of gas either within or without the lamp. The battery should be so constructed that liquid cannot be spilled, and means should be provided for dealing with gas generated by the battery. The materials should not be liable to corrosion. The lamp should be effectively locked, and should be capable of giving not less than 2-candle power continuously for 10 hours. The light should be well distributed, and a movable reflector may be provided.

The subject of electric mining lamps is also dealt with in the report of Prof. Redmayne (H.M. Chief Inspector of Mines) on the Hulton Colliery explosion, just published. The explosion is attributed to the overheating of or damage to an ordinary safety lamp, and Prof. Redmayne suggests that the time may have come when the ordinary Davy lamp should be wholly or partially replaced by the safer electric lamp. There are, he says, already some 2,155 in use. We shall deal at greater length with this report next month.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during May.

May 4th.—Monthly supplement on ELECTRICAL ENGINEERING IN MINES, opening with an article on electric safety lamps for mines. Some amendments proposed to the new Coal Mines Bill are given, and the most important electrical mining patents published in April are dealt with. Some new motor switch pillars are also described and illustrated.

May 11th.—Continuation of description of generating plant at a large London power-house. Article on an automatic starter for squirrel-cage motors.

May 18th.—Literary supplement, with reviews and list of recommended books in all branches of electrical engineering. Conclusion of the discussion on Mr. Collis's Paper on "Circuit Breaking."

May 25th.—Description of a water-purification plant, and short articles on a new testing instrument and some electric portable tools.

A Dust Extractor for Coal Mines.—Messrs. Mavor & Coulson have recently introduced a new appliance for extracting dust in mines. The apparatus in its electrically-worked form consists essentially of a bell-shaped mouthpiece, close to the mouth of which is fixed a nozzle carrying a jet of pressure air, which impinges upon the surface to be cleaned, searching the crevices of rough surfaces, and raising the dust from them. Suction is connected to the bell mouthpiece and withdraws the dust-laden air. The jet of air is produced by a small pressure fan driven by the same motor that drives the suction fan. A filter or separator is provided to retain the dust when collected, and permit of the escape of the air.

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THE ASSOCIATION OF MINING ELECTRICAL ENGINEERS—WEST OF SCOTLAND BRANCH

THE general meeting of the West of Scotland Branch of the Association of Mining Electrical Engineers was held in the Technical College, Glasgow, on Friday the 19th inst., when the President, Mr. Alex. Anderson, presided. It was intimated that the annual meeting of the parent Institution would be held in Glasgow in October. With the exception of Mr. James E. Sayers, M.I.E.E., who had resigned, the retiring Council were re-elected, and Mr. William Brown, Banknock Coal Co., elected to fill the vacancy. Mr. John W. Case afterwards read a Paper on "The Uses of Electricity in Gaseous Mines." Electricity, he said, was a power by which the owner wished to work the coal at a cheaper rate. Compressed air was not suitable, or, at least, not economical for large collieries. It had been stated before the Departmental Committee on Electricity in Mines that the limits of medium pressure should not exceed 250 volts. If that were done it would certainly force colliery owners to instal a higher class of switchgear and cables. It was greatly to be regretted, he said, that some electrical installations in mines were working on the limits of safety. Coal dust was the principal medium by which electricity could cause damage. It was advisable, he said, to have all cables and other electrical apparatus regularly brushed to clear them of coal dust. Every encouragement should be given to the motor attendants to keep clean motor houses and electrical apparatus. In dusty mines it was advisable to keep the floor damp immediately round the apparatus to prevent any dust from rising that might possibly have accumulated between the hours of sweeping,

NEW MINING SWITCHES

MESSRS. Berry, Skinner & Co. (78 Upper Thames Street) have added to their range of well-known substantial enclosed fused switches by producing special patterns for mining work. In the "Firimine" fused switch, illustrated in Fig. 1, the requirements laid down in the Home Office Report on the

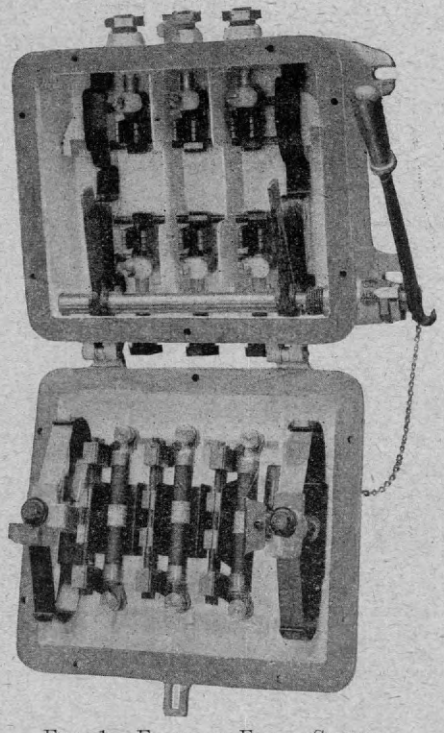


FIG. 1.—FIRIMINE FUSED SWITCH.

special rules have been carefully studied. The switch is of the heavy ironclad type, and the cases are automatically interlocked. The cover and the body of the case are provided with wide metal to metal machined faced flanges with fixing bolts sufficiently closely spaced for clamping the cover and the body of the box closely together. The cover is provided with adjustable hinges. Owing to the compactness of the design, it is claimed that for a given current capacity less internal space is required than is generally the case. The switch case is provided with well-fitted cable glands. The construction is entirely of metal, and mica only is used for insulating purposes. A large creeping surface is provided, in order to provide against the lodgment of coal dust, dirt or moisture. The apparatus is capable of operation by an unskilled workman, and, owing to to its fool-proof qualities, the fuses can be examined and replaced without proximity to live parts. The price compares most favourably with that of other forms of

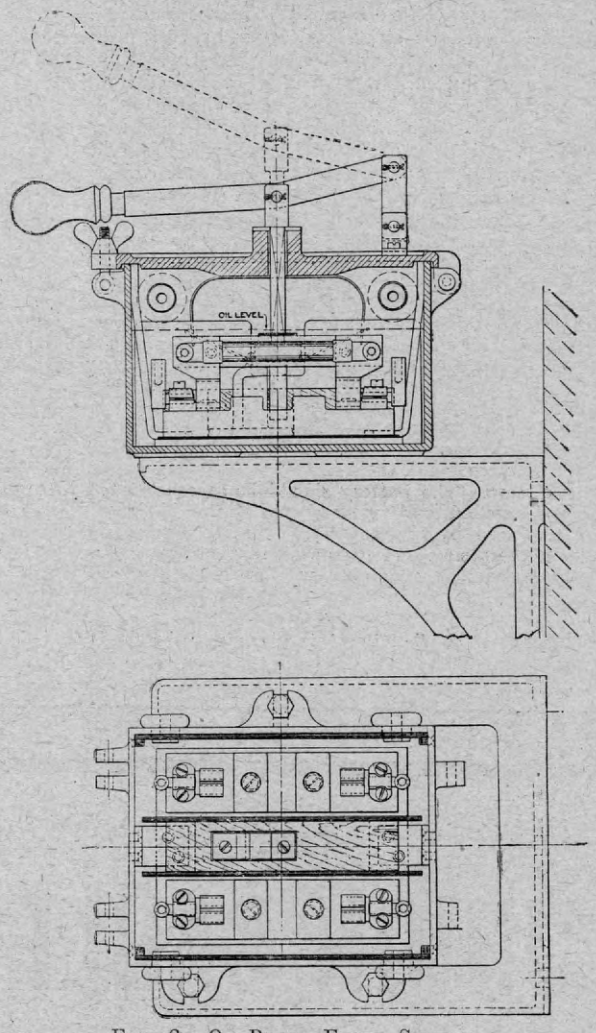
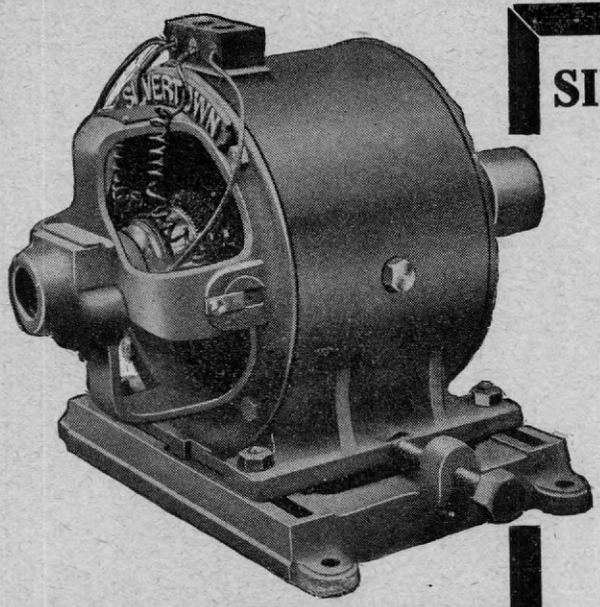


FIG. 2.—OIL-BREAK FUSED SWITCH.

switchgear. The switch is automatically locked "on" and "off" for intermediate positions. It is impossible to tamper with the contact to any degree. The switch is clearly marked "on" and "off." Our apparatus is designed with a generous margin of safety as regards carrying capacity. Our fuses can only be replaced after the current has been automatically switched "off." It is impossible to obtain a shock, as all fuse carrying parts are dead when the switchbox is opened. An oil break form of the switch is shown in Fig. 2.

Visit to the Westinghouse Works.—In view of the annual meeting of the National Association of Colliery Managers, which was held in Manchester on May 18th, 19th, and 20th, the British Westinghouse Electric & Manufacturing Co., Ltd., extended to the members of this Association a cordial invitation to pay a visit to their works, and inspect some of their apparatus particularly suitable for mines. A fairly large number of members availed themselves of this offer, and made a tour of the shops under the guidance of several Westinghouse engineers. A special exhibition of mining switchgear had been arranged, including a complete line of 750, 3,300, and 6,600 volt mining switch pillars, also examples of type "S" gate-end switch boxes specially designed for use in shallow headings, oil switches, circuit-breakers, auto-starters, liquid starters, controllers, rheostats, &c. A large variety of switchboards of all types were going through the shops, and full access to all the details of manufacture was freely given. There were also on view steam turbines, condensers, with Leblanc air pumps, turbo-blowers, R. T. Moore turbine-driven high-lift pump for 400 gallons per minute against 827 ft. running at 3,300 r.p.m., large and small gas engines, motors, generators, and other apparatus, including two-speed motors, 180 h.p. 400-volt D.C., driving a Worthington hydraulic pump 250 gallons per minute, 800 lb. per sq. in., for L. & N.W. Railway London Road station. The visitors were afterwards entertained to tea by the company.

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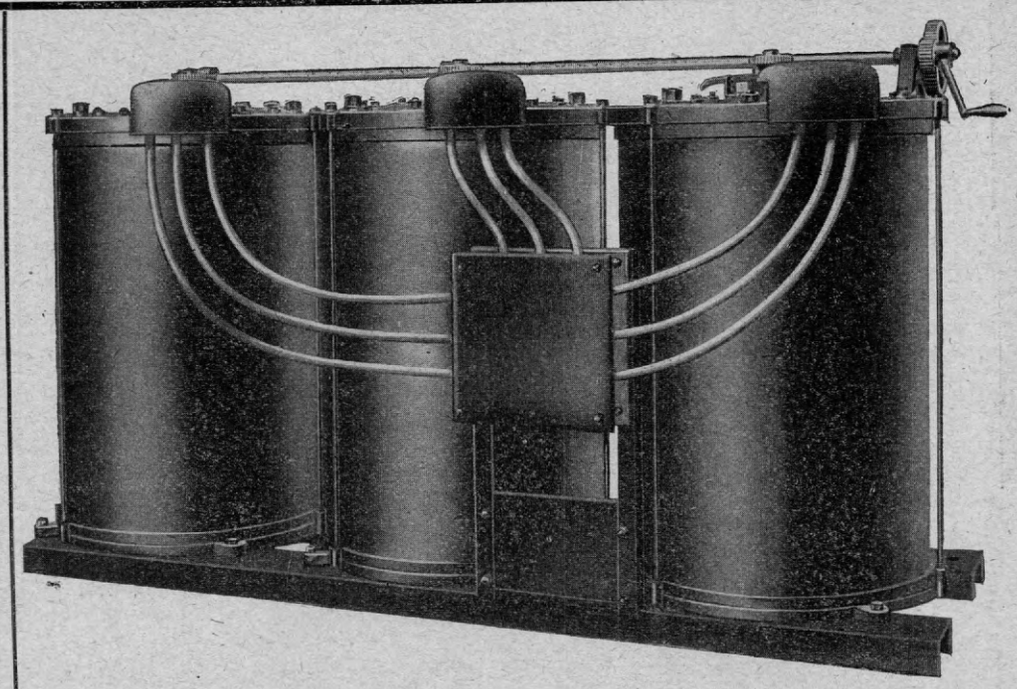
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SILVERTOWN MOTORS



500 H.P.
3 phase
Oil Immersed
ROTOR
STARTER

GEORGE ELLISON

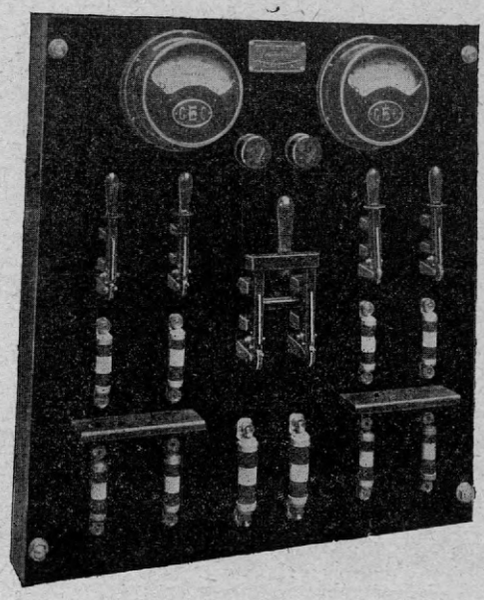
Victoria Works,
WARSTONE LANE, BIRMINGHAM.

Telegrams: "Induction," Birmingham.
Telephone: 5296 Central.

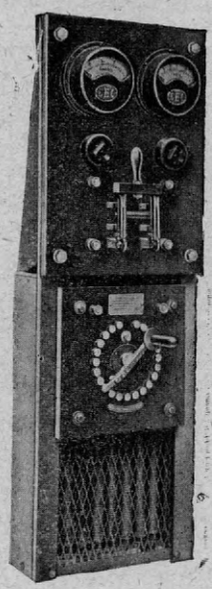
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G.E.C.
"Witton" SWITCHBOARDS

ACCUMULATOR SWITCHBOARDS.
LOW TENSION COMPONENT PANELS.
HIGH TENSION COMPONENT PANELS.
SPECIAL SWITCHBOARDS.
FEEDER PILLARS and PANELS.
DISTRIBUTION BOARDS.
MOTOR CONTROL PANELS.
SWITCHBOARD ACCESSORIES,
ETC., ETC.



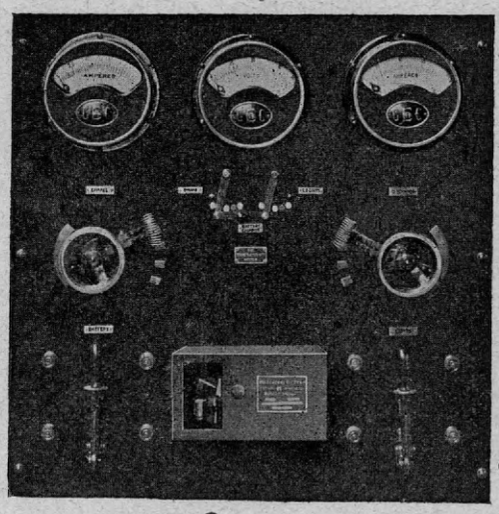
"Witton" Switchboard for controlling Dynamo and Four Feeder Circuits.



"Witton" Garage Switchboard, for Charging Motor Car Ignition Accumulators, Electric Broughams large Portable Accumulators, small Ignition Cells, etc.

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"Witton" Switchboard for Country House Lighting Plants.

THE GENERAL ELECTRIC CO., LTD.,

Head Office: 67, QUEEN VICTORIA STREET, LONDON, E.C.



BRANCHES and AGENCIES: Manchester: Victoria Bridge. Glasgow: 71, Waterloo Street. Birmingham: 42, High Street. Newcastle-on-Tyne: 30, Gallowgate. Dublin: 16, St. Andrew Street. Belfast: 13, Queen Street. Cardiff: Womanby Street. Also at—PARIS, MADRID, MILAN, CAPETOWN, JOHANNESBURG and SYDNEY, Etc., Etc.

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REPORT AND ANNUAL MEETING OF THE INSTITUTION OF ELECTRICAL ENGINEERS

AT the annual general meeting of the Institution of Electrical Engineers on Friday last, the following awards were announced:—

The *Institution Premium* (£25) to Sir R. A. Hadfield, F.R.S., and Professor B. Hopkinson, F.R.S., for their paper, "The Magnetic Properties of Iron and its Alloys in Intense Fields." The *Ayrton Premium* (£10) to Mr. H. T. Harrison, for his paper, "Street Lighting by Modern Electric Lamps." The *Fahie Premium* (£10) to Mr. Donald Murray, for his paper, "Practical Aspects of Printing Telegraphy." The *John Hopkinson Premium* (£10) to Messrs. A. P. M. Fleming and R. Johnson, for their paper, "Chemical Action in Winding of High-voltage Machines." The *Paris Premium* (£10) to Mr. W. T. Taylor, for his paper, "Modern Long-distance Transmission of Electrical Energy." An *Extra Premium* (£5) to Dr. E. Rosenberg, for his paper, "Control of Electric Winding and Hoisting Engines," and a *Premium* (£5) to Mr. C. C. Hawkins, for his paper, "The Theory of the Static Balancer."

Students' Premiums of £10 each were awarded to Messrs. G. W. P. Page and G. J. Scott, for their paper, "Single-phase Commutator Motors, especially the Latour Winter Eichberg Type," and to Mr. H. C. May, for his paper, "Notes on the Design and Construction of Dry-core Lead-covered Telephone Cables," and students' premiums of £5 each were awarded to Mr. A. Monkhouse, for his paper, "Recent Electric Locomotive Practice and the High-tension Direct-current Railway System," Messrs. R. C. Plowman and E. F. Hetherington, for their paper, "Exhaust Steam Turbines," and to Mr. A. R. Stelling, for his paper, "Organisation and the Reduction of Manufacturing Costs."

The Council have awarded Salomons Scholarships of the value of £50 each to Richard Michael Clark, of University College, and to Edward M. Teare, of the Finsbury Technical College, and a David Hughes Scholarship of the value of £50 to Francis Lewes Otter, of the Central Technical College.

One or two new features were announced in the report. The Council have decided to hold examinations of candidates for election and transfer to the class of Associate Members after January 1st, 1913. The complete details are under consideration with a view to publication at an early date. The Council have decided that from January 1st, 1913, candidates for election as Students shall be required to pass or to have passed either the Matriculation Examination of one of the British Universities or some other equivalent examination. The Council deemed it wise not to conduct a special examination.

Other changes under consideration are the publication of the Journal at shorter intervals, the giving of special lectures at meetings of the Institution, and the holding from time to time of informal meetings, at which only short papers serving as openings for discussion would be read, and of provincial summer meetings of these on four days. The Council have also under consideration increases in the subscription and entrance fees.

The report deals also with the growth of the institution, now numbering 6,370 members of all classes, and records considerable activity in all sections. Work in connection with "Science Abstracts," the new edition of the wiring rules, the revision of the model general conditions, and the committees on electricity in textile mills, and on street-lighting specifications is referred to, and the announcement is made that the third Kelvin lecture will be delivered next autumn by Dr. R. T. Glazebrook, C.B., F.R.S. The subject will be Lord Kelvin's work in connection with fundamental units.

The work of the British Electrotechnical Committee (see ELECTRICAL ENGINEERING, May 18th, page 265) is now carried on in connection with the Institution. This committee is now constituted as follows:—Mr. A. Siemens (President), Col. R. E. Crompton, Mr. W. Duddell, Mr. K. Edgcumbe, Mr. S. Z. de Ferranti, Sir John Gavey, Dr. R. T. Glazebrook, Mr. R. Kaye Gray, Mr. R. Hammond, Mr. W. R. Hammond, Mr. C. LeMaistre, Prof. T. Mather, Mr. W. M. Mordey, Mr. H. W. Miller, Major W. A. J. O'Meara, Mr. W. H. Patchell, Sir W. H. Preece, Lord Rayleigh, Dr. A. Russell, Mr. J. F. C. Snell, Dr. S. P. Thompson, Mr. A. P. Trotter, Mr. E. B. Vignoles, Mr. C. H. Wordingham, and Mr. P. F. Rowell (Secretary).

A report on the accounts is included, showing an excess of income of expenditure for the year of £3,053. The balance-sheet shows net assets of £59,835, which is almost entirely locked up in the acquisition of the lease of the Institution building, in the structural alterations, and in the expenses incurred prior to occupation.

The Benevolent Fund shows a satisfactory increase. The capital account now stands at £3,700, and grants amounting to £51 were made during the year. The Wilde Benevolent Trust Fund stands at £1,846.

At the meeting the report and accounts were adopted, and the officers and council whose names were given in ELECTRICAL ENGINEERING, April 27th, page 219, were declared elected, as no further nominations had been received. Messrs. S. Sharp and H. Alabaster were also re-elected honorary auditors.

THE METAL FILAMENT LAMP PATENT CASE

A PRELIMINARY encounter in connection with the impending metal filament lamp patent fight took place in the Chancery Court before Mr. Justice Neville on Friday. This was an application made by the "Z" Electric Lamp Manufacturing Co., Ltd., to restrain the Osram Lamp Works, Ltd., "from threatening by circulars, letters, or otherwise, the plaintiffs, or any other person or persons, whereby the plaintiffs might be aggrieved, with legal proceedings or liability in respect of any alleged infringements of the defendants' letters patent in respect of the manufacture, use, sale, or purchase of incandescent electric lamps manufactured or sold by the plaintiffs."

Mr. T. Terrell, K.C., and Mr. R. Frost appeared for the "Z" Lamp Co., and asked for an interim injunction, explaining that the application was made under Section 36 of the Patents Act, which reads as follows:—

Where any person claiming to be the patentee of an invention, by circulars, advertisements, or otherwise, threatens any other person with any legal proceedings or liability in respect of any alleged infringement of the patent, any person aggrieved thereby may bring an action against him, and may obtain an injunction against the continuance of such threats, and may recover such damage (if any) as he has sustained thereby, if the alleged infringement to which the threats related was not in fact an infringement of any legal rights of the person making such threats:

Provided that this section shall not apply if the person making such threats with due diligence commences and prosecutes an action for infringement of his patent.

It appears that the Osram Lamp Works, Ltd., had commenced actions against Messrs. Baxter & Caunter, who are agents for "Z" lamps, and also against others, and it was contended that the action should be brought against the "Z" Electric Lamp Manufacturing Co., Ltd., themselves, who are ready and willing to fight such an action.

For the Osram Lamps, Ltd. (for whom Mr. Astbury, K.C., Mr. Walter, K.C., and Mr. Colefax appeared), it was contended that the actions were being prosecuted with "due diligence," and that there was no foundation for any suggestion of *mala fides*. It was also mentioned that there was a dispute as to the "retainer of counsel," and that if the "Z" Co. would waive the question of retainer of counsel, the Osram Lamp Works would be willing to issue a writ for infringement against them.

Lord Justice Neville, in giving judgment, said that the matter did not come within Section 36 of the Patents Act, and he saw no ground for supposing that the actions in question were not *bona fide* actions. He added that he had nothing to do with the question as to the retainer of counsel, and dismissed the motion with costs.

The dispute as to the retainer of counsel appears to be with regard to Mr. Walter, K.C. Mr. Walter was originally retained by the "Z" Lamp Co. in their successful action against Messrs. Marples, Leach, in what is known as the "Phospham" case, and apparently they had retained him to act for them in all subsequent patent cases. The General Electric Co., Ltd., also retained him, however, for the action against

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published May 25th, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

11,175/10. **Electrolytic Production of Light Metals.** G. O. SEWARD, FRANZ VON KUGELGEN, and FRITZ VON BIDDER. Relates to the production of metals, and particularly of sodium, lighter than their fused salts by electrolysis. The current is passed through the salt between an outer anode and an inner cathode. The anolyte and catholyte are separated by a chilled salt incrusted curtain, which closely approaches the cathode, which is of large mass, to avoid undue heating, so that the heat generated in the adjacent electrolyte limits the thickness of the salt crust on the curtain. The metal collecting inside the curtain is discharged into a receptacle beneath. The discharge passage has a lip at the top, and is enlarged below to allow the metal to fall free of the lower walls of the passage. Two figures.

11,559/10. **Stage Arc Lamps.** W. WALTERS. In stage arc lamps burning two in series, in order to obviate the trouble, through bad adjustment of the carbons, of one lamp going out and breaking the circuit for the other lamp, a series-wound solenoid is attached to the rear of the carbon bracket-holder. In the forward end of the solenoid a solid iron core is placed and linked to the back end of the bottom carbon-holder, and at the rear end of the solenoid an adjustable spindle is placed to act as an electromagnet. When the switch in circuit with the solenoid is closed, the iron core is attracted to the spindle, and the carbons are parted to burning distance, which can be regulated by the spindle. If one lamp only is required, the switch is opened and the carbons fall together, shunting the current through a resistance to the other lamp. Five figures.

24,390/10. **Telephonic Transmitter.** W. J. MARCHANT. This is a means of increasing the efficiency of a transmitter and receiver in combination. A mouthpiece or horn, parabolic in section, is fixed to the transmitter in such a way that the diaphragm of the transmitter occupies the focal plane of the horn. The sound-waves collected in the horn are concentrated by reflection on the diaphragm, thus increasing the loudness in the receiver associated with the transmitter.

24,909/10. **Arc Lamp Waterproof Protector.** E. WIDMER. The case ring of this device is of insulating material, with a thread which can be screwed into or out of the case. Washers are placed between the adjoining faces of the case and ring and the ring and the globe to keep the moisture out. The ring is also provided with an annular rib to prevent any connection between the conducting parts of the lamp. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: BRITISH THOMSON-HOUSTON CO. (*Allgemeine Elektricitäts Ges.*) [Devices for securing conductors] 18,867/10.

Dynamos, Motors and Transformers: ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Motor plant] 11,439/10; KLOOS [Single-acting motors] 6,152/11; AYERS [Wave motors] 9,231/11.

Electrometallurgy and Electrochemistry: RUTHENBURG [Electrolytic production of antimony] 19,772/10; REID [Electroplating apparatus] 580/11.

Heating and Cooking: REID [Electric furnaces] 19,804/10.

Instruments and Meters: BECK [Telemeters] 25,014/10.

Switchgear, Fuses, and Fittings: ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Motor starting devices] 11,186/10; SAMAIA [Point-controlling mechanism] 11,372/10; IDE [Lamp holder device] 11,747/10; BRYAN [Electrical communication between approaching engines] 13,583/10; PENROSE [Electric switches] 1,037/11; MEHNE [Electric time-switches] 2,259/11; SUN ELECTRICAL CO., RAWLINGS and SWEETSER [Electric switches] 3,705/11.

Telephony and Telegraphy: BOULT (*International Telechronometer Co.*) [Telephone apparatus] 11,048/10; AMERICAN AUTOMATIC TELEPHONE CO. and GOODRUM [Automatic telephone systems] 12,614/10; GIRARDEAU [Radio-telegraphic plant] 3,947/11.

Traction: MUNRO and RAILLESS ELECTRIC TRACTION CO. [Trolley-bases] 7,198/11.

Miscellaneous: SMITH [Winding condenser bobbins] 11,655/10; BRITISH THOMSON-HOUSTON CO. (*General Electric Co.*) [Arc light electrodes] 13,518/10; SIEMENS BROS. DYNAMO WORKS (*Siemens Schuckertwerke Ges.*) [Electric condensers] 14,092/10; STEWART and WESTMINSTER TOOL & ELECTRIC CO. [Electric drills] 14,505/10; GINESTES [Sparking-plugs] 27,991/10; POWERS and EUREKA CLOCK CO. [Self-winding clocks] 4,711/11; BARRET and GAIFFE [X-ray bulbs and tubes] 6,833/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: KÖRTING and MATHIESEN AKT.-GES. [For alternating currents] 10,290/11.

Heating, &c.: POPP [Electric furnaces] 30,390/10.

Instruments and Meters: COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATERIEL D'USINES À GAZ [Electricity motor meters] 30,297/10.

Fittings, &c.: KÖRTING and MATHIESEN AKT.-GES. [Rainproof ventilator for arc lamps] 10,886/11.

Miscellaneous, &c.: ZICKEL [Electric-shutter indicators] 24,495/10 and 10,545/11; LUX [Sparking plugs] 325/11; MACKU [Production of electric oscillations] 8,524/11.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

13,594 of June 2nd, 1897. **Electricity Meters.** C. O. BASTIAN. This patent covers an electricity meter in which the current is measured by electrolysis, the amount of reduction of the electrolyte being a measure of the amount of current passing. In conjunction with this is a prepayment mechanism, comprising a float mounted in the vessel containing the electrolyte, to which is attached a bent arm to form contact outside of the vessel with a suspended contact device in the local circuit, which by means of coin-freed devices is lowered a certain distance to break the local circuit. The coin-freed devices also actuate the main circuit-closer, which is engaged in this position by a spring-actuated catch controlled by a magnet.

13,838 of June 5th, 1897. **Electric Switches.** G. PAGE. Describes a method of securing an equal and more efficient contact between the switch bar and contacts by forming the bar or the contacts in two or more parts, which move independently, and are adapted to be pressed apart or together under spring action.

13,971 of June 8th, 1897. **Motor Controllers.** THE BRITISH THOMSON-HOUSTON CO. (*E. D. Priest, Schenectady, New York*). Substitutes a number of separately actuated contact devices for the commutating and resistance cylinders hitherto used, and provides means for reducing the arcing between intermediate contacts to a minimum; for moving the handle operating the controlling valves continuously in one direction, or by a backward movement to the off position; for a single handle to actuate the valves supplying air to the contact cylinder; for automatically returning the contacts to the off position should the air-supply fail. The invention also relates to the construction of the blow-out magnet, and certain other details.

13,973 of June 8th, 1897. **Open Circuit Controllers.** THE BRITISH THOMSON-HOUSTON CO. (*E. D. Priest and F. A. Merrick, Schenectady, New York*). This patent relates to pneumatically-actuated series-parallel controllers adapted to connect the motors, in series with a number of resistances in parallel for starting, when they are short-circuited, leaving the motors connected in series. The resistances are then reinserted, the circuit interrupted, and the motor connections changed from series to parallel.

13,976 of June 8th, 1897. **Induction Motor Meter.** THE BRITISH THOMSON-HOUSTON CO. (*P. Steinmetz, Schenectady, New York*). This meter comprises a drum of good conducting material, inducing coils co-operating to induce current in and rotate the drum. The coils are energised by a single-phase current, one of them having an induction device in circuit with it for displacing the phase of current exactly 90°. The device consists of coils of different numbers of turns upon a common core, and an auxiliary starting coil to overcome the friction of the meter.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: A. B. UPHAM [Electric trolleys] 3036/11.

Electrometallurgy, &c.: E. KREUSER [Electromagnetic separators] 2849/99.

Instruments, &c.: EVERSHED & VIGNOLES and S. EVERSHED [Electricity meters] 3507/98.

Switchgear, &c.: A. J. BOULT (*Continental Hall Signal Co., Brussels, Belgium*) [Railway signals and points] 3176/99; WESTINGHOUSE BRAKE CO. and J. W. CROSS [Brakes] 2702/05; C. W. ATKINSON [Electric switches] 2919/05; J. A. KENNEDY-MCGREGOR [Electric switches] 3164/06.

Telephony, &c.: D. MURRAY [Telegraphs] 3385/04; C. E. LJUNGMAN, R. O. P. BERGLUM, and W. A. W. E. HJORTH [Telephones] 3224/06.

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Messrs. G. M. Boddy & Co. (which, it will be remembered, was subsequently withdrawn by agreement between the parties), and had also retained him to act for them in actions with regard to the Osram patents. As the action in respect of which the present application was made was against Messrs. Baxter & Caunter, and not against the "Z" Company, Mr. Walter was enabled to act for the General Electric Co.

We have reason to believe that, after Mr. Justice Neville's judgment, a consultation took place between the parties, and it was agreed that Mr. Walter should be left free to act for the General Electric Co., but that the action should be brought against the "Z" Lamp Company, instead of against their agents. The case may be expected to come on for hearing after the long vacation.

THE TELEPHONE TRANSFER

Judgment on Preliminary Points

THE Railway and Canal Commissioners gave judgment on Monday upon the preliminary legal points raised in connection with the transfer of the National Telephone Company's undertaking to the Post Office. We dealt with the arguments on page 267 of our issue for May 18th. As pointed out there, the parties differ as to the definition of the word "suitable," the Post Office contending that it covers the case in which both the Company and the Post Office have plant in the same area, and where the former is unnecessary for the purpose of the Post Office, whereas the Company's argument was that the word refers only to plant which is technically unsuitable as telephone material. The other point dealt with by the Commissioners was in relation to the notices of objection given by the Postmaster-General regarding the plant which he wishes to be relieved from purchasing. It was claimed by the Company that these were invalid, for the reason that they were not specific as to the plant to be so excluded.

Mr. JUSTICE A. T. LAWRENCE said that the first thing that struck him with regard to the meaning of the word "unsuitable" was that it related to quality and not quantity; because otherwise it would exclude a large amount of the Company's property, even from "tramway terms," which were the basis of the purchase. The agreement provided in very clear language against excessive plant being imposed upon the Postmaster-General, but the effect of what was suggested by the Post Office would be to scrap the existing plant of the Company in all competing areas. This did not seem just, and it would require clear words to convince him that such powers were conferred upon one party to the agreement to the detriment of the others. The words of the agreement, "suitable to the actual requirements of the service," might very well apply to the quality and character of the particular plant, and not to the sufficiency of it. It had seemed to be assumed by the Post Office that "requirements" meant "needs," and that the test of these needs was what the Postmaster-General would want, and that any of the Company's plant could be refused if the Postmaster-General became possessed of any plant in a competing area sufficient for his purpose, no matter how modern the Company's plant might be. This did not seem to be a likely bargain to be made even by a licencee whose licence expired at the end of seven years from the date of the agreement. In the London agreement it was clear that "suitable" referred to "quality," and not "quantity," and no satisfactory explanation had been given for reading a different meaning into the term as used in the agreement of 1905.

With regard to the Company's objection to the Postmaster-General's notices of the plant he wished to reject, Part I. of these notices specified certain lands, building, and plant, and he regarded these as quite good notices. Part II. stated the Postmaster-General's objection to taking over lines not on the metallic circuit system, and lines along, upon, or across any railway worked or about to be worked by electric power, but he regarded this part of the notice as not specific enough and consequently bad.

The Hon. A. E. Gathorne Hardy concurred with the above judgment.

Sir James Woodhouse dissented. In London the Postmaster-General objected to taking over the Bank, Westminster, and Avenue exchanges, and also to eighteen exchanges outside London, and in all cases he regarded both parts of the notices of objection given by the Postmaster-General as sufficient for the purpose intended by the agreement.

With regard to the word "unsuitable," he thought it must be held to have a quantitative as well as a qualitative meaning, taken in conjunction with the general text of the agreement. In the competitive areas, the Postmaster-General had installed exchanges on the central battery system, with the avowed object of carrying on the system in competition with the Company. The "requirements" of the Postmaster-General meant his "needs," and an exchange, in his opinion, became unsuitable for the "needs" of the Postmaster-General if it could be shown that he had no need for it. "Suitable" meant, not only "fitting," but "adequacy," and this was a quantitative expression. The position was demonstrated by the Avenue exchange of the Company, which had 4,000 subscribers. Not far away the Post Office had an exchange in Carter Lane with 19,000 subscribers, and facilities for 25,000. A new Post Office exchange was also being erected in Creechurch Lane, dealing with the same district, and the Avenue exchange of the Company was therefore "unsuitable" for the needs of the Post Office.

In the course of a discussion at the close of the judgments, during which notice of appeal was given on behalf of the Postmaster-General, it was agreed to commence the arbitration proceedings on July 5th, the Court of Appeal meanwhile being asked to take the appeal in the present case on the first or second day of the next sittings.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

CONDUIT FITTINGS.—A leaflet from the Sun Electrical Co. (118-120 Charing Cross Road, W.C.) announces reductions in prices for Sun screw tube fittings, including the Kalkos iron box with adjustment ring.

ARC LAMP CARBONS.—A price list from W. Geipel & Co. (72A St. Thomas's Street, S.E.) gives particulars of carbons manufactured by the firm of Fabius Henrion for ordinary and flame arc lamps, cinematographs, projectors, and welding.

MECHANICAL VENTILATION SPECIALITIES.—John Gibbs & Son (72-76 Duke Street, Liverpool) have issued a catalogue illustrating and describing fans for dust removal, forced and induced draughts, ventilating, &c., and also their Peerless blowers, to which several aditions have been made, one with water-cooled bearings for hot gases being a feature of the catalogue.

ELECTRIC GENERATING SETS.—A pamphlet from Fyfe, Wilson & Co. (145 Bath Street, Glasgow) deals with the "Kelvin" petrol and paraffin-driven electric generating sets for lighting country houses, hotels, &c. They are of British manufacture throughout.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

FANS.—The General Electric Co. (67 Queen Victoria Street, E.C.) send us a copy of their revised catalogue relating to "Freezor" fans. Various types are illustrated and described, including an oscillating ceiling fan, which is useful for large rooms; it revolves in a complete circle. The firm announce that they are making substantial reductions in the prices of their fans owing to the increased demand, and are also printing very large quantities of an attractive advertisement folder, which they will supply in quantities to any contractors who will undertake to push this line.

CORRESPONDENCE

THE SINGLE-PHASE PLANT SUPPLYING THE LONDON, BRIGHTON AND SOUTH COAST RAILWAY.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—I note in your issue of May 11th, in Part II. of the article on the Single-phase Plant for the L.B. & S.C. Railway, that it is stated the Chorlton-Whitehead governors were specially designed by Mr. Whitehead. Mr. Partridge is evidently under a misapprehension on this point, as while the arrangement of the governing gear, &c., is rightly due to Mr. Whitehead, the Chorlton-Whitehead governors are designed and patented exclusively by myself, and the governors in question are the largest standard size produced by my firm, Messrs. Ashworth & Parker, Bury, Lancashire, by whom they were supplied to Mr. Whitehead. It may be of interest to know that they weigh, apart from any driving gear, no less than half a ton each.

I am, yours faithfully,

Bury, *May 24th*, 1911. F. O. L. CHORLTON.

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THE NATIONAL TELEPHONE COMPANY

THE seventeenth annual dinner of the National Telephone Co. took place at the Hotel Cecil on Thursday, May 25th. Albert Anns, Esq., Secretary of the Company, was in the chair. Amongst those present were the Rt. Hon. Herbert Samuel, Postmaster-General, the Rt. Hon. Lord Harris, Mr. George Franklin, President of the Company, Mr. S. H. Sands, Vice-president of the Company, Major W. A. J. O'Meara (Engineer-in-Chief to the Post Office), Sir Robert Hunter (Solicitor to the Post Office), Mr. S. Z. De Ferranti, President of the Institute of Electrical Engineers, Mr. S. J. Goddard, General Superintendent, National Telephone Co., Mr. F. Gill (Chief Engineer to the National Telephone Co.), and the principal officers representing between 17,000 and 18,000 members of the staff. The Postmaster-General replying for the guests, said the proceedings between the Post Office and the Company had been, and would be, conducted without any bitterness, and he hoped for a decision, that would cause no ill feeling on either side. The staff of the Company had been fully considered, and all the heads of his department were with him in his desire, that full justice should be done to one and all of the Company's members, when the transfer takes place at the end of the year, and he promised that with the exception of a very few cases, the whole of the staff would be taken over regardless of the time they had served with the Company, and without the usual medical and literary examination. He would propose shortly in the House of Commons, that an option should be allowed to those members, who were now contributing to the Company's Pension Fund, to assign their share to the Postmaster-General, if they so desired, when the fund was wound up, and in return they should be allowed to count all their previous years of service, as if they had been served in the interests of the State, for pension and superannuation purposes, also those who had been original members of the fund, and who were in the Companys' service before that fund was established should be allowed to count all those years as if they were years spent in the service of the state.

The Telephone work was to be kept distinctly free from the other post-office work, and a wide discretion was still to be allowed to local offices. Promotion would not be determined by mere routine rules of seniority, and merit and scientific and technical attainments would be considered.

LOCAL NOTES

Aberdeen: *Breakdown at the Electricity Works.*—A fortnight ago there was a breakdown at the electricity works which resulted in bringing all the tramcars to a standstill and placing the town in darkness for about half an hour. Mr. J. A. Bell, electrical engineer, was in Rugby at the time, but he has now presented an official report with regard to the occurrence. It appears that a pick-axe was driven into a cable in Union Street, which resulted in overloading one of the sets to such an extent that the steam supply was reduced to a point at which it was necessary to shut down the station.

Blackburn: *Tramcar Meters.*—Mr. J. H. Cowell, Corporation Tramway Manager, reporting upon the tests which he has made with meters on the tramcars, states that no reliable meter has yet been put on the market, and for the present he is not prepared to recommend their adoption upon all tramcars.

Bolton: *Electricity Accounts.*—The accounts of the electricity department for 1910-11 show a net profit of £6,857 after meeting capital charges, compared with £7,119 in the previous year. There has been a decrease in revenue and units by the loss of large power users presumably owing to the price offered not being low enough, and it is to be regretted that the Council did not see its way to accept the advice of their electrical engineer to reduce the charges for power purposes. Power users so lost had an aggegrate load of 1,500 kw. The works costs for 1911 were 0·456d. compared with 0·426d. in the previous year, and the total costs 1·173d. per unit against 1·125d. per unit the previous year. This increase marks a break in a long series of steady decrease in works costs which Mr. Day is justified in thinking would not have taken place had his advice in relation to power charges been taken.

Brighton: *Tramway Accounts.*—The Corporation tramway accounts for the year to March 31 show a net profit of £137 compared with £1,190 in the preceding twelve months. The principal cause of the diminution is the expenditure of £5,554 upon permanent way compared with £4,005 in 1909–10, the whole of which has been paid for out of revenue. Sinking fund and interest charges absorb £12,939. The difficulty with the permanent way, the manager points out, is that it was originally paved with a very inferior quality of wood paving. Although the price for electrical energy has been reduced from 1·35d. to 1·2d. per unit, this is still regarded as unduly high.

Electricity Accounts.—The accounts of the Corporation electricity department for the year to March 31st show a net profit of £4,751 (after allowing for the £100 commission to Mr. Arthur Wright), as against £6,251 in the previous year. The number of units sold increased by 13¾ per cent., and in spite of an increase of 11d. per ton in the cost of coal, the coal cost per unit has fallen from 0·4d. to 0·38d. Repairs and maintenance show the considerable increase of £3,510 due to alterations in the high-tension switch gear, oil-cooling, hot-well and circulating water-pipe systems and repairs to sea defences. The Lighting Committee recommend that £4,626 of the net profit be carried to reserve fund and the balance of £125 to relief of rates.

Chester: *Electricity Undertaking.*—A special Committee appointed by the Council has recommended that an independent expert should be called in to advise the Council upon certain matters in connection with the electricity undertaking. Objection is being taken to this on the ground that it is a serious reflection upon the electrical engineer, who has from time to time acted in the capacity of consulting engineer in connection with the undertaking.

Coventry: *Electricity Profits.*—There was a net surplus of £16,414 upon the electricity undertaking for 1910–11 compared with £10,070 in the previous year. It is proposed to transfer £3,500 to relief of rates.

Hull: *Electricity Extensions.*—The Electricity Committee are being urged to arrange for a supply of electrical energy in the St. Andrews Dock district.

London: *Hammersmith: Street Lighting.*—The cost of converting the first 396 street lamps exceeded the amount borrowed, viz., £2,000, by £206. Additional lamps are to be converted at an estimated cost of £544, and a loan of £750 is to be taken up.

Stepney: Electricity Accounts.—The accounts of the municipal electric supply department for the year to March 31st show a net profit of £1,760. The number of consumers has been increased by 300 during the year.

Widnes: *Transporter Bridge.*—The Corporation will shortly shut down their power station which supplies current for working the transporter bridge, and will take the power from the Mersey Power Co.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Accrington.—The Borough Electrical Engineer is preparing a report upon the installation of additional generating plant.

Barnstaple.—The Local Government Board have sanctioned a loan of £1,442 for electric lighting extensions.

Hull.—A Local Government Board inquiry was held yesterday concerning a loan of £99,000 for extensions at the electricity works.

London: *Hammersmith.*—Tenders are to be invited for extensions to the boiler house.

Poplar.—A loan of £4,537 is recommended for sanction by the L.C.C. Finance Committee for mains and machinery.

Stepney.—The L.C.C. Finance Committee recommend sanction to a loan of £15,700 for mains.

Loughboro'.—A Local Government Board inquiry was held last week concerning a loan of £9,143 for extensions at the generating station.

Pembroke (Dublin).—Tenders are invited by June 7th for coal conveying apparatus at the electricity works. Particulars from the Borough Electrical Engineer.

St. Helens.—A Local Government Board inquiry was held last week into an application for sanction to borrow £10,800 for electrical extensions.

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Shrewsbury.—A new boiler is to be installed at the power house at an estimated cost of £1,148.

South Africa.—The Salisbury Council have been authorised to borrow £120,000 for electricity supply and other purposes.

WIRING

Bolton.—Hardcastle Memorial Hall, St. Augustine's. Architect, E. W. Dyson, 17 Lee-lane, Horwich.

Edinburgh.—New school at Fountain Bridge. Architect, Mr. J. A. Carfrae, 3 Queen Street. Training College for Teachers, J. King, 16 Chamber Street.

Glasgow.—Extensions to head post office. H.M. Office of Works.

Harrogate.—New ward at infirmary.

Isle of Man.—Concert Hall, Douglas. Town Clerk.

Letchworth.—New fire station.

London.—New buildings for H.M. Stationery Office, and Office of Works' Stores, Waterloo Road, S.E. Architect, Mr. R. J. Allison, H.M. Office of Works.

Macclesfield.—Elementary school in Athey Street. Architects, Whittaker & Bradburn, 19 King Edward Street.

Russia.—According to the *Board of Trade Journal*, the municipal authorities of Chernikov propose to expend £10,500 upon an electrical installation.

Swansea.—Ragged school in Pleasant Street.

Wakefield.—Additions to Handsworth Council School.

MISCELLANEOUS

Canada.—The Winnipeg Board of Control require tenders for a police patrol telegraph system by July 3rd.

Doncaster.—The Local Government Board have approved of a scheme of sewerage and sewage disposal prepared by Messrs. D. Balfour & Son for the parish of Adwick-le-Street. Electrically driven pumps will be employed.

Hitchin.—The electric light and gas companies are to be asked to submit tenders for street lighting.

London: *Hammersmith.*—Tenders are to be invited for the supply of time switches for public lamps.

Spain.—The Sociedad Anonima Iberia Concessionaria has applied for a concession for the construction of electric tramways in the province of Pontevedra. Particulars from Direccion General de Obras Publicas.

TENDERS RECEIVED AND ACCEPTED

Aldershot.—The D.P. Battery Co., Ltd., of Bakewell, have secured the contract for the new storage battery.

Blackpool.—The tender for the wiring of the new Carnegie library has been given to Messrs. J. W. Fielding & Co., 31 Birley Street, Blackpool.

London: *L.C.C.*—The following firms tendered for the electric wiring of the Kennington fire station: W. Leonard & Co., £205 (recommended for acceptance); Tilley Bros., £276 10s.; J. Bryden & Sons, £340.

Hammersmith.—The following tenders have been received for an additional switchboard panel in connection with the new 3,000 kw. turbo-alternator:—B.T.H. Co., £145; Siemens Bros. & Co., £146; Ferranti, £180; Electric & Ordnance Accessories Co., £180; Westinghouse Co., £198; Reyrolle & Co., £200; Bertram Thomas, £203 10s.; Electric Construction Co., £213; General Electric Co., £225; Spagnoletti, £237; Johnson & Phillips, £240. The tender of Messrs. Ferranti is recommended for acceptance. The tender of the B.T.H. Co. for a Tirrell regulator has been accepted at £105.

The following tenders have been received for lanterns in connection with the conversion of public arc lamps to metal filament lamps:—E.M.F. Co. (Wardle lantern), £240 10s.; Wardle Engineering Co., £245; Drake & Gorham, £259; Pontifex & Co., £268; Haydn Harrison, £263, £277 and £323 15s.; General Electric Co., £302 18s.; Falk Stadelmann & Co., £312; Lucy & Co., £323 15s.; Reason Manufacturing Co., £360 15s. The tender of Messrs. Pontifex & Co. is recommended for acceptance.

Rochdale.—The Tramways Committee have placed an order with Messrs. Siemens Bros. Dynamo Works, Ltd., for a twelve months supply of tantalum traction lamps.

Southend-on-Sea.—The tender of Messrs. J. Stone & Co., of London, has been accepted for driving wheel tyres at £15 9s. per ton. and pony wheel tyres at £18 9s. 6d. per ton.

OSRAM·LAMPS

The electrical engineer has been authorised to purchase an apparatus for the electrical control of points by the tramcar driver at £45.

Stoke-on-Trent.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for two 600 kw. induction-type motor-generators at £2,385 has been accepted, subject to the sanction of the Local Government Board to the necessary loan. The tender of Messrs. Callenders Cable Construction Co., Ltd., for mains and feeders amounting to £14,185 has been accepted under the same conditions.

Messrs. Siemens Brothers Dynamo Works, Ltd., have secured an order for the electrical equipment of the new works of the Carlyle Trading and Investments Trust, Ltd., at Bromley, Bow, including the supply of generators, motors, switchboards, and electric lighting. The wiring has been sublet to Messrs. Walter Mossop & Co. They have also secured an order for a country house lighting installation at Chudleigh, Devonshire. The wiring is being carried out with Stannos wires on the concentric system, and has been sublet to Messrs. A. H. Brooking & Co., Electrical Contractors, Exeter. They have also obtained many large orders for Coronation illumination and decoration schemes. The following are a few premises in London which will be dealt with:—Woolland Brothers, Mann, Crossmann and Paulin, The R.M.S.P. Co., *The Statist*, Pimms, The Commonwealth of Australia, "The Blind Beggar," Gramophone, Ltd., Brown, Shipley & Co., "The Britannia," Cox's Bank, Williams, Deacons Bank, Shoreditch Town Hall, and Drews. All installation work will be sublet to electrical contractors, and the buildings will be decorated with crystal glass and wooden devices, garlands, festoons, and bro-ite strip, shields and emblems, flags and trophies.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. G. McLean has resigned the position of engineer and manager to the Woking Electric Supply Co., Ltd., which he has held for over ten years, having been connected with the company for over fourteen years. Future communications for Mr. McLean should be addressed to Dunblane, Woking, Surrey.

Mr. F. Monkhouse, who for the past seven years has fulfilled the duties of assistant manager to Arc Lamps, Ltd., has terminated his connection with the firm. Communications may be addressed to 17 Blandford Road, St. Albans.

Messrs. W. T. Glover & Co., Ltd. (Trafford Park, Manchester), inform us that on the resignation of Mr. Scott, of Glasgow, Mr. McEwan has been appointed sole representative for Scotland, instead of only for the East of Scotland.

Osram Lamps.—We are informed by the General Electric Co. that at the recent funeral of the late King of Siam, the entire illumination effect was produced by means of Osram lamps. The total number used for this purpose represented more than 100,000 candle power.

The Tramways and Light Railways Association.—The following Papers are down for reading at the Congress of the Association at Edinburgh on July 13th and 14th:—Transfer Fares, by Mr. C. W. Shepherd (General Manager, Edinburgh Tramways); A few reasons why Electric Traction in England remains Stationary, by Mr. G. H. J. Hooghwinkel; Notes on Tramway Problems, by Mr. C. W. Mallins (General Manager, Liverpool Tramways), and Tramways and Light Railways Legislation of the Future, by Alderman W. Ivey, West Ham Tramways Committee.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—*Member*: W. E. Robson; *Associate Members*: T. E. Alger, P. F. Anley, S. Bates, R. A. Broad, L. G. Caunter, R. G. Deveyr, F. J. Gellion, C. H. Grindrod, P. S. Hawkins, T. Hayes, H. F. Johnson, C. Jones, J. C. Jones, C. H. Klyne, J. Lingard, F. W. Parsons, H. Pilling, R. D. Runcie, W. Travis, G. P. Turner, R. C. Wallroth; *Associates*: W. G. Barnett, W. Bell, D. N. Dunlop, W. Heap, A. W. Tait; *Students*: C. G. Abbey, V. O. Haddock, L. T. Mansell.

At the annual general meeting on Friday, the following were elected:—*Members:* B. N. Dadge, H. M. Leaf, S. G. Redman, F. J. Walker, J. H. Woodward. *Associate Members:* H. S. Affleck, S. C. Batstone, A. E. Brewerton, F. B. Brown, W. E. Burnand, A. Bursill, A. A. Collie, W. F. Drayson, E. H. Edwardes, A. Gibbs, J. Gray, W. F. Horne, W. Horsfall, R. Hudson, F. Husband, J. Kerr, S. S. King, R. A. Lower, R. E. Meade, K. Menon, S. Monkhouse, P. Motteram, W. R. Pepper, A. J. Pitt, G. F. Pratt, A. C. Smith, J. E. Storr, R. F. Trotter, F. Wright. *Associates:* W. Brown, J. E. Devlin, O. P. Hoskyns, H. S. Ingleby, A. E. Lee, J. F. North, W. L. Palmer, R. E. Stace, Capt. R.E. *Students*: W. B. Davies, R. A. Gray, C. Orpin, W. Rintoul.

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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic copper bars, net c.i.f. port of arrival, quoted on Tuesday night, was £56 15s. to £57 5s. per ton (last week the same).

Messrs. Drummond Brothers' Agents.—We are asked by Mr. W. G. Handcock, 423 Wellington Street, Clifton Hill, Melbourne, and 15 Moore Street, Sydney, Chief Distributing Representative for Australasia of Messrs. Drummond Bros., Ltd., Ryde's Hill, near Guildford, Surrey, to state that the following are his Company's agents:—Queensland: Paul & Gray, Ltd., Eagle Street, Brisbane. New South Wales: T. M. Goodall & Co., Ltd., 303-5 Kent Street, Sydney. Victoria: G. Leach, 233 Elizabeth Street, Melbourne. South Australia: G. P. Harris, Scarfe & Co., Ltd., Gawler Place, Adelaide. Tasmania, Southern District: C. Davis, Elizabeth Street, Hobart; Northern District: W. Hart & Sons, Charles Street, Launceston. New Zealand, North Island and West Coast of South Island: Cruickshank, Miller & Co., Queen and Wellesley Streets, Auckland; South Island—Canterbury, Otago, and Southland Districts—Laidlaw & Gray, Ltd., 155-7 Rattray Street, Dunedin.

General Electric (U.S.A.) and Westinghouse Patents.—It is officially announced that the agreement relating to overlapping patents between the General Electric Co., New York, and the Westinghouse Electric & Manufacturing Co., of Pittsburg, has expired, and, by agreement, will not be renewed.

Dublin Section of the Institution of Electrical Engineers.—At the annual general meeting on May 11th, the following officers and committee were elected for the coming session:—*Chairman:* Mr. S. L. R. Price. *Vice-Chairman:* Major Roberts. *Committee:* Messrs. S. T. Land, M. Ruddle, R. M. Tweedy, G. F. Pilditch, P. H. Steward, Prof. W. Brown, and Mr. L. J. Kettle. *Hon. Secretary:* Mr. T. Tomlinson.

Electrical Trades' Benevolent Institution.—The following subscriptions and donations have been received since those given on our list on May 11th:—*Subscriptions*: John Lawton & Sons, £1; A. P. Lundberg & Sons, £2 2s.; W. S. Shield, £1 1s.; General Accessories Co., £1 1s.; Davidson & Co., £1 1s.; F. Chard, 10s. 6d.; C. Wilson, 10s. 6d.; W. A. S. Benson & Co., 10s. 6d.; H. W. Butler, £1; E. Clarke & Co., £1 1s.; Electrical Press, Ltd., £2 2s. *Donations*: Crompton & Co., £5; J. Bourne & Son, £1 1s.; Clarke, Forde & Taylor, £3 3s.; P. Ormiston & Sons, £3 3s.; Alfred Graham & Co., £3 3s.; F. Wiggins & Sons, £1 1s.; H. T. May, £1 1s.; J. Gerson, £1 1s.; Johnson, Matthey & Co., £10 10s.; A. A. Campbell Swinton, £1 1s.; Lee Murray, £2 2s.

Parliamentary Intelligence.—The Widnes & Runcorn Bridge (Transfer) Bill was read for the second time in the House of Lords last week.

The Unopposed Committee of the House of Commons last week passed the Bill authorising the Winchester Corporation to purchase the undertaking of the Winchester Electric Lighting Power Co.

The promoters of the Macclesfield & District Railless Traction & Electric Supply Bill were recently granted permission by the Standing Orders Committee to add an additional route to the list originally specified in the Bill. Notice has been given by Mr. Ashton to refer this back to the Committee to further inquire into the circumstances.

"Onewatt" Lamps.—Messrs. Siemens Bros. Dynamo Works, Ltd. (Tyssen Street, Dalston), inform us that they are now placing on the market a range of 55-watt "Onewatt" drawn Tungsten lamps for high- and low-voltage circuits. These lamps, which will be of a similar nature to the other types of "Onewatt" lamps which are at present being supplied, and are specially suitable for street lighting owing to the robust nature of the filament. They may be used for either alternating or direct current, and will be supplied in bulbs of the same size as "Tantalum" lamps of the corresponding voltage candle-powers. The price for 100- to 130-volt lamps, in pear-shaped bulbs, will be 2s. 9d. each, and for 200- to 250-volt lamps 3s. 9d. each. For round bulbs price will be 3d. each extra. The discounts and selling conditions will be exactly as those at present in force on "Tantalum" and "Onewatt" lamps. These lamps can be supplied with either B.C. or Edison screw caps at the same price, and can be supplied to special order. Large stocks are to hand, and customers' orders can therefore be promptly attended to. Price lists dealing with the subject will shortly be issued, and notification of same will be given to the trade.



COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Electric Supply Corporation.—There was a net profit of £3,960 for 1910, which is distributed as follows:—£500 to renewals account; £1,248 to writing off expenditure on temporary plant and cost of transferring Hendon undertaking; £2,212 to be carried forward. At the annual meeting on Monday attention was particularly called to the disappearance from the balance-sheet of the temporary loans which have embarrassed the company for some time past, and that during the year the lamp connections have increased by 19 per cent. The Chairman expressed the opinion that the shareholders should receive a dividend as the result of this year's writing.

Swansea Tramways & Improvements Co.—The tramways portion of the company's undertaking shows a net profit for 1910 of £11,265, after setting aside £6,000 for renewals. The sum of £3,000 is placed to depreciation account, and a 4½ per cent. dividend declared upon the ordinary shares, carrying forward £1,048. During the year the sum of £2,000 has been repaid to the British Electric Traction Co. in reduction of the liability in respect of advances for reconstruction purposes. Six additional single-deck bogie cars to be purchased. Negiotiations are proceeding with the Corporation for the sale of certain lines, the lease for which will fall in shortly.

Cowans.—The *Financial News* states that Messrs. Cowans, Ltd., have gone into voluntary liquidation following the appointment of a receiver for the debenture holders. The assets of the company figure in the books at £22,957, but our contemporary states they are only estimated to realise about £4,500.

Electric Supply Corporation.—Subscriptions have been invited for £60,000 5 per cent. debenture stock.

Chloride Electrical Storage Co.—A dividend of 10 per cent. is recommended on the ordinary shares for the year to March 31st, placing £5,000 to reserve fund and carrying £8,543 forward.

Johnson & Phillips.—The annual general meeting was held in London last week, when the report and accounts, given in our last issue, were adopted. Mr. R. W. Blackwell, who presided, said that the balance-sheet showed a very distinct advance over the position to which the company had been brought owing to bad business in previous years. He thought the corner had been safely turned now, and they could look forward to substantial business in the future. There were at present in hand uncompleted orders to the value of £77,508. Mr. T. Dence, who seconded the motion for the adoption of the report, said that during the first three months of 1911 the work done by the company constituted a record, and there were sufficient contracts in hand to keep all their departments employed for another six months.

Birmingham & Midland Tramways.—The accounts for 1910 show a net profit of £8,306, and after meeting a dividend of 2 per cent. on the preferred ordinary shares and transferring £1,000 to depreciation, a balance of £306 is carried forward.

Uxbridge & District Electric Supply Co.—An issue of £75,000 5 per cent. first mortgage debenture stock at par is being made. Messrs. Callenders Cable Construction Co., Ltd., guarantee a sinking fund which will redeem the stock in thirty-six years. The issue is to pay off existing debentures and other liabilities of the Company, and will also provide a considerable sum of money for extensions to plant.

Lancashire Power Construction Co.—Subscriptions are being invited to an issue of £50,000 5 per cent. prior lien bonds.

Callender's Cable and Construction Co.—After meeting debenture interest, preference dividend, and depreciation, there is a net profit for 1910 of £66,323. A dividend at the rate of 10 per cent. per annum is recommended, and a bonus of 5s. per share, carrying forward £40,973. The report calls attention to the fact that the increase in trade which manifested itself in the early part of 1910 was not maintained, and the year was characterised by the absence of new enterprises. In the early part of 1911 also there were distinct evidences of improvement in the electrical industry, but this also seemed for the present to have disappeared. On the other hand the use of electrical energy for power purposes is extending in many parts of the United Kingdom, with a consequent increase in the amount of cable orders. Considerable contracts have been secured in the Colonies, especially in South Africa. The business of the Anchor Cable Co. in house wires and rubber cables has again been highly satisfactory.

Brush Electrical Engineering Co.—The accounts for last year show a loss of £10,780, after providing debenture interest and maintenance of plant and buildings, &c., but not depreciation, increasing the debt balance brought forward to £61,139. A scheme of capital reorganisation is under consideration.



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ELECTRICAL ENGINEERING

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SUMMARY

An article by Mr. E. Parry gives some useful tables and formulæ for the determination of tension and sag in overhead wires. (Page 313.)

Results of tests of a 5,000 kw. Westinghouse turbo-alternator at the Motherwell power house of the Clyde Valley Electrical Power Co. show steam consumption down to 13 lbs. per kw.-hour. (Page 314.)

Our monthly article on new electrical supplies and accessories contains illustrated descriptions of a new alternating-current hot wire arc lamp for low frequencies, special metal filament lamps for motor-car headlights, and some small motor starters. Notes are also given on metal filament lamps for tubolite reflectors and cinematograph equipments. (Page 315.)

A new pattern of tramway controller in which rheostatic braking is possible when the car is running backward is described. (Page 316.)

A Paper by S. W. Melsom and H. C. Booth was read at last Thursday's meeting of the Institution of Electrical Engineers, giving the results obtained at the National Physical Laboratory on the heating of cables with current, which were carried out at the request of the Wiring Rules Committee. (Page 317.)

Mr. Marconi, in a lecture on "Radiotelegraphy" at the Royal Institution, spoke of many curious results that had been obtained, and which still required a satisfactory explanation. He also said that with properly equipped stations mutual interference could be eliminated. (Page 319.)

An article on Municipal Wiring reviews the situation in Marylebone, Sheffield, and Sunderland. In the last-mentioned case, the Newcastle Branch of the Electrical Contractors' Association are proposing to issue a writ against the Sunderland Corporation, alleging that the Corporation are doing electric light wiring in contravention of their statutory powers. (Page 319.)

Among the specifications published by the Patent Office on Thursday last was one by A. J. Boult dealing with a telephone meter to register the number of calls, and also the length of time the line is in use. G. H. Ide describes a method of locking lamps in their holders, and A. Stewart and the Westminster Tool & Electric Co. have patented certain improvements in electric drills. The appeal which was made against the patent by E. Von Lepel, covering a disc discharger of the Lepel system, has been withdrawn. Leave has been granted to T. Ferguson to correct certain figures in the drawings of his patent describing a switch for controlling train lighting circuits. (Page 320.)

The Hampstead Borough Council have opened new showrooms at 283, Finchley Road, N.W., where every kind of electrical appliance for household use can be seen in actual operation, and an experienced engineer is at the service of visitors requiring information or advice. (Page 321.)

The Electric Supply Publicity Committee held their first annual conference last week. (Page 322.)

A party of telephone engineers has left for Constantinople to make preliminary surveys for the telephone system. (Page 322.)

It is stated that a scheme for the construction of tube railways in Manchester is under consideration.—The appeal of the Glasgow Tramways Committee

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against the assessment of their undertaking has been dismissed.—There was a loss upon the Kingston-on-Thames electricity undertaking last year of £1,192.—The Maidstone Electricity Committee report that they have approached the I.M.E.A. with regard to the introduction of a municipal wiring bill.—The Blackpool Corporation propose to supply electric energy free for Coronation illuminations.—There was a profit of £6,798 upon the Croydon electricity undertaking last year. (Page 322.)

SCHEMES for extensions of municipal electrical power stations are contemplated as follows:—Hull, £99,322; Ilford, £8,070; Bermondsey, £18,563; Loughborough, £3,210; Bradford, £60,000; Barking, £11,400. An electric pumping plant is required in Egypt; Poplar Council requires a 3,000 turbo-alternator; an oil-eliminating plant is required at Kettering; battery, reversible booster, and switchgear at Swindon; telephones in Australia; accumulators in Turkey; and a 10,000-h.p. turbo-generator plant in Canada. An electric lighting scheme is being prepared for Pontardawe, and a street lighting scheme is under consideration in Eccles. (Page 323.)

THE first year's work of the Peel-Conner Telephone Works resulted in a net profit of £7,276, after meeting debenture interest. The Adelaide Electric Supply Co. are issuing £100,000 debentures. (Page 324.)

The Johannesburg Gas Engine Station.—In Edinburgh, on Tuesday, an action was commenced in which the Johannesburg (South Africa) Corporation claim about £400,000 damages from Messrs. D. Stewart & Co. (1902), Ltd., for breach of contract in connection with the gas producer plant and gas engines supplied to the Johannesburg Council for their electricity supply works in 1906–7. It will be remembered that the plant worked unsatisfactorily and was ultimately replaced by steam plant. A claim is also being made for the representatives of the late Mr. Joseph Beardmore, of Glasgow, as guarantor for £115,000.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JUNE 8TH.

Royal Institution.

3 p.m. Afternoon Lecture on "Practical Progress in Wireless Telegraphy," by T. Thorne Baker.

WEDNESDAY, JUNE 14TH.

Royal Meteorological Society.

4.30 p.m. At 70 Victoria Street, S.W. "Investigation of the Electrical State of the Upper Atmosphere, August, 1910," by A. J. and Dr. W. Makower, W. M. Gregory, and H. Robinson.

CORRESPONDENCE

THE METAL FILAMENT LAMP PATENT ACTION.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Our attention has been called to the article in your issue of to-day's date in reference to proceedings before Mr. Justice Neville on Friday last in connection with the litigation between this Company and the "Z" Electric Lamp Manufacturing Co., Ltd. In such article it is stated that after Mr. Justice Neville had given judgment dismissing the "Z" Company's application with costs, a consultation took place between the parties, when it was agreed that an action should be brought against the "Z" Company instead of against their agents.

I think it right to point out at once that this statement is incorrect. This Company is quite willing to attack the "Z" Company for infringement of its patents now that the question of the retainers to counsel is settled, but any such action brought against that company will be in addition to, and not in substitution for, the actions already pending against other infringers who have sold or used "Z" lamps, which will be pressed on as rapidly as possible.

Yours faithfully,

OSRAM LAMP WORKS, LTD.

Brook Green, Hammersmith, W. (C. Wilson.)
June 1st, 1911.



The Secretary of the Electrical Contractors' Association is refusing, on behalf of the Central Board, to allow any of the "fighting fund" (collected to meet the expense of a possible fight against the municipalities in Parliament) to be used for an action with which the Newcastle Branch of the Association is threatening the Sunderland Corporation. (See page 319.)

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THE DETERMINATION OF TENSION AND SAG IN OVERHEAD WIRES

By Evan Parry

(Electrical Adviser to the Government of New Zealand).

THE extension of wires suspended in spans under the combined influence of gravity and temperature has received considerable attention since the introduction of long spans of wire for the transmission of electrical energy at extra high tension, and formulæ and diagrams have been evolved for calculating the dip or sag of the wire for a given span and given range of temperature.

The following development after several eliminations results in an equation of the third degree, which is the simplest form to which the equation can be reduced consistent with accuracy. As far as I am aware, no tables have yet been published of dip and tension of wires with varying temperature differences based on being near enough for practical purposes and substituting for c, we have :—

$$s = x(1+\frac{x^2w^2}{6T^2}) \text{ and } y = c+\frac{x^2w}{2T}.$$

The sag or dip $d = y - c = \frac{x^2w}{2T}$.

Let a wire whose length is $2s'$, and cross section A be subject to a tension T under which it stretches to a length $2s$, then :—

$$\frac{T}{A}\Big/\frac{s-s'}{s'} = E = \text{the modulus of elasticity of the material ;}$$

also $$\frac{s-s'}{s'} = \frac{T}{EA}.$$

But EA is the modulus of elasticity of the wire whose area is A. Let this be denoted by λ, then :—$\frac{s}{s'} - 1 = \frac{T}{\lambda}$.

If $2s_o$ and $2s'_o$ be the stretched and unstretched length of wire at some temperature considered as a datum, and $2s_t$ and $2s'_t$ the stretched and unstretched lengths of the same wire at some temperature t above the datum temperature, the following relations hold good :—$\frac{s_o}{s'_o} = 1 + \frac{T_o}{\lambda}$ and $\frac{s_t}{s'_t} = 1 + \frac{T_t}{\lambda}$, where T_o and T_t are the tensions in the wire at the lower and upper limit of temperature.

If α be the coefficient of expansion with temperature $s'_t = s'_o(1+\alpha t)$

and therefore $$s_t/(1+\frac{T_t}{\lambda}) = s_o(1+\alpha t)/(1+\frac{T_o}{\lambda})$$

or $$\frac{s_t}{1+\frac{T_t}{\lambda}} \times \frac{1+\frac{T_o}{\lambda}}{s_o} = (1+\alpha t).$$

Substituting for s_t and s_o their values in terms of the half span x we have :—

$$\frac{1+x^2w^2/6T_t^2}{1+T_t/\lambda} \times \frac{1+T_o/\lambda}{1+x^2w^2/6T_o^2} = 1+\alpha t.$$

Rise of temperature.		0.		25°F.		50°F.		100°F.		150°F.		200°F.	
Size of wire.	Span in feet.	Tension lbs.	Sag feet.	Tension lbs.	Sag feet.	Tension lbs.	Sag feet.	Tension lbs.	Sag feet.	Tension lbs.	Sag feet.	Tension lbs.	Sag feet.
0 SWG	100	1256	0·316	980	0·406	732	0·544	394	1·015	261	1·520	202	1·960
	200	1256	1·265	1024	1·550	833	1·900	580	2·525	447	3·560	369	4·340
	300	1256	2.846	1063	3·37	918	3·900	714	5·02	588	6·10	505	7·10
	400	1256	5·060	1096	5·80	982	6·49	813	7·80	698	9·23	617	10·30
	500	1256	6·900	1120	9·0	1035	9·80	895	11·30	785	12·80	700	14·10
	600	1256	11·384	1141	12·80	1066	13·70	946	15·50	855	17·05	773	18·90
	700	1256	15·480	1167	17·0	1100	17·80	1000	19·80	915	21·60	845	23·0
	800	1256	20·240	1179	21·60	1127	22·57	1040	24·50	968	26·38	908	28·00
00 SWG	100	1526	0·300	1206	0·379	907	0·504	484	0·947	311	1·470	238	1·92
	200	1526	1·200	1252	1·458	1023	1·787	707	2·59	537	3·41	440	4·16
	300	1526	2·700	1300	3·16	1117	3·68	858	4·80	699	5·89	597	6·89
	400	1526	4·800	1340	5·46	1194	6·13	978	7·50	833	8·80	731	10·00
	500	1526	7·500	1373	8·30	1252	9·1	1070	10·8	940	12·2	840	13·5
	600	1526	10·80	1398	11·83	1300	12·72	1144	14·45	1026	16·1	935	17·67
	700	1526	14·70	1417	16·0	1336	16·9	1200	18·9	1095	20·7	1012	22·3
	800	1526	19·2	1432	20·52	1364	21·57	1248	23·55	1154	25·45	1076	27·25
000 SWG	100	1813	0·288	1443	0·362	1100	0·475	585	0·894	369	1·415	278	1·877
	200	1813	1·152	1496	1·397	1221	1·712	832	2·525	644	3·25	508	4·12
	300	1813	2·592	1555	3·025	1332	3·53	1016	4·63	822	5·72	697	6·75
	400	1813	4·608	1600	5·23	1425	5·875	1158	7·22	979	8·55	855	9·78
	500	1813	7·200	1643	7.9	1498	8·75	1265	10·3	1100	11·8	985	13·2
	600	1813	10·368	1680	11·2	1556	12·08	1355	13·88	1213	15·52	1099	17·12
	700	1813	14·11	1705	15·1	1600	16·3	1430	18·1	1305	20·0	1195	21·5
	800	1813	18·43	1726	19·37	1637	20·8	1488	22·5	1370	24·4	1272	26·3
0000 SWG	100	2200	0·275	1772	0·342	1365	0 444	749	0·81	445	1·362	333	1·82
	200	2200	1·102	1825	1·328	1492	1·624	1010	2·4	747	3·24	602	4·03
	300	2200	2·479	1886	2·9	1615	3·39	1196	4·575	980	5·59	826	6·63
	400	2200	4·408	1941	4·995	1720	5·635	1388	6·985	1166	8·32	1014	9·57
	500	2200	6·887	1988	7·6	1802	8·4	1515	10·0	1320	11·5	1170	12·85
	600	2200	9·918	2027	10·75	1872	11·65	1626	13·42	1445	15·1	1304	16·74
	700	2200	13·47	2058	14·5	1927	15·5	1715	17·5	1550	19·3	1420	21·1
	800	2200	17·63	2083	18·62	1971	19·68	1784	21·75	1634	23·6	1516	25·6

Board of Trade regulations, and a beginning is here made with solid copper wire in four sizes. Perhaps others will follow with stranded copper wires and aluminium wires, so that in course of time a series of tables covering a wide range will become available.

Let a wire or cable, uniform in section, whose weight is w per unit length, be stretched between two supports distance $2x$ apart. The wire, if inextensible and subject to its own weight only, takes up a position known as a catenary, the fundamental equations of which curve are

$$s = c\ sinh\ \frac{x}{c} \text{ and } y = c\ cosh\ \frac{x}{c}$$

where $2s$ is the length of the wire, c is a length of wire whose weight is equal to the horizontal component, T of the tension in the wire which is also the tension at the lowest point of the wire), so that $T = wc$.

Expanding $sinh\ \frac{x}{c}$ and $cosh\ \frac{x}{c}$, using two terms of the series as

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Multiplying up and neglecting the last term of each product we have:—

$$\frac{1+x^2w^2/6T_t^2+T_o/\lambda}{1+x^2w^2/6T_o^2+T_t/\lambda}=1+\alpha t.$$

Multiplying up again and neglecting the smaller orders of magnitude, the equation reduces to:—

$$T_t^3+T_t^2(\alpha\lambda t+\frac{x^2w^2\lambda}{6T_o^2}-T_o)-\frac{x^2w^2\lambda}{6}=0 \qquad (1).$$

This is the simplest form to which the equation can be reduced, and its solution presents no difficulty.

As an example, let a copper wire equivalent to No. 2/0 S.W.G. be stretched between supports 600 ft. apart, the diameter of the wire is 0·348 inches, and area 0·095 square inches, and weight per foot 0·367 lbs.

Take the modulus of elasticity of copper at 16×10^6, the modulus of the wire is $16\times10^6\times0\cdot095=1\cdot52\times10^6$. Take the elastic limit of copper at 28,000 lbs. per sq. inch the corresponding limit in the wire is $28{,}000\times0\cdot095=2660$ lbs. per sq. inch. If the maximum wind pressure be taken as 50 lbs. per sq. foot of plane surface the pressure per foot of wire is $\frac{50}{2}\times\frac{0\cdot348}{12}=0\cdot725$ lbs. As provision must be made against the contingency of the maximum wind pressure occurring when the temperature is at its lower limit, the allowable tension in the wire in still air at the lower limit must be less than the elastic limit in the ratio 0·367 to $\sqrt{(0\cdot367^2+0\cdot725^2)}$ or 0·367 to 0·81, viz., $2500\times0\cdot367\div0\cdot81=1134$ lbs. Take the coefficient of expansion with temperature at 9×10^{-6} per degree Fahrenheit and let the range of temperature be 105 degrees F., we have:—

$$\alpha=9\times10^{-6}\quad\lambda=1\cdot52\times10^6\quad t=105.$$

$$\alpha\lambda t=9\times10^{-6}\times1\cdot52\times10^6\times105=1435.$$

$$x=\frac{600}{2}=300.\quad x^2=90{,}000.\quad w=0\cdot367.\quad w^2=0\cdot1345.\quad T_o=1134.$$

$$T_o^2=1\cdot29\times10^6.$$

$$\frac{x^2w^2\lambda}{6T_o^2}=\frac{9\times10^4\times0\cdot1345\times1\cdot52\times10^6}{6\times1\cdot29\times10^6}=2375.$$

$$\alpha\lambda t+\frac{x^2w^2\lambda}{6T_o^2}-T_o=1435+2375-1134=2676.$$

$$\frac{x^2w^2\lambda}{6}=\frac{9\times10^4\times0\cdot1345\times1\cdot52\times10^6}{6}=3070\times10^6.$$

$$T_t^3+2676T_t^2-3070\times10^6=0.$$

By trial T_t is found to be 920 lbs.

The dip or sag is obtained directly from this from the equation

$$d_t=\frac{x^2w}{2T_t}=\frac{9\times10^4\times0\cdot367}{2\times920}=17\cdot9 \text{ feet.}$$

The table on page 313 has been calculated on the basis of the Board of Trade requirements issued under the Electric Lighting Acts of 1882–1890 in the form of a model description, paragraph 5 of which states, "Wind pressure will be taken at 30 lbs. per sq. ft., and the effective area of the wire will be taken as 0·6 of the diameter multiplied into the length."

"Water Wireless Telegraphy."—We have received a copy of an interesting pamphlet with the above title by Habibur Rahman Khan, Deputy Superintendent of Telegraphs, Allahabad, India, describing a system of wireless communication more of the nature of earth (or water) conduction telegraphy than true Hertzian-wave telegraphy, but utilising to obtain sensitivity the full advantages of resonance between the impulses sent and the natural period of the receiving apparatus. The system has been used with success in India for communication between different points on a river. Full diagrams of the system are given, and the actual description is prefaced by some general notes on wireless telegraphy, with a delightful note of originality in the expression of the ideas.

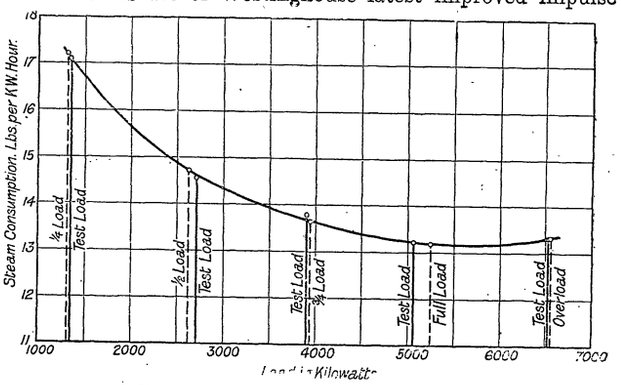
Inspection of Turbo-blower.—At the invitation of the British Westinghouse Electric & Manufacturing Co., Ltd., a large number of managers of iron and steel works, and others interested, paid a visit to the Westinghouse Works, Trafford Park, on Monday and Tuesday, May 29th and 30th, to inspect the test of a mixed-pressure turbo-blower for operating in connection with blast furnaces. The blower has a capacity of 25,000 cu. ft. of free air per minute against 8 to 10 pressure. Considerable interest was shown by the visitors in the test, and every facility for inspection was afforded by the company, the visitors being accompanied in their tour by several Westinghouse engineers.

Petrol-Electric Car on the Great Central Railway.—The Great Central Railway Company have recently placed an order with the British Westinghouse Electric & Manufacturing Company, Limited, for one of their "petrol-electric" cars, which will shortly be put on the tracks in the London district for its trials under the direct observation of Mr. Sam Fay, the General Manager of the Railway, preparatory to going into service on a branch line. The car in question, which is of the general type developed so successfully by the Westinghouse Companies on the Continent, particularly in Hungary (see ELECTRICAL ENGINEERING, Vol. IV., page 510), will seat 50 persons, and be capable of hauling two trailers, seating 50 more, at an average speed of 30 miles per hour on the level.

TEST OF A 5,000-KW. TURBO-ALTERNATOR

THE tests of the new 5,000-kw. steam turbo-generator, one of two which the British Westinghouse Electric and Manufacturing Co., Ltd. is supplying to the Clyde Valley Electrical Power Co., Glasgow, show even better results than those recently obtained on the 3,000-kw. turbo-alternator, supplied by the same company for the Bristol Corporation (see ELECTRICAL ENGINEERING, May 4th, page 235). The tests were carried out at the Motherwell power house on April 8th and 9th, 1911, in the presence of Mr. B. A. Starr, the General Manager of the company, Messrs. Strain and Robertson, the consulting engineers, and other officials.

The turbines are of Westinghouse latest improved impulse



RESULTS OF TESTS OF 5,000-KW. WESTINGHOUSE TURBO-ALTERNATOR AT MOTHERWELL POWER HOUSE OF THE CLYDE VALLEY ELECTRICAL POWER CO.
Corrected to 175 lb. per sq. in. steam pressure.
150° F. superheat.
28·5 in. vacuum.

type, arranged for working with high pressure steam supplied direct from the boilers at 175 lbs. per sq. in. pressure, and 150° F. superheat, both being measured at the stop valve.

The conditions specified for carrying out the tests were as follows:—

The normal output is 5,000-kw. 3-phase at 11,000 volts 25 cycles. The tests included runs at 25 per cent. overload for six hours, full load for six hours, three-quarter load for two hours, one-half load for two hours, one-quarter load for two hours.

The tests work out as follows:—

Output, k.w.	1346	2715	3902	5066	6487·5
Speed, r.p.m.	1500	1500	1500	1500	1500
Steam pressure, lbs. ...	174	176	175	174·5	174·5
,, temp., °F.... ...	518	519	542	552	544
,, superheat, °F. ...	141	141	164	175	167
Vacuum corrected to 30″ Bar.	28·13	28·28	28·58	28·68	28·53
Cir water inlet, °F. ...	43·9	43·7	44	44	43
,, ,, outlet, °F. ...	48	53 6	57	60	65·5
Steam consumption, total lbs.	24,780	40,130	53,125	65,860	85,880
Ditto. Ditto.	18·41	14·78	13·61	13·00	13·24

We understand that Mr. Starr, the General Manager of the company, the Consulting Engineers and the Directors have expressed their gratification at the results obtained, and at the reduction of the generating costs as shown by their records since the turbo-generator was put in commission.

A High-tension Electrostatic Wattmeter.—An instrument of this nature was described in a Paper by Prof. E. Wilson at a meeting of the Physical Society on April 28th. When the electrometer is used as a wattmeter it is necessary that the voltage impressed upon the quadrants shall not be less than a certain minimum depending upon the voltage to be impressed upon the moving system. When the latter voltage is of the order 10,000, the quadrants require a voltage larger than can economically be provided by a shunt, and intensifying devices have to be used. The current transformer, whose secondary winding is closed on a non-inductive resistance, can be used to give fairly good results, but it is not accurate at all frequencies, and is dependent upon wave form. The author's method employs a generator with an air-cored magnetic circuit. The mains current is passed through the field coil of the generator and produces a magnetic field proportional to the current; the armature is driven at known speed in this field, and is provided with a commutator and brushes. The brushes when set accurately have a voltage between them proportional to, and having the same wave form as, the mains current. Another device depending upon the charging of condensers in parallel and the placing of them in series has also been used for multiplying a small voltage produced by the passage of the mains current through a low-resistance shunt.

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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Arc Lamps.

AN arc lamp has been designed by the Foster Engineering Co., Morden Road, Wimbledon, to work with frequencies from 25 to 40. This has been found possible by constructing on the hot wire principle; a strip of special alloy being used to operate the chief working parts. Figure 1 shows the operation of the mechanism; the circuit of the current starts at terminal T_1 and flows down L_1 to the strip S, from which it passes to the top carbon holder by the flexible F_L. The action of the

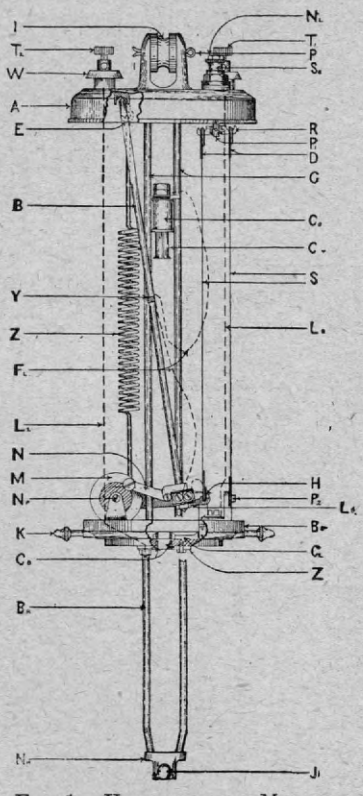


FIG. 1.—VIEW SHOWING MECHANISM.

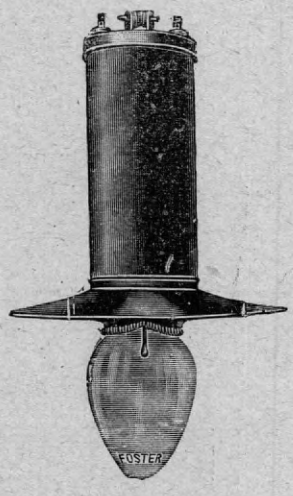
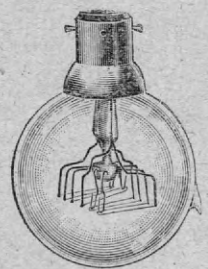


FIG. 2.—GENERAL VIEW OF LAMP.

current in expanding the strip S, causes the disc M to rotate and lift a clutch C_L, thus striking the arc. The reverse of this takes place if the arc lengthens or breaks. In this lamp the unreliable dashpot is conspicuous by its absence, and there is also no self-induction, so that a high power factor is maintained. On 200/440 volts it is advisable to burn the lamps in series parallel with a transformer, so that each lamp is independent in the circuit, and also the substitutional resistance and cut-out can be dispensed with on high voltage circuits. Fig. 2 shows an outside view of the lamp.

Incandescent Lamps.

Messrs. Ward & Goldstone (Springfield Lane, Salford, Manchester) have turned special attention to metal filament lamps for motor-car lighting, and supply these from 2 to 12 volts for various candle powers from 1 to 22. For headlights they have developed the special form of focus lamp illustrated here with several filaments arranged in the same plane in a special bulb with the pip at the side. The 4-volt lamps of this kind range up to 16 c.p. and a 32-c.p. 3-volt lamp taking 4 amperes is also made. The firm also list the "festoon" form of lamp for interior lights.

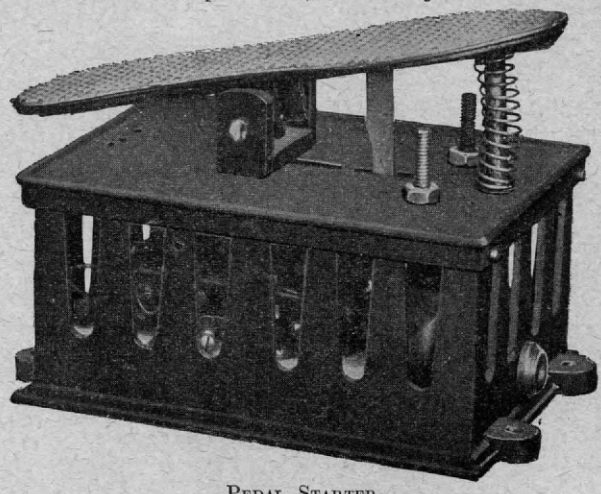


"AUTO-METAL" FOCUS LAMP. (Ward & Goldstone.)

The Linolite Co. (25 Victoria Street, S.W.) whose "tubolite" system of tubular lamps in special aluminium trough reflectors was originally introduced when the carbon lamp was all that available, have for nearly three years had on the market a tubolite metal filament lamp for 25 volts. They now inform us of further advances and of their readiness to supply metal filament "tubolite" lamps of 12 c.p. each for circuits from 100 to 125 volts with an efficiency of about 1·5 watts per c.p. The total cost of the complete fitting with these lamps is the same as for the old lamps, notwithstanding the fact that the price of the lamps themselves is slightly higher. New pamphlets and price-lists are now available.

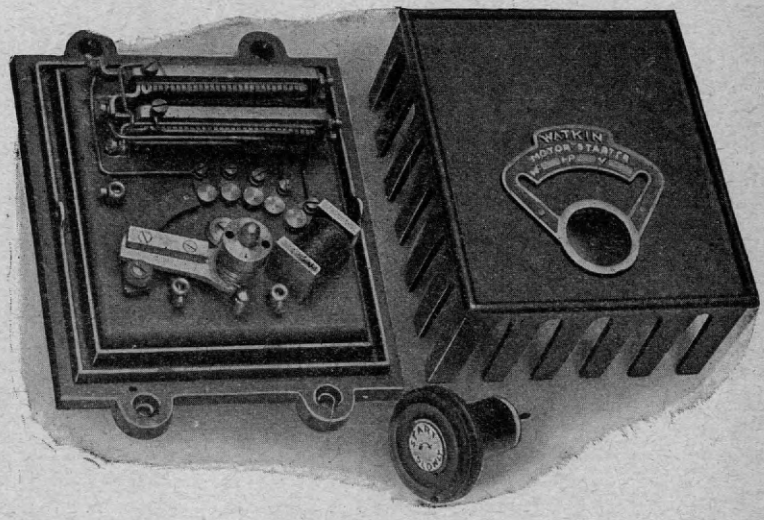
Switches, Fittings and Accessories.

The Adams-Watkin Co. (36 Victoria Street) have issued a list which, in addition to their well-known resistance switches for incandescent lamp circuits, contains particulars of some



PEDAL STARTER. (The Adams-Watkin Co.)

new patterns of small motor starters and regulating switches which they have brought out. One of these starters with no-voltage release such as is made for motors from ½ to 7½ h.p.



STARTER FOR SMALL MOTORS. (The Adams-Watkin Co.)

is illustrated here, while another illustration shows a foot starter and regulator for motors up to ¼ h.p. for sewing-machines, dental and jewellers' appliances, etc. Complete small motor panels are also listed.

Miscellaneous.

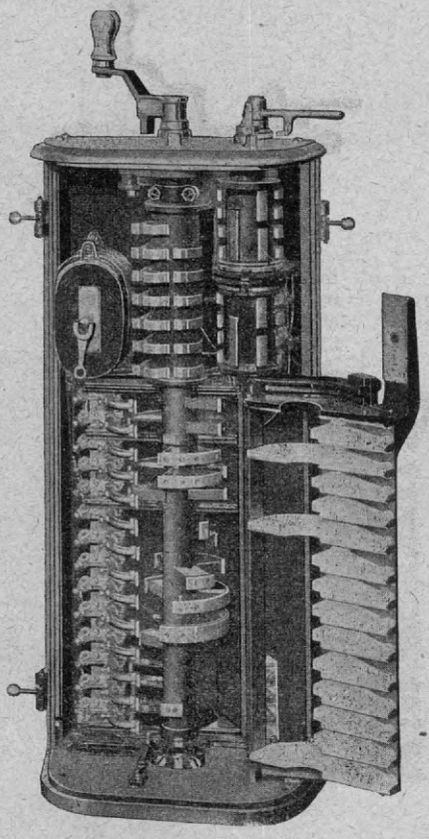
A booklet from the British Westinghouse Electric and Manufacturing Co., Ltd. (Trafford Park, Manchester) entitled the "Cinematograph Theatre," deals very thoroughly with the electric equipment for these establishments and describes apparatus which the company have developed specially for this purpose giving useful information as to its use. The superior economy of motor generators over resistances is demonstrated and the special switch and central gear which has been standardised is explained. Illustrations of actual installations are given, and for cases where public supply is not available, gas and petrol driven generating sets are put forward. A few words on general interior and exterior lighting and on the much neglected subject of ventilation are also included. A reprint of the booklet now in the press contains in addition, all the regulations governing the use of electricity in cinematograph theatres.

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A NEW TRAMWAY CONTROLLER

FOR tramway service a simple form of control apparatus is essential, in order that a driver in case of emergency may instinctively do the correct thing to avoid accident. Very reliable and simple forms of controllers have been in use for many years, but with respect to rheostatic braking in the event of a car running away backwards, there has been room for improvements.

Controllers of the braking type now in use are arranged so that if the car is running in a forward direction, on moving the handle to the brake notches currents are generated in the motors, producing a retarding torque, the direction of the currents in the motors being such as to strengthen the magnetism of the fields. If, however, the car is running backwards, and the controller handle be moved to the brake notches, the direction of currents generated in the motors is such as to demagnetise the fields, so that no braking effect is produced.

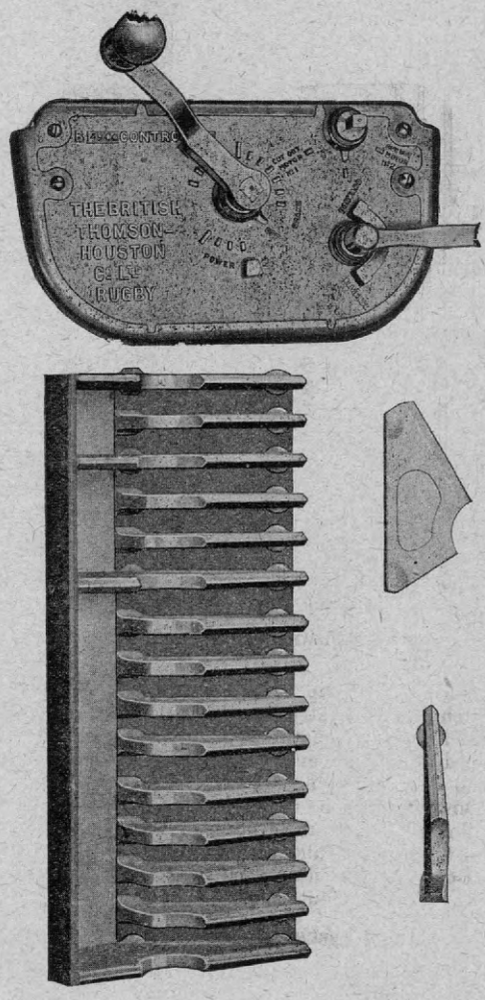


NEW PATTERN OF B.T.-H. TRAMCAR CONTROLLER, GIVING RHEOSTATIC BRAKING WHILE CAR IS RUNNING BACKWARD.

To obtain a braking action when the car is running backwards, the British Thomson-Houston Co., Ltd., of Rugby, have designed and manufactured controllers in which, when the controller handle is moved to the "off" position, connections are made which cause one or more of the motors to act as generators, producing the desired effect. These connections are such that no braking action is obtained during forward running of the car if the handle is in the "off" position. An arrangement preferable to this, however, is one in which the motion of the control handle, which produces braking for forward running will also produce braking for backward running. The B.49 controller shown in the illustration will give this result. The reverse switch handle may be in either the forward or reverse position when, by moving the main control handle to the braking notches, a rheostatic braking effect will be obtained for either forward or backward motion of the car. This controller is suitable for use with two 40-h.p. 500–600-v. series motors, and has four series, four parallel, and seven brake-controlling points.

Another important new feature is the mechanism by which a defective motor may be cut out of service without removing the cover of the controller. To cut out a motor it is only necessary to remove the reverse-switch handle from its spindle, and apply it to the cut-out spindle which projects through the cap plate, shown in the illustration near the back edge of the cap plate. This cut-out spindle has three running positions: a central position for which both motors are in circuit, and a position on each side to cut out either motor. An interlocking mechanism prevents the reverse-switch being moved unless the cut-out switch spindle is in one of its three running positions. The usual interlocking mechanism is provided to prevent the reverse switch being moved unless the main cylinder is in the "off" position.

The arc deflector, consisting of fire-proof barriers, is of strong mechanical construction, the large deflector plates being being supported at both ends, and the small plates moulded with large bosses for the fixing screws, thus providing rigid fixing for the plates. A strong magnetic blow-out is provided for all fingers of the main cylinder on which arcing takes place, and an insulating trough surrounds the back half of the main cylinder protecting the frame from the influence of the arc or live parts. The trough is divided into sections by barriers; these, with the arc deflector which covers the front half of the main cylinder, form separate chambers for enclosing various sections of the cylinder which may be at different potentials.



The brake cylinder is mounted on the main cylinder spindle in accordance with long-established standard B.T.H. practice, thus preventing any possibility of change in the relative positions of brake cylinder and handle, which may occur due to wear on the gears or cams when the brake cylinder is mounted on a separate spindle. One feature of this controller not to be found on most tramway controllers, is the provision of ample space for the incoming cables, and the arrangement of the various parts to enable wiring to be easily and quickly effected.

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THE HEATING OF CABLES WITH CURRENT

AT the request of the Wiring Rules Committee of the Institution of Electrical Engineers, an investigation has been made at the National Physical Laboratory to determine the temperature rise and the current density for a given rise of temperature in cables of various sizes with different coverings, and the results obtained were given in a Paper by S. W. Melsom and H. C. Booth, which was read at last Thursday's meeting of the Institution. The cables, some of which were paper-insulated lead-covered, and the others rubber-insulated, taped, braided, and compounded, were tested in air, and also, in respect to the rubber cables, in casing and in iron tubes, laid in air and in plaster 4 ins. deep by $6\frac{1}{2}$ ins. wide. The temperature rise was measured by the increase of conductor resistance. The initial temperature of the cables was assumed to be that of the air, and was taken at the same level and about 3 ft. from the cable, under conditions adapted for constancy of temperature. The temperature co-efficiency was obtained by cutting about a metre off several cables, and testing each

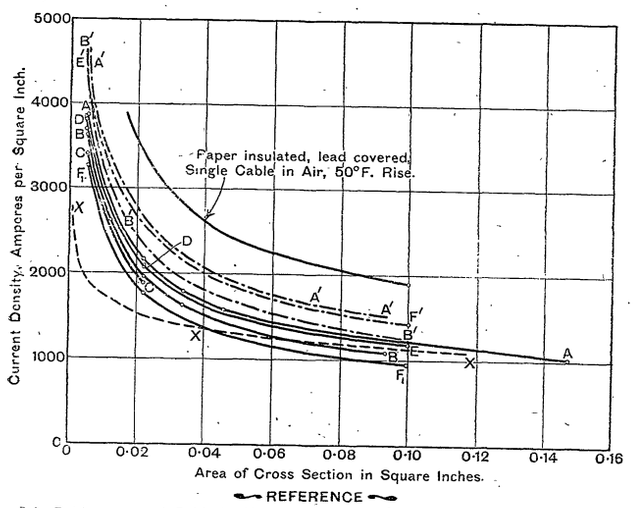


FIG. 1.—CURVES OF CURRENT DENSITY AND SECTIONAL AREA OF CONDUCTOR.

separately in an oil bath at various temperatures, and this was used in the following formula for the rise of temperature, $R_t = R_{15}\{1+0{\cdot}004(t-15)\}$, where R_{15} is the resistance of the conductor at 15° C., and R_t the resistance at t° C. Mr. Wordingham suggested that, in the case of the larger stranded cables, the resistance would not rise in proportion to the temperature, there being a possibility of the strands, when hot, coming into better contact than when cold; but from a test carried out on a 0·5 sq. in. paper-insulated, lead-covered cable, which was heated in a wooden box by means of woven resistances, to a temperature of 50° C., it was found that the presumed variation in resistance due to the tightening of the strands made no difference to the previous results. The resistance of conductors was taken on a Kelvin double bridge of the direct-reading type. The following precautions were taken to avoid undue heating or cooling at the ends: cable of the same size as that under test was used for connection to the standard resistance, the joints were wrapped in canvas, and the potential leads joining the cable and bridge were taken off at a point just inside the joints; water-cooled German-silver tubes, in which the rise of temperature is very small, formed the regulating resistances for the larger currents, and in the case of the smaller cables Eureka strip was used. A battery connected up to give six volts supplied the current, which was kept steady throughout the tests. An Elliott precision millivoltmeter, adjusted to give a full-scale reading for a drop of 0·15 volt, was used to measure the current. The standard resistances were made of manganin sheet or wire, the resistances of which closely resembled that of the cable under test. The heating effect of alternating current was tested by heating the cable with the current and then switching it on to a direct-current supply to measure the resistance, the result obtained coming to within 3 per cent. of the previous tests with direct current, being within the probable limit to which the alternating current was kept constant. A comparison was made between the solid wire and the different methods of stranding by making a correction in the result for the small differences in cross section between the conductors, and it was found in the case of a 14 S.W.G. and a 7/21 s. cable that the difference of a current required for a given temperature was

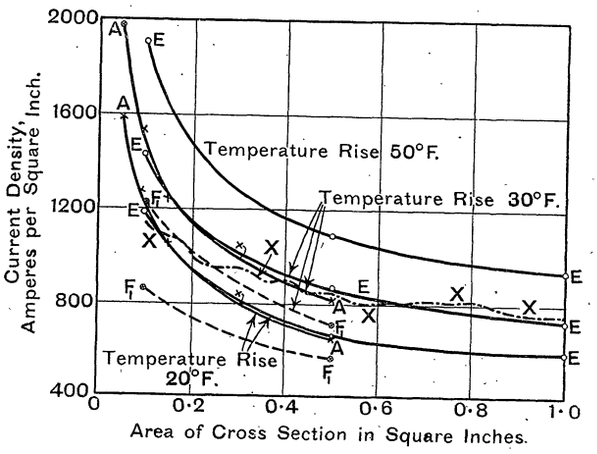


FIG. 2.—CURVES OF CURRENT DENSITY AND SECTIONAL AREA OF CONDUCTOR.

only 3 per cent., the actual temperature difference being 1° F. with 20 amperes. Curves of results were shown in which it was seen that the current-carrying capacity of the rubber cables for a temperature-rise of 20° F. was about 10 per cent. less when run in casing than in air, and that there was very little difference between the rubber- and paper-insulated cables when laid under similar conditions, also the difference between the rubber cable in casing and in tubing laid in air was very small compared with the tubing when embedded in plaster, which produced such a good cooling effect as to agree very closely with the result of the lead-covered single cable. The curves reproduced in Figs. 1 and 2 show the results of the whole series of cables tested in current-density per sq. in. of conductor for a given temperature rise, which show that with the single rubber-covered cables in air and wood casing, and the paper-insulated lead-covered cables, both single and concentric, the connection between cross section and current density could be fairly represented by the general formula of the type $i = K(\frac{D}{S})^n$, where n is a constant and is obtained from the slope of the curve, and K depends on the units adopted and the temperature rise. Log i and Log $\frac{D}{S}$ were plotted, showing that, for the same rise of temperature, 20° F. and 30° F., the values follow approximately a linear law. In the curves given here the current density allowed by the present wiring rules is shown by the curve x, which, on comparing with the other curves, is seen to give a temperature rise of 20° F. for cables from 0·05 sq. in. to 0·15 sq. in., rising to rather more than 30° F. for cables up to 1 sq. in., and for those smaller than 0·05 sq. in. the temperature rise is much less than 20° F., being only about 7° F. for a 3/18 s. cable in casing.

DISCUSSION.

Mr. C. P. SPARKS (Chairman of the Wiring Rules Committee) said that attention had been called to the fact that the new rules permitted a high current density in the smaller conductors, but it had not been pointed out at the same time that a lower current density was allowed in the larger cables. A study of this Paper would show that with even that large decrease they were still working on a very conservative basis. For instance, an increase of temperature rise of 20° with rubber cables and 30° for paper cables was very small indeed, since it was assumed that it was safe to work up to an air temperature of 100° F., so that 20° heating was still a very moderate figure even at the higher current densities. The real reason for the change

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was the largely increased use of electricity for power and heating purposes, as in these cases the pressure drop was not of such importance as with lighting. It was the supply engineer who realised that it did not help the industry to have idle copper, and he was more responsible than the contractor. They could feel quite satisfied with regard to public safety, for besides going through the hands of the Committee and Council, the rules had been accepted by about forty-eight leading insurance offices. It was proposed to go further in the revision later, and to deal with the question of critical temperature. Safe temperatures had been given of 120° for rubber and 150° for paper, but the deterioration of these materials deserved careful investigation.

Mr. H. HUMAN (Guardian Fire Office) recalled his early attempts to frame wiring rules on the basis of a certain number of amperes per square inch. This, however, implied that the temperature rise for a given current was proportional to the sectional area of the wires, and this was not the case. In 1890 he recast his rules in consequence of Dr. Kennelly's researches on rubber-covered cables in casing, as compared with gutta-percha, which was previously used. In 1897 the Institution Rules contained a table of current densities based on rise of temperature, and he adopted these rules for the sake of uniformity. There were, however, no reliable data available, so that when the rules were further revised the National Physical Laboratory was asked to make an investigation.

Mr. J. F. C. SNELL said that although the larger sections of cable had been badly rated in the past, no evil results had shown themselves. He would like to see a thorough investigation of the heating of cables laid in the streets. It was suggested in the Paper that a temperature rise of 3° was sufficient for cables in wet earth, and this seemed to be rather a strong indication that armoured cables or lead-covered cables laid in the soil were capable of carrying higher currents than solid cables or cables laid within ducts. If the investigation could be extended in this way, it would materially assist them, especially with three-core cables laid solid and in concrete ducts. The authors did not deal with the effect of the current densities and temperature rise upon the dielectrics used. He believed it was true that with paper cables the insulation resistance actually dropped some 4 per cent. per degree F. rise of temperature.

Mr. W. R. RAWLINGS, who represented the Electrical Contractors' Association on the Wiring Rules Committee, said that the old rule of 1,000 amperes per sq. in. had permeated the industry to such an extent that it had blocked progress. To lay down a small heating installation under the old wiring rules it cost £100, as against £30 under the new rules. The new rules should greatly develop the heating day load.

Professor PORTER said the Paper gave experimental verification of theoretical assumptions made many years ago, and referred to experimental work of his own in the past.

Mr. A. W. WHALLEY asked if experiments had been made with lead-covered rubber cables, and, if so, were they identical with the lead-covered paper cables? He hoped the formula given in the Paper would be simplified, after the manner of that given by Kennelly.

Mr. C. C. PATERSON (National Physical Laboratory) pointed out they were not any worse off in the matter of voltage drop than under the old tables, on account of the universal use of metal filament lamps, with which the fall in candle-power per volt drop was only half what it was with carbon filament lamps.

Mr. T. RITCHIE thought the alteration in current densities would affect arc lamp work very materially. He had just inspected a large arc lamp installation, and calculated that the work could be done under the new rules for about 17 per cent. less capital expenditure. He thought that information would be valuable in the case of pit shaft cables, where there was moisture and practically forced draught.

Mr. W. P. DIGBY said that in the case of lead-covered rubber cables there was an increase in dielectric strength with rise of temperature, which offset some of the effects due to fall of insulation resistance.

Mr. MELSOM, in reply, said that the insulation resistance of paper cables dropped about 50 per cent. for each degree F. rise of temperature, and not 4 per cent. No experiments had been made with lead-covered rubber cables, but the formulæ given in the Paper made it quite easy to calculate. With regard to a simpler formula, Kennelly's was simpler, but it was not strictly accurate for covered cables. The formula in the Paper gave the heating which determined the current density which would be obtained in the cable, and in order to determine the heating it was necessary to know the true diameter of the copper, which Kennelly did not take into account. One of the figures in the Paper gave the nearest approximation he could get to a colliery shaft. That cable was in a shaft, along which was drawn a current of air at normal temperature, which kept the cable cool. When actually laid in a colliery shaft, it would keep cooler than the current density curves shown.

Railway Electrification.—According to a Reuter telegram from Santiago de Chile, the Chilian Minister of Public Works proposes to submit a Bill for the conversion to electric traction of over 600 miles of railway.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

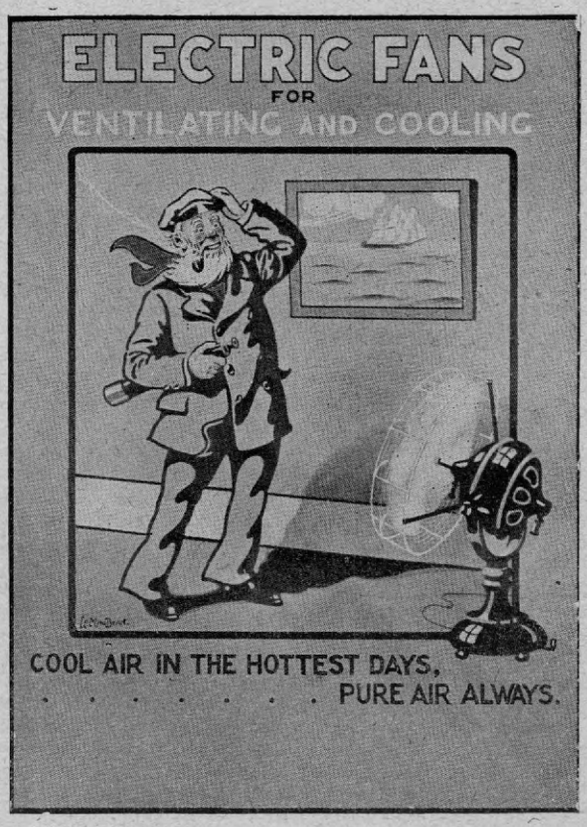
SMALL TRANSFORMERS.—A new price list from Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston) deals with transformers for "Tantalum," "Onewatt," and other types of metal filament lamps. This list has been specially prepared owing to the popularity of transformers for use in conjunction with low-voltage metal filament lamps, and particular attention should be called to the double-wound type for Stannos installations on the concentric system, although the firm will be pleased to quote on inquiry for any type of transformer not included in the list. A wide selection of auto-transformers, balancing auto-transformers, double-wound transformers, and bell transformers is standardised at prices comparing very favourably with those of other manufacture. The windings of these transformers are protected by the cases, and it is therefore impossible to damage them accidentally. They are practically noiseless, and are tested before despatching at a voltage considerably in excess of that for which they are designed.

INSTRUMENTS.—A booklet from R. W. Paul (33 Leicester Square, W.C.) describes some recent improvements in electrical measuring and testing instruments, including resistances and bridges, moving-coil instruments, testing sets, condensers, potentiometers, alternating and high-frequency instruments, and apparatus for measuring inductance and capacity and for telephonic research.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

CABLES, &c.—A card from the St. Helens Cable & Rubber Co., Ltd. (Warrington), calls attention to their various manufactures, including cables and wires, tyres, matting, insulating gloves, tape, &c. The back of the card gives some condensed hints on golf.

ELECTRIC SUPPLY ADVERTISING.—The Electric Supply Publicity Committee are making a further issue of advertising matter, including a large poster designed by Mr. L. C. McBean,



ELECTRIC FAN POSTER.

depicting an old seafaring man enjoying the breezes from an electric fan. A special fan booklet and an ironing folder have also been produced. Another publication is an electric sign circular, and the Committee have also prepared a miniature edition of the fan poster for attaching to correspondence.

RECTIFIERS.—A folder (in German) from the Allgemeine Elektricitäts-Gesellschaft calls attention to special mercury vapour rectifiers for running cinematograph arcs. These are arranged to start automatically as soon as the arc is struck, and obviate the use of series resistances.

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STRIP FITTINGS FOR ILLUMINATIONS.—A leaflet from the Electrical Co., Ltd. (122-124 Charing Cross Road), gives notice of a special offer of series striplite with porcelain holders for illuminations at 1s. per point complete.

CORONATION ILLUMINATIONS.—A card from Simplex Conduits, Ltd., gives particulars of special coloured lanterns for Coronation illuminations, of which an effective coloured illustration is given.

POLYPHASE INDUCTION MOTORS.—Messrs. Bruce Peebles & Co., Edinburgh, have issued a pamphlet dealing with induction motors. Part 1 relates to their open bedplate type, which are arranged with two or three bearings, and Part 2 deals with the endhood pedestal type of machine, the bearings being carried in the end hoods. This type is well adapted for direct coupling to pumps, fans, &c. Lists are given showing the range of voltage, 110-6,600, with approximate weights and dimensions of both types.

ELECTRIC KETTLES.—As we go to press we have received a pamphlet from the British Thomson-Houston Co., Ltd. (Rugby), describing their latest form of electric kettle, a special feature of which is the heating element, consisting of calorite wire wound on a mica former enclosed between cast-iron plates.

WIRELESS TELEGRAPHY

MR. G. Marconi, in a lecture on radio-telegraphy at the Royal Institution on Friday, June 2nd, said that while it was easy to transmit waves up to a distance of 2,500 miles, beyond this distance there were many curious facts requiring a satisfactory explanation. For example, short waves will traverse much greater distances by night than by day, while longer waves will traverse only about the same or less distances, also at night much greater distances are obtainable in a north-southerly direction than in an east-westerly direction, and mountains and land generally obstruct short waves in the sunlight, but not at all in the night. He referred to improvements made in his earlier system to secure selectivity, which comprised two tuned circuits in the transmitter and receiver known as the syntonic system. At the Transatlantic station at Clifden, in Ireland, he employed air condensers and rotating disc dischargers, producing a musical note in the receivers, which are tuned both to the same note and the wave frequency thus securing great selectivity. Towards the end of last year a number of long distance tests were carried out between the stations at Clifden and Glace Bay in Canada and a receiving station on the Italian ss. Principessa Mafalda in the course of a voyage to the Argentine. The aerial was supported by a kite, and signals and messages were obtained without difficulty by day as well as by night up to a distance of 4,000 miles from Clifden. Beyond this distance reception could only be carried out during the night. At Buenos Ayres, over 6,000 miles from Clifden, the night signals from both Clifden and Glace Bay were generally good. Improvements introduced at these two stations had greatly reduced the effect of interference and had strengthened the received signals so that they could be recorded. The recording was done photographically, a fixed record of the messages being received at a much greater speed than any operator by sound or sight could attain. He thought that he was not too bold when he said that wireless telegraphy is tending to revolutionise our means of communication. The fact that a system of Imperial Wireless Telegraphy was to be discussed by the Imperial Conference showed the supremely important position which radiotelegraphy over long distances had assumed in the short space of one decade. Its importance from a commercial, naval and military point of view had increased very greatly during the last few years owing to the innumerable stations which had been erected or were in the course of construction. Notwithstanding this multiplicity of stations and their almost constant operation, mutual interference between properly equipped and efficiently tuned instruments had so far been almost entirely absent. In regard to the high power Transatlantic stations the facility with which interference had been prevented had to some extent exceeded his expectations. During a recent demonstration arranged for the Admiralty, at a receiving station situated only eight miles from the powerful sender at Clifden, messages could be received from Glace Bay without any interference from Clifden when the latter station was transmitting at full power on a wave-length differing only 25 per cent. from the wave radiated from Glace Bay. Permanent arrangements are now being made to send and receive simultaneously at these stations, which will constitute in effect the duplexing of of radiotelegraphic communication between Ireland and Canada. It would, therefore, also be practicable to operate at one time on slightly different wave-lengths a great number of long distance stations situated in England and Ireland without danger of mutual interference.

MUNICIPAL WIRING

A REFERENCE to the possibility of "serious developments" in Marylebone is made in the leading article of the June number of the *Electrical Contractor*, the official organ of the Electrical Contractors' Association, and this has impelled us to make inquiries to ascertain what is precisely the position there with regard to the statutory powers of the Sales Department as to house wiring.

The Marylebone Borough Council, by their special Electric Lighting Act of 1904, may "provide sell let for hire and fix set up alter repair and remove (but shall not manufacture) lamps meters electric lines fittings motors apparatus and things for lighting and motor power and for all other purposes for which electrical energy can or may be used or otherwise necessary or proper for the supply distribution consumption or use of electrical energy and may provide all materials or do all works necessary or proper in that behalf." The power given in this Act is, however, subject to the proviso that the Council shall not themselves execute the wiring of private property except between the main of the Council and the consumer's meter.

On the other hand, the L.C.C. (General Powers) Act, which was passed two years later, viz., 1906, gave power to any Metropolitan Borough to carry out wiring work without the restriction contained in the Marylebone Act.

Although it might be thought that under this latter Act the Marylebone Borough Council would be quite safe in carrying out wiring work, yet it appears that the Council prefer to be on the safe side, and contend that they do not do any wiring work themselves. They certainly furnish all the material, such as cables, fittings, motors, cooking and heating appliances, lamps, etc., for the work which they undertake, but it is claimed that in all cases, without exception, the actual wiring is sub-let to contractors. Even if it were not so, however, we cannot but think that the Electrical Contractors' Association would find it very hard to make a good case against the Marylebone Borough Council, as it is not at all certain that under the latter Act the Council could not do the whole wiring themselves without exceeding their powers.

The action of the Electrical Contractors' Association against the Sheffield Corporation is making slow progress. The plaintiffs have experienced some difficulty in obtaining an Order authorising an investigation of the books of the Corporation, but it appears now that permission has been given them to see some of the books and documents required. In Sheffield it will be remembered the Corporation took over its electricity supply business from a company, a large proportion of whose work consisted of private wiring. The Corporation maintain that they are quite justified in continuing the wiring business as they are doing, but the contractors contend that the Corporation possess no real authority to carry on other business than supply.

The Newcastle-upon-Tyne Branch of the Electrical Contractors' Association is issuing a writ against the Sunderland Corporation, contending that this Corporation are doing electric light wiring in contravention to the statutory powers which they possess. According to the *Electrical Contractor*, there has been some little hitch in connection with the financing of this proposed action. The Newcastle Branch of the Association have contributed to the "fighting fund" which was collected by the Association in view of the Bill which the Incorporated Municipal Electrical Association were threatening to introduce to authorise all municipalities to carry out house wiring. The Newcastle Branch, therefore, claim that their Association should finance the action they are proposing to take against the Sunderland Corporation, but the Central Board has replied through the Secretary, Mr. L. G. Tate, to the effect that this "fighting fund" was organised to deal with matters vital to the Association as a whole, and that allotments cannot be made from it for local cases. The Newcastle Branch, however, are still insisting that the general fund should be applicable to such purposes. We must confess our sympathy with their point of view. In the first place, it is improbable that the question of general wiring powers for all municipalities will have to be fought in Parliament for some time to come; and secondly, any success that may be obtained in an action in any particular district would tend to strengthen the cause of the Electrical Contractors' Association. It is greatly to be regretted that a compromise was not arrived at between the two Associations at the Conference held in London a few months ago, for there continues to be a very large amount of electric wiring to be done and new business to be sought, all of which will be facilitated if the supply authorities and the contractors work in perfect amity.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published June 1, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

11,048/10. **Telephonic Apparatus.** A. J. BOULT (*International Telechronometer Company, New York*). This invention provides a metering apparatus, which is installed at a telephone subscriber's station (in conjunction with the telephone set) to register the number of calls and also the length of time the call takes. Each of the mechanisms comprises an operating electro-magnet. A normally open shunt circuit round the electro-magnet, which can be closed by contacts under control, is arranged to remove the impedance of the operation from the circuit. For recording a number of messages and also the length of time the line is in use, the operating electric magnet and the shunt controlling magnet are oppositely polarised, so that one responds to current flowing in one direction, and the other magnet responds only to current in the opposite direction. Two circuits are provided for impressing currents of opposite polarity on the subscriber's circuit with the necessary arrangement, whereby the message meter and the time recording device are not operated until the call has been answered by the removal of the receiver, when the circuit is complete. Two figures.

11,186/10. **Motor Starting Devices.** ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*). This patent covers an improvement on the electrically operated step-by-step mechanism, which now rotates a contact drum gradually to cut out resistance from the motor circuit. The electrically operated mechanism is controlled by a relay device, which, when energised, establishes a circuit, causing the step-by-step mechanism to operate, and when de-energised produces a circuit allowing the mechanism to operate as soon as the current is restored, when the contact drum is moved and the whole of the resistance is in the motor circuit ready for starting. An auxiliary contact segment is provided, and operated simultaneously with the contact drum, the segment controlling the circuit through a solenoid, which operates the main switch in the motor circuit. The segment also opens the circuit through a solenoid operating the step-by-step mechanism, when all the resistance is either out or in the motor circuit. One figure.

13,518/10. **Arc Light Electrodes.** BRITISH THOMSON-HOUSTON CO. (*General Electric Co., Schenectady, New York*). This invention aims at the increase in life of titanium carbide electrodes by the addition of a small percentage of chromium carbide. An iron tube, closed at the lower end by a plug, contains the mixture. It is found that an addition up to 5 per cent. of chromium carbide increases the life of the electrode, and also slightly increases the candle power of the arc, but beyond this, though the life of the electrode is increased, the candle power slightly decreases. The best results have been obtained with 95½ per cent. of titanium carbide mixture, and 4½ per cent. of chromium carbide.

11,747/10. **Lamp-holder Locking Device.** G. H. IDE. This device consists of a circular metal ring and a thumbscrew. The ring is made of toughened brass or steel, which may be pressed, cast, or formed from drawn tube, its shape and size being such that it can be fitted over the lower portion of a standard incandescent lamp-holder of the bayonet pattern. The lamp can only be removed by means of the thumbscrew.

14,505/10. **Electric Drills.** A. STEWART and THE WESTMINSTER TOOL & ELECTRIC COMPANY, LTD. This invention relates to electric drills of the kind provided with an adjustable friction clutch for transmitting the motion to the drill. Upon the motor armature spindle a collar is mounted, which rotates with the armature, and a number of springs, which may be flat, curved, or helical, project tangentially from the periphery of the collar. The outer ends of the springs are fitted with shoes, which are held by them in contact with the inner face of the driven clutch, and which actuates the drill gearing. In conjunction with each of the springs, means is provided for adjustment so as to regulate the pressure between the shoes and the clutch surface. This may consist of a set screw in conjunction with each spring, the set screws being mounted radially to modify the shoe pressure against the clutch. In order to keep the armature cool, the clutch may be formed with vanes. Three figures.

19,804/10. **Electric Furnace.** J. H. REID. This patent is a combination with an electric smelting furnace of a refining and tapping furnace. The former is of the type in which the metal to be treated is supported on electrodes, inclined from the sides of the furnace, and which allow the molten metal to fall through various chambers into the lower furnace, where it is further treated and tapped. One figure.

19,772/10. **Electrolytic Production of Antimony.** In this process of treating stibnite with ferric chloride and electrolysing the solution, which is a mixture of ferrous and antimonious chlorides, soluble instead of insoluble iron anodes are used. The electrolytic action is stopped before the electrolyte is completely exhausted of its antimony, and after the electrolysis the solution is converted, either by adding free chlorine, nitric acid, or simply by blowing hot air through the solution, or other means of oxidising, into ferric and antimonic chlorides, becoming an active solvent for taking up more antimony from a fresh supply of stibnite, the process thus being cyclic, efficient, and economical.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: KORTING and MATHIESEN AKT.-GES. [Alternating current] 6,336/11.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: BOWYER and ANCHOR CABLE CO. [Identification of conductors] 15,792/10.

Dynamos, Motors, and Transformers: ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Motor control] 12,026/10; ELECTRIC CONSTRUCTION CO. and PENSABENE [Induction motor control] 13,962/10; ALLGEMEINE ELECTRICITÄTS GES. [Commutator A.C. machines] 14,024/10; MACDONALD [Screw motors] 5,853/11.

Heating and Cooking: NEWITT and FLETCHER [Electric heating] 12,322/10; LEONARD [Rheostats and heaters] 19,019/10; LOFQUIST [Electric geyser] 19,100/10; BYNG and ARCHER [Electric heaters] 20,289/10; ROCHE [Electric water heaters] 29,733/10.

Incandescent Lamps: SHIRLEY [Fixing and removing of] 22,103/10; DARBY [Socket for] 22,304/10.

Switchgear, Fuses, and Fittings: LOCKE [Time-signalling apparatus] 12,071/10; BERRY [Switch apparatus] 12,427/10; IRVING [Railway switch point control] 16,157/10; TRAUS [Lamp switches] 2,520/11.

Traction: SEFTON-JONES (*Oesterreichische Daimler Motorenges Akt.-Ges.*) [Overhead collectors] 27,798/10.

Miscellaneous: PHILLIPS [Wave-control of aerial vessels] 6,316/10; AITKEN [Electric light control] 11,854/10; HERBERTS [Means for varying A.-C. voltage] 11,951/10; BRITISH THOMSON-HOUSTON CO. (*General Electric*) [Alloy resistances] 12,757/10; HENRI, HELBRONNER and VON RECKLINGTON [Sterilising liquids] 12,949/10; CLARK (*Telelectric Co.*) [Electrical music apparatus] 16,620/10; GOLDSTONE and LIGHTFOOT [Electric cord grips] 17,819/10; ALLGEMEINE ELEKTRICITÄTS GES. [Couplings for electrically-driven looms] 29,309/10; LANGE [Aerial conducting structures] 2,242/11; SIEMENS BROS. & CO. (*Siemens and Halske Akt.-Ges.*) [Electric block signalling] 6,627/11; ALLGEMEINE ELEKTRICITÄTS GES. [Voltage regulation of D.-C. machines] 8,150/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Telephony, &c.: GIRARDEAU [High-frequency alternator for radio-telegraphic and telephonic plants] 3,948/11; GOLDSCHMIDT [High-frequency transmitter] 11,162/11.

Miscellaneous: PÖRSCKE and ACHENBACH [Secondary cell electrodes] 9,945/11 and 9,946/11.

Opposition to Grant of Patents

17,349/08. **Wireless Telegraphy.** E. VON LEPEL. The appeal which was lodged against the Comptroller's decision, and which was mentioned in ELECTRICAL ENGINEERING, September 8th, 1910, p. 582, has been withdrawn. It covers the disc discharger of the Lepel system.

Amendment Allowed

26,289/09. **Electric Light System.** T. FERGUSON. Leave has been granted to correct three figures in the drawings describing this patent, which covers a switch having two windings for controlling the lighting circuit of trains, &c.

Expiring and Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Instruments, &c.: F. CONRAD [Alternating-current meter] 3,540/04.

Switchgear, &c.: A. J. BOULT (*Continental Hall Signal Co.*) [Railway points and signals electrically controlled] 3,325/99 and 3,597/99; A. J. FULLER [Circuit brakers] 3,088/05.

Telephony, &c.: W. W. MASSIE [Wireless telegraphy] 4,221/06.

Traction: W. GRIFFITHS and B. H. BEDELL [Electric railways] 3,886/03.

Miscellaneous: W. W. MASSIE [Electric condensers] 4,220/06.

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HAMPSTEAD ELECTRICAL SHOWROOMS

THE Hampstead Borough Council opened their new showrooms of electrical appliances at 283 Finchley Road, N.W., on Thursday, June 1st, when we had the pleasure of inspecting them. The Council are endeavouring to bring within the means of all householders such apparatus as heaters of all kinds, toasters, kettles, flat-irons, bed-warmers, etc., by a very reasonable system of charging. The flat rate for lighting is 4d. per unit, for heating and cooking 1½d. per unit, and for power 1½d. per unit. All these, however, can be had under the "telephone" system for 1d. per unit with a fixed annual charge of £8 5s. for a demand of 1,000 watts. Apparatus can be hired or purchased on a hire-purchase scheme. The electric kitchen, a photograph of which is reproduced here, is fitted with every convenience for cooking, and demonstrations with the "Tricity" stove were given. The principles of this stove were outlined in ELECTRICAL ENGINEERING, Vol. VI., pages 93 and 519. The demonstration showed that the heat in the oven was remarkably uniform, and this is essential in order that the reduction in weight of the meat when cooked shall be a minimum. The "Vickers-



Eclipse" cooker is another worth mentioning: this is constructed of cast iron heavily lagged. The heating elements are placed on either side of the oven, and are protected by perforated cast-iron gates, which carry the runners for the oven grids and shelves, and are easily removable for cleaning purposes. At the top of the cooker two circular hot-plates are provided, and one combined hot-plate and grill, the former being controlled by a three-heat turn switch and the latter by an "on" and "off" switch. A ruby lamp is also provided as a reminder should the cook leave any switches on when the cooking is finished. Cookers can be hired on the following charges: 15s. the first day, 10s. the second day, and 5s. the third day, with longer periods on application. Demonstrations were also given with the electric iron and the imperial vacuum cleaner. A feature of the exhibits was the Halliwell portable hair-dryer, consisting of a motor-driven fan and an electric heater, which can be put in or out of circuit to give either a cooling or heating effect. We understand there is great demand for a cheap, economical and reliable electrical geyser. The showrooms are illuminated with Siemens tantalum and one watt lamps in conjunction with holophone glassware, the distribution of light being very uniform and effective. A very pleasant afternoon can be spent in these showrooms, where tea and toast is available free of charge for visitors willing to make it themselves.

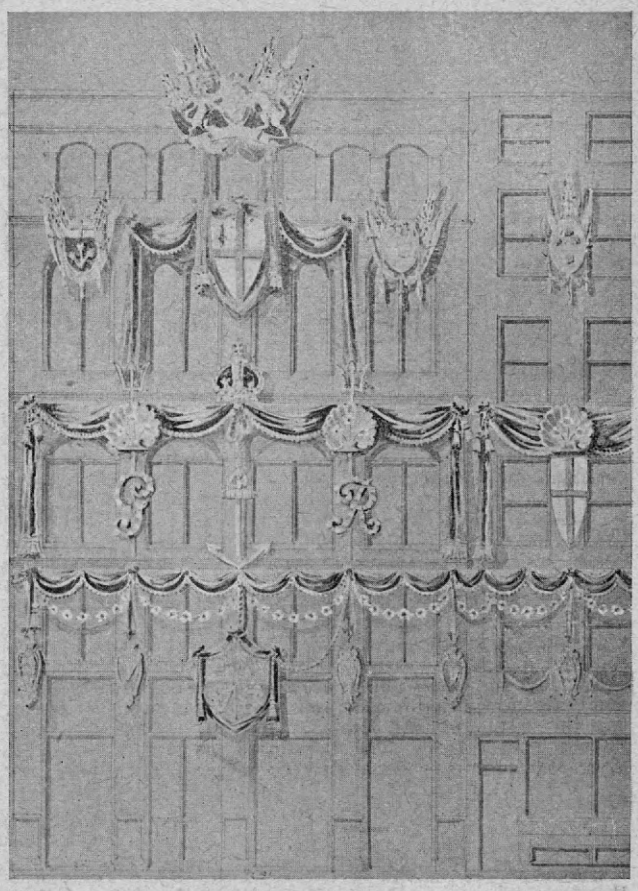
Obituary.—Mr. J. W. Boucher, manager of the Edison & Swan United Electric Light Co.'s business in Dublin, shot himself in his office last week.

Telephone Transfer.—The Court of Appeal have fixed June 14th for hearing the appeal against the judgment of the Railway and Canal Commissioners on the points decided last week, and which were reported on page 307 of our last issue.

Tramcar Accident at Stalybridge.—A serious accident took place upon the tramway system of the Stalybridge, Mossley, Hyde, and Dukinfield Tramways and Electricity Board on Monday. Whilst descending a steep hill a car got beyond control and left the rails on a curve, dashed across the road and turned over. The Board of Trade have imposed three compulsory stops on the hill in question, as two previous accidents have occurred there. The car was double decked, and contained some 50 passengers at the time of the accident, of whom 33 sustained injuries.

CORONATION ILLUMINATIONS AT PIMM'S

THE illustration below shows the frontage of Pimm's, in Poultry (London, E.C.), which is being decorated and illuminated for the Coronation by Messrs. Siemens Bros., Dynamo Works, Ltd., Tyssen Street, Dalston. Approximately 150 8-c.p. carbon lamps are used and the load is approximately 4½-kw. The festoons consist of lamp-holders fixed on a Bro-ite strip, and each holder will be surrounded by a sort of rosette-shaped reflector, made of metal and fixed by means of the shade carrier ring, which gives the appearance of a flower when the lamp is lighted. The two large letters,



G.R., seen in the illustration are each illuminated with 17 lamps, and the anchor between these (not illuminated) is of wood finished in gilt. Above these are seen three devices in the shape of a large shell, in the centre of each of which is a spray of three lights, with reflectors arranged in a somewhat similar manner to those on the festoons. The Royal Arms surrounded by flags and the City Arms and other devices beneath, together with the window canopies, all add to the effect, which, it is seen, is a very pleasing one. The frontage is 46 feet long. Messrs. Siemens Bros., Dynamo Works, Ltd., are supplying the whole material and the work is being carried out by contractors.

Meters on Tramcars.—With reference to the Local Note in our last issue to the effect that Mr. J. H. Cowell, the Blackburn Corporation Tramway Manager, is not satisfied that there is a reliable tramcar meter yet on the market, we would point out the fact that a large number of corporations and tramcar companies have been using them for some time with very satisfactory results. Figures relating to a large tramway company near London have reached us, from which it appears that by fitting 50 cars with such meters, the power bill was cut down from £10,000 to £8,250 with very little trouble. Those responsible for this installation tell us that it is only a question of having accurate instruments, so that they can point out to the motormen that it is cheaper to "coast" than to wear out the brake blocks, and prevent the shed staff from having the brake blocks too tight on the wheels. Ferranti meters have been used in this case, and the average of 35 meters showed a maximum error of about 3 per cent. above or below the average. A second batch of 15 meters showed results equally close, and as the meters have had hard traction wear, the results must be regarded as speaking extremely well for the accuracy of the ampere-hour meter.

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CONSTANTINOPLE TELEPHONE SYSTEM

MESSRS. F. GILL and W. W. Cook, Engineer-in-Chief and Assistant Engineer-in-Chief of the National Telephone Company, have been appointed consulting engineers to the Constantinople telephone scheme, the formal agreement for which was executed between Djavid Bey, then Minister of Finance, and Mr. Herbert Laws Webb, at Constantinople on May 6th last. A staff of engineers left London this week to make a telephonic survey of Constantinople and to prepare plans and specifications for the system, which is to have an original capacity of 10,000 lines and to be ready to start service in July, 1913. Mr. John Scott is in charge of the engineering force, and left London last week for Constantinople. The work Mr. Scott has in hand is one of many difficulties, as Constantinople is the most peculiarly situated of all European capitals. The city is divided by the Bosphorus, which is deep and has swift and variable currents; moreover, it is extensively used as an anchorage. The European section is again divided by the Golden Horn, an arm of the sea over which there is no permanent bridge. In all parts of the city the streets are extremely primitive, narrow, winding and ill-paved, and many of them are precipitous hills.

As no telephone service yet exists in Turkey, all modern facilities having been debarred by the ex-Sultan, there are no available data whereby to gauge the probable use of the service or the probable traffic which the system will be called upon to carry. The peculiar composition of the population of Constantinople, about one-half of which consists of non-Moslem races, Greek, Armenian, Jewish, and so on, makes the business part of the engineering study one of much complexity. Three languages are current—Turkish, Greek, and French—while many more are spoken, and the variety of local customs and practices is probably greater than in any other large city in the world. No exact statistics exist, but the population of the area is estimated at between 1,000,000 and 1,250,000 inhabitants. Means of communication are at present so primitive and expensive that a large demand for the telephone service may be anticipated.

The Telephone Development Company, Limited, has been formed for the purpose of carrying on the necessary work pending the organisation of the Ottoman Telephone Company, which will construct the plant and operate the service.

THE ELECTRIC SUPPLY PUBLICITY COMMITTEE

THE first annual conference of this Committee was held at the Institution of Electrical Engineers on Tuesday, May 30th. Mr. H. B. Renwick, Chairman of the Committee, presided, and over thirty members representing London and provincial undertakings were present. The Chairman outlined the aims and future programme of the Committee. He remarked that the meeting was thoroughly representative, and referred to issues of publicity literature which had been made at frequent intervals throughout the year, including posters, show-cards, booklets, pamphlets, circulars, folders, leaflets, mail-cards, postcards, and adhesive labels, covering practically the whole of the field of electric supply. The issues had been arranged so as to be appropriate to the various seasons of the year, and the shape and size of the publications had been carefully chosen, so as to fall in with the general office arrangements of supply undertakings. The total sales during the year numbered nearly one million and a half, and extended throughout the whole of the United Kingdom, in addition to the Colonies and abroad. The Committee, he said, had also done signal service in connection with the newspapers, and the various erroneous reports which had been given currency to in the Press in regard to the causes of fires. Corrections had been arranged in the Press wherever necessary, and the interests of electric supply generally upheld. A certain amount of newspaper advertising had also been done, and there was hope that in the forthcoming year this would be carried on on a much larger and more comprehensive scale. He concluded with some remarks on the necessity for concerted action in this class of advertising.

Mr. W. A. Vignoles (Grimsby), who strongly upheld the Committee's work, spoke particularly as to the energetic pushing of electric cooking, and Mr. H. R. Burnett (Barrow-in-Furness) suggested the inclusion of an information bureau in the Committee's sphere of action. Mr. A. H. Shaw, of Ilford, was in favour of large-sized posters. Another suggestion was that of Mr. Cramp (Croydon), who thought that the Committee might undertake the registration of canvassers. A vote of thanks to the Chairman and officers was proposed by Col. Hopkins (Marylebone), and seconded by Dr. Mansfield Robinson, and replied to by the Chairman and by Mr. Walker, the Honorary Secretary.

LOCAL NOTES

Belfast: *Cavehill and Whitewell Tramways.*—The Corporation have taken over the workings of the Cavehill and Whitewell Tramways, pending a settlement of the legal point arising out of the Arbitrator's award. It will be remembered that the Arbitrator's award was £66,000, but the Corporation contend that he had no jurisdiction to base the award upon the principles which he adopted.

Blackburn: *Electricity Accounts.*—The net profit from the electrical undertaking last year was £697 less than in the previous year. Mr. P. P. Wheelwright, the Borough Electrical Engineer, attributes this to the continued bad trade in the town, which was very marked during the first three quarters of the years, but which showed improvement in the last quarter.

Blackpool: *Coronation Illuminations.*—The Corporation have decided to supply electricity free to private consumers for illuminations during the Coronation.

Brighton: *Electricity Accounts.*—The accounts of the electricity, which were abstracted in our last issue, were passed at the Council Meeting on Thursday, great satisfaction being expressed with them. The Chairman of the Committee, in moving the adoption of the report and accounts, said they would, in the near future, be able to consider a substantial concession to consumers, and if they could offer a reduction of ½d. per unit they would render electricity so superior and economical that there would soon come a time when gas would be prohibited as an illuminant in private houses.

Croydon: *Electricity Accounts.*—The accounts of the Electricity Department for the year to March 31st show that there was a decrease of £3,494 in the total receipts compared with the previous year. Special attention is drawn to the fact that the tramways have taken 20·6 per cent. less energy than in the previous year, the cash value of this being £5,372, and that in addition the reductions for power supply and public lighting account for a further reduction of £418. Taking these facts into consideration, Mr. A. C. Cramb, Borough Electrical Engineer, regards the position as a satisfactory one. The profit available for distribution is £6,978, and a balance of £372 is carried forward after transferring sums to the reserve fund and to relief of rates.

Dundee: *Electricity Accounts.*—The accounts of the Electricity Department for the past year show a total revenue of £46,047 compared with £39,908 in the previous year. The sum of £22,957 was carried to net revenue account, and after meeting interest and sinking fund the balance has been transferred to reserve fund and depreciation. The number of units sold during the year was 7,720,018 against 6,144,927.

Edinburgh: *Reduction in Lighting Charge.*—The Electric Light Committee recommend the Town Council to reduce the price of electricity for lighting purposes to 2¾d. per unit. The question of reducing the rate for power purposes is to receive further consideration.

Glasgow: *Tramways Assessment.*—The appeal by the Tramways Committee against the assessment of their undertaking has been dismissed by the Sheriff's Court. The Committee contend that the tramways should be assessed as a railway, viz., upon the basis of one-fourth of the rateable value.

Kingston-on-Thames: *Electricity Accounts.*—The accounts of the Electricity Department for the year to March 31st show a loss of £1,193. Mr. J. Edgcome, in his report, points out that during the past eight years there has always been a substantial profit from the working of the undertaking, after paying interest on borrowed capital, the smallest being £1,925 and the largest £3,732, and that it is entirely due to the heavy repayments of capital that there has been a succession of deficits during the last five years. The loss shown by the accounts this year is £450 less than that of last year. During the year 140 public incandescent lamps have been erected, and there has been a satisfactory increase in the number of consumers for light and also in the number of electric motors, fans, and heating and cooking apparatus which has been installed.

Llanelly: *Electric Traction.*—The electric tramcar service

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was commenced last week. There are about a dozen cars, the length of track being about 12 miles.

London: *Islington.—Coronation Illumination.*—Special arrangements are being made for supply for this purpose at a fixed rate equivalent to 1d. per unit with a fee of 5s. for connecting and inspection.

Macclesfield: *Electric Lighting.*—The New Electricity Company of Macclesfield applied for an electric lighting Provisional Order for this district, and the Macclesfield and District Railless Electric Traction and Electricity Supply Co. now have a Bill before Parliament in which electric lighting powers are also sought. The Macclesfield Corporation refuse to give their consent to the first-named, and the Board of Trade have decided to dispense with this consent, but have made the Order out in such a form that it is left to Parliament to decide which of the two companies shall be given the powers in question.

Maidstone: *Municipal Wiring Powers.*—The Electricity Committee report that they have approached the Incorporated Municipal Electrical Association with a view to getting that body to promote a Bill in Parliament granting powers to all local authorities to wire and fit consumers' premises for electric supply.

Manchester: *Proposed Tube Railways.*—It is stated in the Manchester papers that efforts are being made to promote a Bill in Parliament for the construction of a system of tube railways in Manchester, Salford and district.

South Shields.—After meeting interest and sinking fund charges there is a net profit of £3,344 upon the tramways for the past year. It is recommended that £1,844 be transferred to reserve fund and £500 to an accident and compensation fund.

Electricity Accounts.—The accounts of the electricity undertaking for the past year show a net profit of £1,400 against £209 for the previous year.

West Bromwich: *Electricity Accounts.*—The net profit from the Electricity Works for the past year was £1,782, an increase of £56 over the previous year. There was a considerable decrease in the energy used for tramway purposes, but the revenue from private consumers increased by £1,568.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Atherton.—The Council have received the sanction of the Local Government Board to borrow £2,867 for the electrical extensions.

Barking.—A loan of £11,400 is to be applied for in connection with the scheme of extensions at the Electricity Works, the tender for the buildings for which has been let.

Bradford.—A Local Government Board inquiry was held last week concerning a loan of £60,000 for extensions by the electricity department. There was no opposition, and the Inspector undertook to bring before the Local Government Board the Electricity Committee's request for as long a period for repayment as possible.

Farnworth.—The Council have decided to apply to the Local Government Board for permission to borrow £3,000 for electrical extensions.

Hull.—An inquiry was held last week concerning a loan of £99,322 for extensions to the electric supply undertaking. The Inspector amended and raised the amount of the loan to £101,087 in consequence of certain items only being estimates and in his opinion rather low. There was some opposition.

Ilford.—A Local Government Board inquiry was held last week concerning a loan of £8,070 for electric lighting extensions. The new loan is required for the provision of a feeder from the electricity works to the Broadway, conduits, distributing switch board, and also other mains and services.

Kettering.—Tenders are invited by June 19th for an oil eliminating plant and extensions to pipe work. Particulars from Messrs. Kennedy & Jenkin, 17 Victoria Street, Westminster.

London: *Bermondsey.*—Estimates for new generating plant, amounting to £18,563, have been placed before the Council. After consideration, the Electricity Committee are unable to recommend the Council to take a supply in bulk from either of the companies now supplying electricity in the district.

Poplar.—Tenders are invited for a 3,000-kw. turbo-alternator with surface condensing plant, two water tube boilers with super-heaters, air heaters, fans and chimneys, a 30-ton electric overhead travelling crane and water-softening plant. Particulars from the Borough Electrical Engineer.

Loughborough.—An inquiry was held last week concerning a loan of £2,310 for extensions to the electricity works.

Manchester.—The Electricity Committee invite tenders for two water tube boilers with superheaters, etc. (See advertisement on another page.)

Mexboro'.—The Electricity Committee require a balancer-booster set. Particulars from Electrical Engineer and tenders by June 10th.

Pontardawe.—Mr. J. Morgan has been requested to prepare a report upon lighting the district by electricity.

South Africa.—According to the *African World*, Mr. W. A. Harper, of Messrs. Harper Bros. & Co., consulting engineers, of London and Johannesburg, has just returned from a visit to South Africa in connection with a number of large power schemes. An important one is the installation of a power station at the Tweefontein Colliery, another relates to supply to the Kimberley and neighbouring diamond mines, whilst a further scheme is in contemplation for the neighbourhood of Vryheid.

Swindon.—Tenders are invited by June 20th for a battery of 220 cells, automatic reversible traction booster, three wire hand regulated booster and switchgear. Particulars from the Borough Electrical Engineer.

Turkey.—The Turkish Ministry of War invites tenders by June 26th for electric accumulators. Applications to Commission des Achats, Administration Generale des Fournitures, Ministere de la Guerre, Constantinople.

WIRING

Brighton.—The plans for the new pier winter gardens have passed the requirements of the Board of Trade, and the constructional work is to be commenced at once.

Coventry.—Tenders are invited by June 14th for electrical work at the Coventry and Warwickshire Hospital. J. A. Rudd, Secretary.

Devonport.—New wing at Beaconsfield High School for Girls.

Edinburgh.—New science laboratories at Heriot's School. Architect, John Anderson, Heriot Trust Office.—New building for Edinburgh Provincial Committee for training teachers.

Horsforth.—Parish hall and school. Architects, Empsall & Clarkson, 7 The Exchange, Bradford.

Ipswich.—Sanatorium. Architect, Mr. H. M. Gautley, 32 Museum Street.

Macclesfield.—Infirmary. A. E. Hanrahan, Secretary.

Margate.—Electric lighting of Pavilion and Winter Gardens.

Rotherham.—Erection of Kimberworth Upper Standard School. Director of Education, Imperial Buildings.

Sheffield.—Hospital at Hallwood.

St. Albans.—Additions to School of Art, Technical Buildings. County Surveyor, Hatfield.

Wrexham.—Alterations to market hall, &c. Town Clerk.

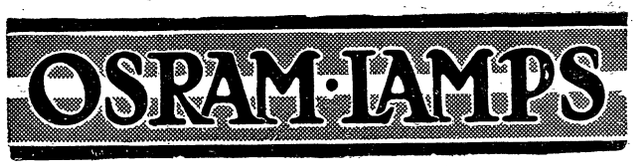
MISCELLANEOUS

Brumby and Frodingham.—A Local Government Board inquiry has been held concerning a loan of £1,100 for the purpose of street lighting. It is proposed to take energy from the Frodingham Iron and Steel Co. The streets are at present lighted by oil.

Eccles.—The Town Council have decided to light with electricity several streets in the borough, and are borrowing the sum of £666 for the provision and laying of a high tension electric feeder for this purpose.

Egypt.—Tenders are invited by the Ministry of Public Works for the supply and erection of a complete electric pumping installation. Forms from Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Westminster.

London: *L.C.C.*—The County Council invite tenders by July 4th for four electric traversers for their car-sheds. Particulars from the Clerk to the Council.



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Nelson.—A Local Government Board inquiry was held last week concerning a loan of £14,525 for tramway purposes.

Swansea.—Tenders are invited for a one and two years' supply of continuous current motors and starting switches. Particulars from the Electricity Department and tenders by June 13th.

TENDERS RECEIVED AND ACCEPTED

Dublin.—The contract for the electric lighting installation at St. Mark's Church, Great Brunswick Street, has been secured by Messrs. Dockrell, Sons & Co., Ltd.

Blackburn.—The tender of the British Westinghouse Company has been accepted for a 2,000-kw. turbo-generator and two rotary converters.

Caversham.—A contract has been entered into with the Reading Electric Supply Co. for public lighting. There are to be installed 247 lanterns each equipped with two 55-watt lamps, and 11 lanterns each equipped with two 80-watt lamps. The prices vary from £1 17s. 3d. per post per annum to £3 2s. 6d. per post per annum, according to the number of hours the lamps are burning.

G.P.O.—Messrs. Siemens Bros. Dynamo Works, Ltd., have been awarded a contract for tantalum and onewatt lamps of various voltages and candle powers for the General Post Office, to extend for a period of six months.

Grimsby.—The tender of the Stirling Boiler Co. has been accepted at £318 for a new steel casing and fire-brick lining for one of the boilers at the power station.

Queensland Government Railways.—Messrs. Willans and Robinson, Limited, of Rugby, have received an order from the Railway Commission for a 750-kw. Willans impulse-disc and drum turbine, with a General Electric Co.'s two-phase alternator, and surface condensing plant. This turbine will be capable of giving its normal full load with high-pressure steam or with any mixture of high-pressure and exhaust steam, and is intended for installation in the Ipswich Locomotive Works of the Queensland Government Railways.

Messrs. Siemens Bros. Dynamo Works, Ltd., send us a further list of orders received for Coronation illumination work in London, in addition to the list published on page 309 of our last issue.

APPOINTMENTS AND PERSONAL NOTES

The Sunderland Electricity Department require a superintendent to take charge of main and sub-stations. Salary £182 per annum. (See an advertisement on another page.)

Electrical fitters experienced in shipwork are required. (See an advertisement on another page.)

Mr. Egerton J. Ward has resigned his position as senior engineer-in-charge at the Eccles Corporation Electricity Works in order to take up the post of assistant engineer with the Para Electric Railways and Lighting Company, at a commencing salary of £600 per annum.

The Leek Corporation have increased the salary of Mr. W. B. Child, Assistant Electrical Engineer, from £100 to £110 per annum.

The Mysore Government have appointed Mr. T. G. Hanscombe to succeed Mr. Gibbs as Chief Electrical Engineer to the State. The latter retires in July to take up the appointment of General Manager to the Tata Hydro Electric Supply Co., Bombay.

Electrical Equipment of the s.s. "Titanic."—The new 45,000-ton White Star liner *Titanic*, which was launched last week at Belfast, will have a very complete electrical installation. Four 400-kw. sets, supplied by Messrs. W. H. Allen, Son & Co., are provided in a separate watertight compartment aft of the turbine room. The engines indicate each about 580 horse-power, and are of the Allen vertical three-crank compound, running at 325 r.p.m. They take steam at 185 lb. per square inch, and exhaust either into a surface heater, which is the usual seagoing condition, or to the condenser. Each engine is direct-coupled to a compound-wound continuous-current 10-pole dynamo, fitted with interpoles, with an output of 4,000 amperes at 100 volts. In addition to the four main sets, there are two 30-kw. engines and dynamos in a recess off the turbine-room at saloon-deck level. Three can be supplied with steam from either of several boiler rooms, and will be available for emergency purposes. The distribution is on the single-wire system. The main switchboard is on a gallery in the electric engine-room. The main feeders pass up through port and starboard cable trunks to the various decks, radiating thence to switch and fuse boxes grouped at convenient points in the machinery spaces and accommodation, from whence run branches to the distribution fuse boxes scattered throughout the vessels. In addition to lighting, electricity is largely employed for heating, as well as for motive power. There are 75 motor-driven "Sirocco" fans from 55 in. to 20 in., all of which are provided with automatic and hand-speed regulation.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic copper bars net c.i.f. port of arrival, quoted on Tuesday night, was £56 15s. to £57 5s. per ton (last week the same).

Patents for Sale.—Patents relating to improvements in secondary battery plates and improvements in galvanic battery plates are for sale. (See an advertisement on another page).

The Globe Electric Co.—This company inform us that they are taking in hand the manufacture of signs, and for this and general extension of their business, they are taking two more floors in the building they occupy.

Dissolution of Partnership.—G. Bradwell and Matt Jennison, electrical engineers, 4 St. Anne's Square, Manchester, and 77 Victoria Street, South Grimsby, have dissolved partnership. Debts by Matt Jennison.

Bankruptcies.—At the first meeting of the creditors of J. D. Carlmark, electrical engineer, 402 High Street, West Bromwich, it was stated that the liabilities amounted to £442 and the assets to £52. The debtor attributes his failure to keen competition and bad trade, and to his having made himself liable for £200 as a guarantor. The debtor began business in 1899 in partnership with another, without capital, and the Official Receiver remarked upon the fact that no balance sheets or profit and loss accounts were ever prepared. The matter was left in the hands of the Official Receiver.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Urban Electric Supply Co.—The accounts for 1910 show a profit of [30,982, which falls short of £1,528 of the amount required to meet 5 per cent. guaranteed dividends on the company's capital. This debit balance has been provided by Edmundson's Electricity Corporation, Ltd., under their contract with the company.

Traction & Power Securities.—The accounts for 1910 show a gross profit of £32,105. The directors have applied £1,920 to writing down certain securities, and have transferred £25,000 to investment account, carrying forward £5,185. The company has loaned £140,500 to the Clyde Valley Electric Power Co., and has undertaken to increase this to £194,500, the Power Company granting, as security, a first charge on their undertaking.

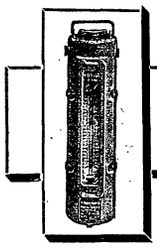
Calcutta Electric Supply Corporation.—The profits for 1910 amounted to £85,598, and the directors recommend a final dividend on the ordinary shares, making 8½ per cent. for the year, carrying forward £5,622. This distribution is after providing £20,000 for depreciation and renewals, and £7,500 for reserve. A site has been purchased for the erection of a new generating plant in the Cossipore district, in connection with which a new issue of capital will have to be made.

Aron Electricity Meter.—The transfer books and register of members will be closed from June 12th to June 24th inclusive.

Adelaide Electric Supply Co.—Applications have been invited for £100,000 5 per cent. debenture stock at par.

Peel-Conner Telephone Works.—The accounts just published show a net profit from the commencement of the company, after writing off the preliminary expenses and placing £2,151 to reserve, of £7,276. After meeting the full dividend on the 5 per cent. preference shares, the sum of £320 is carried forward. The Board express their satisfaction with the result of the first year's trading. The difficulties of training efficient labour are gradually being overcome, and the work executed has met with the full approval of purchasers. The number of contracts recently obtained will ensure the full employment of the factories for some considerable time.

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ELECTRICAL ENGINEERING

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I.M.E.A. CONVENTION AT BRIGHTON.

(*June 27th—30th.*)

"ELECTRICAL ENGINEERING" of June 22nd will contain a List of Members attending the Meeting, Portraits and Biographies of the President and Readers of Papers, and Descriptions of the Works to be visited.

Copies may be obtained at Messrs. W. H. Smith & Son's Railway bookstalls at Victoria, London Bridge, East Croydon, and Brighton; at the Grand, Metropole, York, and Albion Hotels, Brighton; and also at Messrs. John Beal & Sons, 55 East Street, Brighton.

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CORONATION HOLIDAYS.

In consequence of the Coronation Holidays, our next issue (dated June 22nd) will be published two days in advance (Tuesday, June 20th).

Our offices will be closed from Thursday, June 22nd, to Saturday, June 24th, inclusive.

Advertisement copy for our issues of June 22nd and June 29th should be sent us AT ONCE.

SUMMARY

A highly interesting report has been published on the electricity supply of Zürich from the water-power of the river Albula. A tunnel 4½ miles long conveys the water to a power station containing eight 3,000 h.p. turbine sets, and the energy is transmitted at 47,000 volts, three-phase, over two pole lines, 85 miles long, to Zürich. The lighting of the town is by single-phase current supplied from motor-generator sets to which are coupled D.C. machines for running off a battery when the three-phase supply fails. (Page 327.)

A letter from the English house of a well-known Continental firm points out the exaggeration in some statements regarding foreign tariffs made recently. (Page 328.)

Mr. C. Vernier's Paper on cable laying and jointing has been further discussed at Glasgow. (Page 328.)

The power-house of the Commissioners for the Port of Calcutta contains continuous-current plant aggregating 700 kw. Power is supplied for various purposes about the docks. (Page 329.)

A simple form of automatic liquid starter is described. (Page 330.)

A recent Paper by Prof. J. T. Morris, read before the Physical Society, compares different methods of magnetic testing. (Page 330.)

A Paper by Mr. G. Archer, read recently before the Dublin Section of the Institution of Electrical Engineers, described a system of records of connections, &c., in sub-stations, distributing points, &c., of a network. (Page 331.)

An illustrated description of a new starter for single-phase induction motors is given. (Page 331.)

Mr. A. Scott-Hansen read a Paper recently before the Faraday Society on the water-power resources of Norway. (Page 332.)

The Osram Lamp Works, Ltd., in addition to proceeding against the "Z" Electric Lamp Supply Co., their agents, Messrs. Baxter & Caunter, and the Café Royal, who are users of "Z" lamps, for alleged infringement of the Just-Hanaman and "weighting" patents under which Osram lamps are manufactured, have also threatened proceedings against the Corona Lamp Works Co., who reply denying infringement. (Page 333.)

A work on the cable communications of the Empire, and a treatise of graphic statics are reviewed on page 334.

Among the specifications published by the Patent

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Office on Thursday last was one by J. Darby relating to lamp sockets. The Allgemeine Elektricitäts-Ges. describe a coupling for electrically-driven looms. H. Lang deals with aerial conducting structures, and another by Körting and Mathieson Akt.-Ges. covers arc-lamps. An application has been made by Hans Theodore Hansen to amend his specification for a block signalling system. Opposition has been entered to the grant of a patent to J. L. Paillet and E. Roger on the discharge of electricity from materials. (Page 334.)

THE Holborn Borough Council have found themselves compelled to accept the combined tender of the gas and electricity companies for the lighting of the borough. Half of the borough will be lighted by electricity and half by gas. The Council have also accepted the request of the companies that an addition of 10 per cent. is to be made to the price in the tender on account of the clause dealing with maintenance of candle-power. A clause compelling the companies to adopt all new lighting devices free of charge has been withdrawn. (Page 335.)

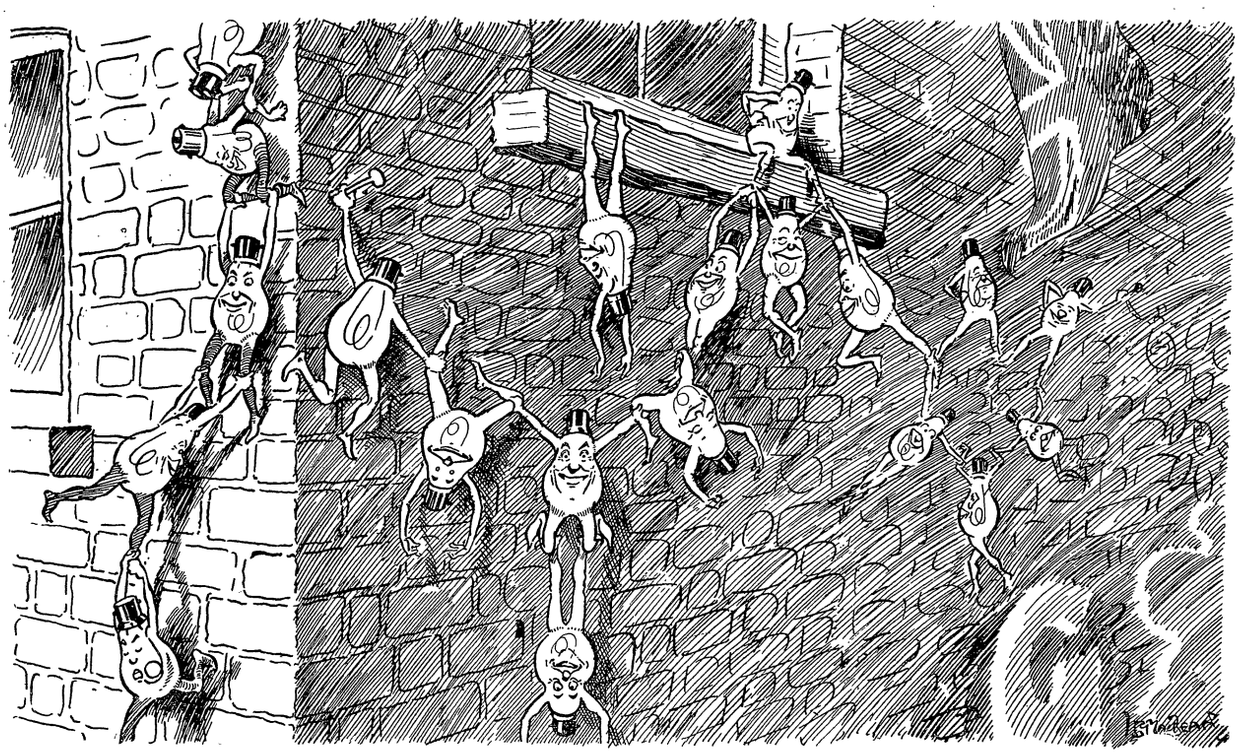
THE Belfast City Electrical Engineer recommends the erection of a new power house with an extra high-tension system and sub-stations.—The Bournemouth Tramway Manager reports a considerable saving in current consumption since the substitution of the overhead system for the conduit.—The proposal to spend £18,563 upon additional plant at Bermondsey is meeting with considerable obstruction.—The proposal of the Marylebone Electricity Committee to purchase an electrically driven van has been referred back on the ground of high maintenance costs.—The substitution of trolley omnibuses for tramways in Scarborough is under consideration.—£15,000 have been transferred to relief of rates from the Nottingham Electricity Committee, and £15,000 from the tramways. (Page 336.)

AN expenditure of £6,500 is contemplated at Dudley; £7,000 at Limerick.—The £60,000 scheme at Stoke-on-Trent is being inquired into.—An Electric Lighting Co. is being formed for Wharfedale.—Tramcar bodies and equipments are required at Aberdeen.—Telephone apparatus in Australia, and electrical accessories in Birmingham. (Page 336.)

A SCHEME for the re-arrangement of the British Electric Traction Co. is shortly to be formulated.—At the annual meeting of Callender's Cable & Construction Co. it was stated that the shareholders may in the near future be asked to assist in the formation of a banking institution.—The capital of the Brush Electric Engineering Co. is to be re-organised. At present the company is doing much better business.—At the first annual meeting of the Peel-Conner Telephone Works, Mr. Hugo Hirst suggested cheap rates for the installation of telephones in all private houses, the connection being made by local contractors.—A 6 per cent. dividend is recommended by the Aron Electricity Meter Co. (Page 338.)

Parliamentary Intelligence.—The L.C.C. (Tramways and Improvements) Bill, has been read a third time in the House of Commons. The following received Royal Assent last week:—London Electric Railway Act; Metropolitan District Railway Act; and London United Tramways Act.

Telegraph Traffic and Movements of Cable Ships.—Land-line communication is restored with all offices in Mozambique.—Some trouble has been experienced with the lines about Bassorah for several days.—Recently the c.s. *Minia*, of the Anglo-American Telegraph Co., repaired the company's 1874 cable, and then put through the Newfoundland cable of the Direct United States Cable Co., interrupted some 250 miles from Halifax. Afterwards she completed work in connection with the Western Union Telegraph Co.'s cable between Bay Roberts and Coney Island, which was broken some 150 miles from the former place. Cables awaiting repair are those between Assab and Perim, and Malta and Tripoli; the former has been interrupted since July 8th, 1909, and the latter since April 20th, 1910.



(Large quantities of Carbon Filament Lamps are being used for Coronation Illuminations.)

Carbon Filament Lamps (*in Chorus*): **God save King George V—There is some use for us yet.**

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THE ALBULA-ZURICH 47,000-VOLT TRANSMISSION SYSTEM.
A 20,000-h.p. Water-Power Station

BRITISH engineers who are interested in the development of water-power for the supply of electrical energy, can well be advised to purchase a copy of a report which has just been published on the constructional work involved in the harnessing of the water-power of the River Albula for the supply of electric power to the town of Zürich, 85 miles distant.. The report is entitled "Bericht über die Erstellung des Albulawerkes" (Buch-und Kunstdruckerei Jean Frey, Zürich. 8 francs, excluding postage), and has been prepared by Messrs. H. Peter and H. Wagner, the Managers and Engineers of the Water and Electricity Supply Departments of the city of Zürich. It comprises 70 pages of text and a large number of excellently reproduced drawings, diagrams, and coloured plans, besides some 50 reproductions from remarkable photographs of the hydraulic works in various stages of construction, of the machinery and switchgear in the power house, and of the transmission line and sub-stations.

The lighting, power, and traction supply of Zürich has been dealt with for many years by a combined steam and water-power station near by, but the growing demand for power led the authorities to consider the acquisition of one of the available water powers, and that of the Albula was chosen as the most suitable. The river has been dammed at a point somewhat over four and a half miles above the position of the power house, so that a total head of about 500 feet is obtained. From the intakes the water is conveyed through a concrete tunnel four and a half miles long to the two pipe lines. These are nearly six feet in diameter and have a length of 1,500 feet. Very complete information is given in the report of the hydraulic works, including the constructional details of the tunnel and pipe lines, and the costs of the work. Even the calculations for the anchorage of the pipe line are dealt with in detail. The method of constructing the tunnel is also fully described with the aid of numerous drawings.

The size of the present tunnel (78 sq. ft. section) permits of the delivery, at the permissible velocity of 7·5 ft. per second, of some 510 cubic feet of water per second which, with the available net head of 466 feet and a turbine efficiency of 75 per cent., corresponds to a turbine capacity of 20,600 h.p. Eight Francis turbines, by Escher, Wyss & Cie, each of 3,000 h.p. capacity, have been installed, and coupled to each is a 2,500 k.v.a. 600 r.p.m. alternator, by the Maschinenfabrik Oerlikon, generating at 6,900 volts, three-phase, 50 cycles. The guaranteed efficiencies, &c., and the prices submitted by the firms who tendered, as well as the actual figures obtained on test and very complete particulars of the machines are given in the report. The mechanical construction of the 10-pole alternator rotors, which are over five feet in diameter, is of especial interest in that they are built to withstand the exceptional forces which would obtain on the turbine speed rising to double the normal, *i.e.* 1,200 r.p.m. Each pole is made up of five packets of laminations interspaced by long steel plates, the ends of which are bolted up between the five steel rings of which the yoke is composed. Another interesting feature of the generators is the stator winding. The coils are of copper, 7·5 mm. by 7·5mm., and are insulated with micanite after they are wound on the formers. The latter is not, therefore, subjected to the strains of bending. Finally, the coils are thoroughly impregnated. Two 200-kw. exciters are installed. These are interpole machines driven by separate water turbines and generating at 125 volts.

It is interesting to note that a high-tension direct-current series system with a line pressure of 80,000 volts, was submitted as an alternative, but that it was rejected mainly on account of the unfavourable effect of the heavy constant line loss, and the impossibility of "linking up" with existing and future three-phase systems.

The generators are connected direct through isolating switches to three-phase transformers. Each generator has its own transformer and forms a unit, paralleling being carried out on the high-tension side of the transformers. The primary windings of the transformers are connected in delta and the secondary (47,000-volt) windings in star, the neutral point being connected to earth through a running-water resistance. This is arranged so that in the event of one phase being earthed, the current is limited to about 100 amperes. The transformers are of the water-cooled, oil insulated pattern, constructed by Brown, Boveri et Cie. They are rated at 2,000 kw. each and have an efficiency of 97·87 per cent. at 80 per cent. power factor.

The general arrangement of the switchgear and a complete diagram of the connections are given in the report, but the apparatus itself is not described in any detail. A considerable amount of information can be derived, however, from a careful study of the diagram and the excellent series of photographs already mentioned. The oil-switches between the transformers and the H.-T. 'bus-bars are of the Oerlikon pattern in which each contact is enclosed in a separate oil pot. They are actuated by small D.C. motors controlled from an operating desk on a gallery overlooking the engine-room, and supplied with current from the station battery.

It should be mentioned that only six generators are used at present for the Zürich supply. The other two supply a local electrochemical works and the neighbouring districts at the generated pressure of 6,900 volts. A special turbine set supplies the station lighting and the power required for the battery.

The transmission line which, as mentioned above, is 85 miles long consists of four three-phase circuits divided between two pole lines. Each wire is hard-drawn copper 50 sq. mm. in section. The total energy loss along the line at full load and 80 per cent. power factor is 13·8 per cent., so that the pressure at the Zürich end is about 40,000 volts. Four different kinds of poles are employed, namely, reinforced concrete poles of H-section, Siegwart reinforced concrete poles of circular section, Mannesmann tubular steel poles, and ordinary steel lattice poles. The span from pole to pole is nowhere greater than 50 feet. Results of the tests carried out on these poles and on the insulators are given in great detail in the report. The cross-arms are in all cases of impregnated wood attached to the poles by fittings of galvanised iron. Samples of the petticoat insulators were tested up to 100,000 volts under artificial rain. The line is carried for the most part through valleys, and a way had to be cut through much forest land, involving considerable expense. Switching stations are provided at intervals of about twelve miles, and one or more circuits of any of the intermediate sections can be made dead for repairs. A diagram of the connections for a typical switching station shows how this is accomplished, and what precautions are taken against lightning and pressure surges. It is interesting to note that the transmission line cost over twice as much as the complete power station.

An elaborate system of telephones and telegraphic signalling apparatus is provided, the latter being used for important messages which cannot, therefore, be misunderstood and are recorded. The signalling circuit is in duplicate, and is insulated throughout to withstand a pressure of 15,000 volts in view of the fact that the wires are strung along the pole line the induced voltage from which may rise to this amount. The insulators used will withstand a pressure of 30,000 volts. At the switching stations each of the signalling circuits is brought into a separate chamber containing the protective apparatus. From here cables lead to a signalling room, all the apparatus in which is carefully protected against high-pressure.

There are four main sub-stations in Zürich, where the current is transformed down to 6,000 volts for distribution by underground cables. The largest of these contains four 2,000-kw. water-cooled, oil transformers, while the others have two or three 1,000-kw. transformers. All these stations are connected by a 40,000-volt ring main and also by the 6,000-volt distribution network. Special feeders are laid to the steam plant now used as a reserve, the lighting sub-station, and the tramways sub-station.

The lighting system in the town is single-phase alternating current with small transformer sub-stations, and was originally supplied with current at 2,000 volts from the steam station. The new lighting sub-station contains three motor-generator sets each consisting of a 2,200-h.p. 6,000-volt synchronous motor coupled to a 1,500-kw., 2,000-volt single-phase generator, and also to a 1,800-kw., 600-volt D.C. machine which can run either as a motor or a generator. The sets run at 500 r.p.m. A battery of 6,000 ampere-hours capacity is connected in parallel with the D.C. machines. Normally, the single-phase generators supply the lighting load and the D.C. machines run in parallel with the battery without any appreciable interchange of current. Immediately the three-phase supply is interrupted, the D.C. machines take current from the battery and pick up the load automatically, the change-over being hardly noticeable. The diagram of the connections of this plant given in the report is well worthy of careful notice.

The report concludes with some particulars of the organisation of the system, and a large map of the city showing the lay-out of the distribution network. The complete system was first set in operation in September, 1909, and has since then been giving every satisfaction.

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CORRESPONDENCE

To the Editor, Electrical Engineering.

IMPENETRABLE TARIFFS.

Sir,—I have before me the copy of a speech made a few days ago by the chairman of a large electrical engineering company on the occasion of their annual meeting of shareholders. Amongst other things it contains the following statement: "It must also be remembered that in this market of free imports we have to meet the competition of most powerful Continental manufacturers, who with their home markets secured to them by *impenetrable tariffs*, are able to work at a good profit," &c. By "powerful Continental manufacturers" I suppose the speaker means principally German manufacturers. If so, I cannot understand how such a statement passed unnoticed and without protest from those present at the meeting, some of whom must surely know that the German tariff is anything but impenetrable, at least as far as it applies to electrical material. The import duties levied in Germany on electrical goods of English origin work out at about 2 per cent. to 4½ per cent. of the value for motors, ¾ per cent. to 1½ per cent. of the value for glow lamps, 3 per cent. to 4 per cent. of the value for turbo-generators, whilst lead-covered cable and a few other classes of goods pay no import duty at all.

I should feel obliged if you could find room for this letter in your next issue.

Yours truly,
A.E.G. ELECTRIC CO., LTD.
L. Pfeffer,
General Manager.

133–135 Oxford Street, W.

CABLE LAYING AND JOINTING

Mr. C. VERNIER'S Paper on "The Laying and Maintenance of Transmission Cables," which was discussed before the Institution of Electrical Engineers on March 9th, and also at Newcastle (see Electrical Engineering, March 16th, page 135, March 23rd, page 151, and April 20th, page 208), was further discussed by the Scottish Local Section of the Institution of Electrical Engineers at Glasgow on Tuesday, May 16th.

Mr. McLeod (Clyde Valley Electric Power Co.) understood that Mr. Vernier assumed that conductors would expand 4 ft. 6 in. per mile. He therefore emphasised the importance for free movement of all cable joints, but did not think the particular joint mentioned in the Paper adequate to take up movement due to contraction and expansion. For this purpose he preferred the method adopted by the Clyde Valley Co., whereby large expansion bends were provided similar to expansion pipes in a steam-pipe range.

Mr. W. W. Lackie (City Electrical Engineer, Glasgow) was practically in agreement with all the statements made in the Paper. He preferred creosoted or haskinised wood troughing as being superior to wood treated with Stockholm tar, which he had found of little protection. As a filling-in compound he preferred plastic pitch, the only objection to this material being lack of mechanical strength, which he expected to remedy by adopting a mixture of pitch and whin-stone dust. He referred to the importance of filling up the space between the different cores of a cable with some plastic material so as to exclude all air from the inside of the cable, as he found that when the cable was laid solid in hot pitch or bitumen compound, considerable expansion of such air took place inside the conductor.

Mr. Tidd (Morris Warden & Co.) showed a collection of samples of bitumen fibre conduits as originally used in America and now to a considerable extent in this country. Mr. Tidd explained that the "socket joint duct" and the "sleeve joint duct" were usually laid in concrete and direct in the ground respectively, and no difficulty was experienced in making them water-tight. Samples of the Key fibre troughing were also shown and its use explained.

Professor Baily (Heriot Watt College, Edinburgh) suggested the use of slag wool as a filling for underground troughing in combination with pitch. He asked the author if he knew whether there was any likelihood of the lead covering not returning to its original position after expansion, because he knew of combinations of lead and iron being subjected to heating and cooling when the lead thickened up at some parts and became thin at others.

Mr. S. Mavor referred to the mains engineer's chief difficulties being associated with the proper lying of cables, and especially with the proper jointing of them, as little trouble was experienced with the cables themselves as at present manufactured. He gave an interesting description of a visit to the Carlton Colliery, following the underground disaster which recently occurred there. After the explosion at that colliery the cables in the mine were buried under thousands of tons of rock which had fallen from the roof, and the whole system when tested was found to be practically perfect, as the lowest insulation was 50,000 ohms with all the boxes connected.

Mr. Vernier, in reply, while agreeing with Mr. McLeod as to the expansion of cables being 4 ft. 6 in. per mile, mentioned that this included lateral displacement, the total expansion being considerably less, and being easily taken up in the joints described in the Paper. He did not consider expansion bends any use to prevent troubles due to subsidence unless these were provided close to positions where subsidence was expected. If iron bridges were used for cable supports, he recommended the earthing of the lead sheathing, but he did not consider them as satisfactory as other methods.

In connection with filling up strands, he considered this of more importance in low-tension work, as all high-tension cables have their strands filled up by impregnation under a vacuum. He was favourably disposed towards the systems of fibre ducts shown by Mr. Tidd, but he thought difficulty might be experienced in getting the top half quite filled in with the circular form of conduit. He had never had any trouble due to the lead covering not regaining its original form after expansion, although he knew similar trouble had occurred in other directions, although not in connection with cables. Mr. Vernier told of some recent tests on a 20,000-volt cable, which was subjected to three times the working pressure for a quarter of an hour, then to a pressure of 50,000 volts for five minutes on a length previously saturated overnight in heated water at 160° F. Another short length was subjected to 100,000 volts for a quarter of an hour without damage.

Annual Tables of Scientific Data.—At the International Congress of Applied Chemistry held in London in 1909 an International Commission was appointed for the purpose of compiling and publishing annual tables of constants and numerical data, and this Commission was subsequently accorded the patronage of the Association of Academies at the meeting of that body held in Rome in 1910. The tables published in any year are intended to contain all the numerical data likely to be of interest in connection with chemistry, physics, and allied sciences, pure and applied, to be found in the literature published during the previous year, and are to be accompanied by full bibliographic references. Portions of the volume for 1910 are already in the press. It is hoped that ultimately the enterprise may become self-supporting, but obviously this cannot be the case for some time to come. The Commission has been greatly assisted by grants from various societies, and donations from private persons, but further help is still needed. The organisation of the Commission is sufficiently complete to deal effectively with the periodical literature, but data published only in non-periodical publications may easily be overlooked. Accordingly, the authors of such books, monographs, &c., are requested to communicate with one or other of the members of the Commission. The members of the International Commission for the United Kingdom are: Dr. A. Findlay, the University, Birmingham; Dr. R. T. Glazebrook, National Physical Laboratory; and Dr. N. T. M. Wilsmore, University College, London; and the General Secretary is Dr. Charles Marie, 98 Rue du Cherche-Midi, Paris VI.

The Thomas Transmission.—The Royal Automobile Club has now issued its certificate regarding the performance of the Thomas transmission in its 2,000 miles trial referred to in Electrical Engineering, May 4th, page 236. It is recorded that no work was done on the transmission during the 2,008·25 miles except lubrication, 5½ ounces of oil being used for the purpose. The route explained in the article referred to was exceptionally hilly. The fuel consumption worked out at 7·555 miles per gallon, or 58·046 ton miles per gallon for gross weight, or 24·03 for useful load carried. River Hill was climbed at an average speed of 7·206 miles per hour, and the total weight, including load and passengers, was 7·683 tons, of which 4·502 tons is accounted for by the vehicle itself. The average rise of temperature of the electrical machines was 22·8° C. Satisfactory working of the electric lighting equipment is also recorded.

In considering these results, the large amount of extra weight carried in the shape of tanks, seats, lighting and starting battery, tools, and spares must be borne in mind. The hilly nature of the route, and the fact that no speeds above 12 m.p.h. were allowed, so that short hills could not be rushed, were also serious handicaps as regards petrol consumption, and it must also be remembered that the energy for charging the battery is included. The efficiency of the transmission from engine to road wheels has been calculated from the time up River Hill assuming a road resistance of 70 lbs. per ton as 83 per cent., including the losses in the back axle gearing as well as in the planetary gear and the electrical machines.

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THE NEW GENERATING PLANT FOR THE PORT OF CALCUTTA

By Cyril E. Robertson (Messrs. Crompton & Co., Ltd., Chelmsford).

THE new generating plant of the Port Commissioners (which cost £13,000 for station, machinery, and electrical gear, exclusive of cables) is situated at Garden Reach, near the Kidderpore Docks. The power station, which was begun in 1906 and completed at the latter end of the following year, has a direct-current capacity of approximately 700 kw. The building, which is of hard brick and stone, and the concrete engine foundations, were contracted for by a local firm of civil engineers and architects, whilst the engines, machinery, generators, and electrical gear were supplied by Messrs. Galloways, Ltd., and the British Westinghouse Electric and Manufacturing Co., of Manchester, respectively.

In the boiler-house there are three Lancashire marine-type boilers, working under a pressure of 180 lbs. per square inch, and arrangements are being made for putting down a fourth boiler owing to the demand for another generator being installed, which will probably take place very soon as two 60-h.p. Crompton motors will shortly be coupled to the mains. There is also a separately fired superheater working up to 500° F., and a Green economiser. The boilers are hand-fired by native firemen, one fireman on each boiler for each watch, along with two coal trimmers, who help to clean the boiler flues and remove ashes and clinkers. Coal is supplied direct from the collieries in trucks to sidings, and is emptied out direct into the coal-bunkers by native labourers, broken up by the coal-trimmers, and fed to the boilers.

In the boiler feed pump-house are a Worthington steam pump and two Allen three-throw pumps geared to Westinghouse motors. The former is used chiefly as a standby.

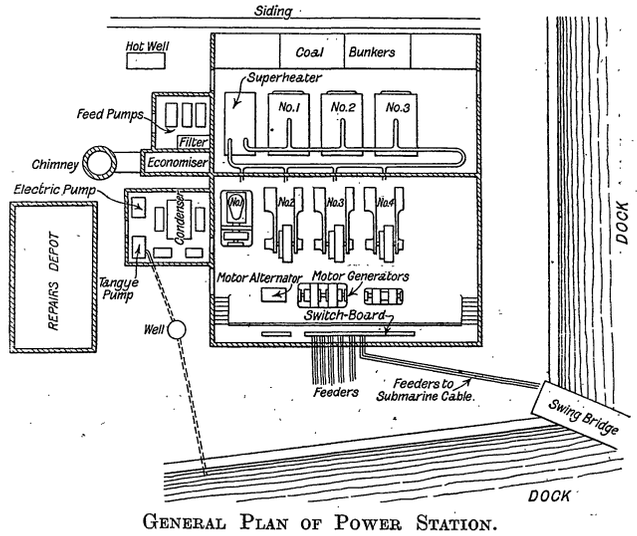
Feed water is obtained from the docks, which contain fresh water, with the help of an artesian well, the level of which is controlled by the tidal basin water level. The water from the artesian well is pumped by means of a Tangye electrically-driven pump into a steel tank with a capacity of 40,000 gallons on the roof of the condensing plant.

In the engine-room are four compound-wound British Westinghouse generators direct-coupled to Galloways' compound condensing engines. No. 1 engine set is of the enclosed self-lubricating vertical type with piston-valves, and runs at a speed of 500 r.p.m. It is controlled by a shaft throttle governor. The generator has six poles and has a maximum output of 153 amperes at 450-500 volts. The other three generators are large machines with ten poles each, and are direct-coupled to horizontal compound condensing slow-speed Corliss-type engines, running at a speed of 90 r.p.m. The maximum output of each of these big sets is 434 amperes at 450–500 volts.

The condensing plant is of the jet type, with electrically-driven air and circulating pumps. There are two sets of these pumps; the air pumps are of the three-throw Edwards type, geared to Westinghouse motors; the circulating pumps are centrifugal, and are direct-coupled to British Westinghouse motors running at 500 r.p.m. While one set of condensing pumps is in use the other set acts as a standby. The vacuum maintained in the condenser is 28·5″. Circulating water is obtained from the artesian well mentioned, to which it is returned.

The switchboard is of black polished slate, and is erected on an elevated gallery. There are four generator circuit-breaker panels, two balancer control panels, and fifteen feeder panels. Each panel has its own set of circuit-breakers, knife-switches, safety cartridge fuses, voltmeter, ammeter, and wattmeter, and, in addition to these the four generator panels have each a paralleling knife-switch. All the instruments on the switchboard are supplied by the British Westinghouse Co., with the exception of the master voltmeter for 0—600 volts, which has been supplied by Messrs. Crompton & Co., Ltd., of Chelmsford, and is of the sector type with an external resistance, and the voltmeter and earth recorders supplied by Messrs. Kelvin & White and Elliot Bros. respectively. The station voltage may be conveniently controlled by the attendants, there being shunt regulators placed immediately opposite each generator circuit-breaker panel. The balancer loads and voltage are controlled from the balancer panels by rheostat-type regulators. There are two sets of balancers, a small and a big set. The smaller set runs during the day shift, when there is a light load on the generators of 400 amperes, and the big set is put under way to cope with the night load, which is fairly big, when three big generator sets are run in parallel. All the circuit-breakers are of the spring arm type; they can be set for full and overloads, and have release current coils fitted at the back of the switchboard. The feeder bus-bars are a continuation of the generator bus-bars connected by spiral expansion coils, and the neutral bus-bar, which supplies 230–250 volts to the line, is connected to the balancers and runs the full length of the feeder panels. This half-volt circuit is used for incandescent lighting and low-power work. A few yards from the main switchboard there is a small switchboard with two panels which works a motor-generating set. The generator is an alternating three-phase, fifty-cycle machine, direct-coupled to a high-speed direct-current motor. This set is used for testing the insulations of machines and cables in the station, and has two oil-cooled transformers for transforming the alternator volts to the required pressure.

In the power-station yard, divided by a party wall from the engine-room, there is a lightning-arrestor tank containing salt water. This is connected to the switchboard, and is put in or cut out as required by means of contact plugs on the balancer panels. The framework of all the generators and motors in



GENERAL PLAN OF POWER STATION.

the station are connected to an earthed conductor, which is in turn connected to the balancer bus-bars and lightning-arrester.

The total capacity of the station, as previously mentioned, is 700 kw., and the maximum load very often nears this figure during a night run. There are five main sections to be fed, each with an independent sub-station, which in turn feed numerous smaller sections. The current is conveyed to the five sub-stations by armoured cables and overhead bare copper conductors, and the approximate carrying capacity of these is 2,000 amperes. The cables are laid in trenches 3 ft. by 4 ft., and are placed on petticoat insulators in melted coal-tar pitch in earthenware troughs, the tops of which are sealed over with slabs and Portland cement. The trenches are then filled in to the surface with earth and beaten down firm owing to the heavy railway traffic which passes over them. The cables are insulated with paper rubber composition and gutta-percha, and are lead covered. There are always three sets of cables laid in each trough for full- and half-voltages, positive, neutral, and negative. The overhead conductors have also three lines each, and in the event of the underground cables burning out through any reason, the supply can be transmitted by the overhead network alone, and vice *versa*. To maintain a supply on the opposite banks of the docks, there are two sets of submarine cables laid in the bed of the basin. These meet at the sub-station on the opposite bank, which distributes the supply for this area.

There are altogether five sub-stations, each of which is fitted with a receiving and feeding panel, distributing switches, deflecting instruments, and regulators for raising or lowering the voltage on the line as required. The current generated in the station is consumed chiefly in the Commissioners' dockyard, where there are some 400 Excello arc lamps in the shipping wharves, sheds, and along the railway tracks, &c. Then in the tidal basin there are four caissons, worked by electric power, for damming the various dock

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gates to maintain the right tidal level in the docks, and also for damming the water from the dry graving docks. There are also two 50-ton electric cranes and a lighting circuit for some 2,000 incandescent lamps in the various offices of the Commissioners, in the dockyard, and in the quarters of the Commissioners' officials and employees.

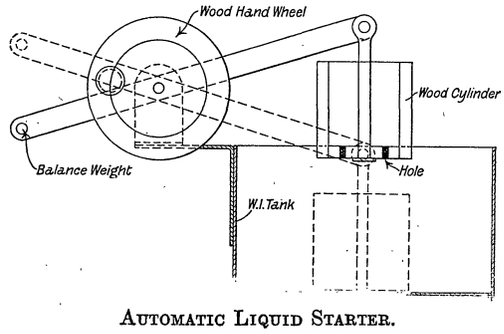
These different circuits are all controlled by four of the sub-stations. The remaining sub-station supplies light and power to the Commissioners' jute wharves, tea warehouse, and workshops. In the jute wharves there are several arc and incandescent lamps installed. In the tea warehouse there are 21 electric lifts, and the four storeys are lit with incandescent clusters and arc lamps. In the third floor there is an electric bulker in which the different qualities of teas are blended. In the ground floor there are four electric packers, which receive the blended teas from the bulker and pack them automatically in wooden chests for export to all parts of the globe.

The workshops are electrically driven by 80 Westinghouse motors here, driving the various shafts and direct-coupled in some cases to the machinery. These shops are also fitted with incandescent and arc lamps. During the day the workshop load alone registers 400 amperes. All repairs to station machinery and outdoor lines are executed by the workshops and mains departments respectively.

Before concluding, it may be interesting to say a few words on the cost of generation. As previously stated, the coal is obtained direct from the collieries, and the fact of the Commissioners purchasing large quantities of this for the consumption of their numerous vessels and hydraulic and pumping stations, &c., enables them to obtain it at approximately ten shillings to twelve shillings per ton. Then again, native labour in India is comparatively cheaper than what the labour in England is, and the cost of generation, after paying expenses, works out roughly to three farthings per unit, it is retailed to the Commissioners' employees, etc., at 4d. per unit.

A NEW LIQUID CONTROLLER

THE accompanying illustration shows a form of automatic liquid controller which has been designed by Mr. F. C. Morris, of Bolton, to meet the demand for a starter which is simple in construction and "fool proof." By turning the handle to the right, a lever, with a bucket or cup attached



AUTOMATIC LIQUID STARTER.

to one end, is released. The bucket has one or two small holes at the bottom, and gradually fills with water so that it sinks and slowly cuts out the resistance. A controller on this principle can easily be made to be electrically controlled to work in conjunction with pump, motor, &c. The device is provisionally patented.

Wireless Telegraphy.—Mr. T. Thorne Baker lectured on the practical progress of wireless telegraphy at the Royal Institution on Thursday, June 18th, and dealt principally with portable equipments, describing that of Marconi for use in the field. With this apparatus, which is packed on four horses, each carrying 120 lbs., communication can be maintained up to about 50 miles. The aerial is raised by means of a portable mast, which can be raised to a height of 80 feet. Telegraphy on aeroplanes was also discussed, a model aeroplane being exhibited, showing the aerial attached, which was altogether 110 feet long. The difficulty of receiving messages owing to the noise of the engine has been overcome by means of a coherer in conjunction with a relay and lamp, which glows and reproduces the Morse signals. He described how the instrument could be tuned to receive musical sounds. Some interesting experiments had been made with Sharman's telephonic apparatus, communication being carried on through one mile of ground, pegs being stuck in the ground at the receiving and transmitting ends. In conclusion, the author mentioned the Habibia system, in which the conductivity of the water of a river is utilised.

MAGNETIC TESTING

A PAPER was read before the Physical Society on May 12th entitled "The Method of Constant Rate of Change of Flux as a Standard for determining Magnetisation Curves of Iron," by J. T. Morris and T. H. Langford.

The research described was instituted with the object of finding what differences there were between the magnetisation curves for a given sample of iron when determined (1) by the older methods in which the flux is changed suddenly, (2) by a method in which it is changed exceedingly slowly and at a uniform rate.

The methods experimentally examined were :—Method of constant rate of change of flux; "slow cyclic" hysteresis loops by method 1; "step by step" magnetisation curve; "step by step" hysteresis loops; method of reversals; alternating-current magnetisation curve. Details are given of the theory and practical working of the first method, in which the magnetising current is continuously increased through a primary winding by a specially designed resistance at such a varying rate as to maintain a constant voltage generated in a secondary winding. A certain amount of skill is required, and the complete change of the current occupied times varying from one up to some five minutes.

Tables are given of the magnetisation curve determined by the six different methods at a number of values from **H** 0·3 up to 70·0, and of the permeability from **B** 500 up to 17,000. At low values of the magnetising force the uniformly varying flux method gives results of some 200 lines per square centimetre in excess of the older methods. As regards the time required for determinations by the various methods experimentally examined, ballistic methods are undoubtedly the most tedious. The alternating-current method has considerable advantages in this respect, a full set of readings of magnetising current and induced voltage occupying a very short time. When, however, it is necessary to take oscillograms at various points in order to plot curves of form factors, the time required is enormously increased. The method of uniformly varying flux is peculiarly adapted for use where time is a consideration, and at the same time a high degree of accuracy is desired. A complete magnetisation curve may be taken in a very few minutes, and the mean of many such curves obtained in, say, one hour, the iron being demagnetised between each test.

The method of "uniformly varying flux" appears to possess advantages, both scientific and practical, over the older methods in use for the testing of ring samples of magnetic materials. It avoids difficulties due to eddy currents and magnetic viscosity, which effects are themselves due primarily to rapid or irregular changes of flux. Besides rapidity of experiment it also has the advantage of accuracy of repetition under standard or predetermined conditions of magnetic change. The method is, therefore, commended for the carrying out of magnetic tests, especially where great accuracy under definitely known conditions of experiment are essential.

University College.—In connection with the organisation of the new Department of Heating and Ventilating Engineering at University College, towards which the London County Council have made a grant in aid, Mr. Arthur Henry Barker, Vice-President of the Institution of Heating and Ventilating Engineers, has been appointed lecturer for the session 1911–12.

Diesel Engines for Large Stores.—An instance of the reliability of the Diesel engine is furnished by the fact that one of the large Continental stores, that of Hermann Tietz, is dependent entirely for power and lighting in its branches at Munich, Berlin, and Hamburg on Diesel engines. These engines have all been ordered from the Maschinenfabrik Augsburg-Nürnberg A.-G. (London office: M.A.N. Co., Caxton House, Westminster, S.W.), and the sizes of the various power stations are 2,200 b.h.p., 540 b.h.p., 3,500 b.h.p., 800 b.h.p., and 1,250 b.h.p.—altogether 8,300 b.h.p. M.A.N. Diesel engines for similar purposes have been installed at the large stores of Rudolph Hertzog, Berlin, at the Bon Marché and Galeries Lafayette, Paris, and at a great number of smaller stores.

Electrical Propulsion of Ships.—The experimental vessel built by Messrs. Mavor & Coulson, of Glasgow, to demonstrate their system of electrical ship propulsion has been undergoing trials on the Gareloch. The boat, which is named the "Electric Arc," is 50 ft. in length, 12 ft. beam, 7 ft. 4 in. moulded depth, and of 17 tons displacement. She is now driven by a 45-h.p. Wolseley petrol engine, but it is intended ultimately to replace this by a gas engine and producer of similar power. The engine drives a three-phase alternator and exciter, and a multiple wound variable speed induction motor of special construction drives the propeller. The control is entirely from the bridge by means of simply arranged interlocked switches controlling the excitation and the motor and generator connections to give various frequencies and effective numbers of poles. The vessel attained a mean speed of 8¼ miles per hour, and is reported to have given great satisfaction as regards ease of control and manœuvring.

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A NETWORK FILING SYSTEM

THE system of records of connections of sub-stations, feeding points, distributors, &c., in use on the Dublin system was described in a Paper read before the Dublin Section of the Institution of Electrical Engineers, on May 11th last, by Mr. G. Archer (Chief Assistant Engineer, Dublin Corporation Electricity Works). In this system, which has far less limitations than special maps or the filing of written reports of alterations, the chief feature is the placing of small plugs of bone or metal in holes in special diagrams to indicate the position of links, switches, and fuses. First of all, the various sub-stations were taken into consideration, and what was the natural or normal network to be fed by each sub-station was decided upon; and this being done, a diagrammatic plan was prepared for each sub-station network, showing all network boxes and section pillars, &c., each carefully numbered; the points where linking up with another sub-station was possible being indicated. These were called reference plans. The next question was to represent the connections in the sub-station itself, and to do this a diagrammatic sketch was made of the high-tension and low-tension switchboards, plug-holes being provided where links, switches, or fuses were used. The position of the plugs on this diagram will indicate at once which circuits are being fed from the sub-station. Provision is made on the sub-station card for miscellaneous information, such as size of transformers in use, inspections made, &c. The sub-station switchboards and the cables radiating therefrom having been dealt with, each section pillar, network box, and transformer kiosk was treated in like manner. The diagrams are glued on to boards and contained in the drawers of a neat and compact filing cabinet.

Mr. G. F. PILDITCH (Chief Electrical Engineer, Rathmines), who opened the discussion, said that with the author's system there seemed to be a risk of the plugs being put in the wrong holes in the card dummies, which if not discovered at the time might lead to chaos. He thought it better in such an emergency to go straight to the boxes and see how the connections actually were. On his own system at Rathmines the boxes were all symmetrically arranged, but where there was any obscurity he had diagrams of the connections painted on boards, which were kept in the disconnecting boxes.

Mr. W. J. U. SOWTER (Chief Electrical Engineer, Bray) thought that all disconnecting boxes should be symmetrically arranged so that they formed their own diagram. On high-tension systems there was grave risk to human life if the engineer could not make disconnections with absolute certainty that he was right. He remembered a case where it was supposed that a faulty high-tension cable was entirely disconnected. when the jointer received a severe shock because wrong links had been taken out. The author's system apparently provided no means of identifying the cables one from another in the streets.

Mr. S. L. R. PRICE (Chief Electrical Engineer, Pembroke) said that it was hopeless to rely upon written reports or personal memory. He believed that in Newcastle one man was entirely responsible for all alterations and disconnections, and that nothing could be done without his sanction. If there were two or three men in a position to give orders, mistakes were very likely to occur.

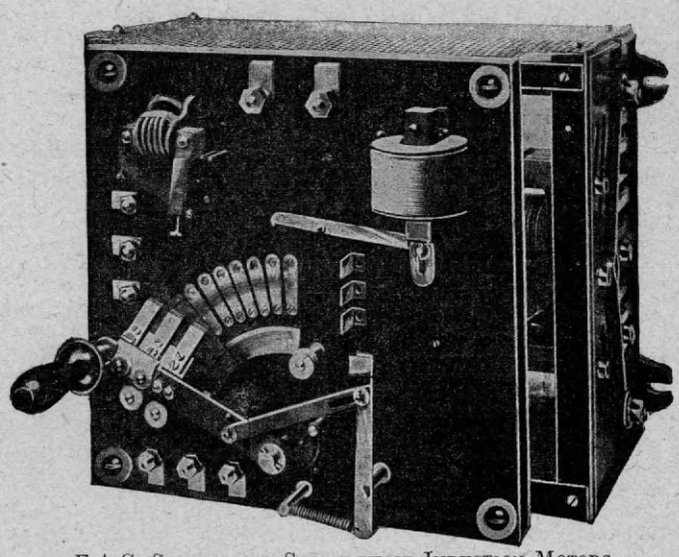
Mr. P. T. BLISSETT (Messrs. Guiness & Co.) asked what precautions were actually taken in the Dublin sub-stations to ensure beyond doubt that the 'bus-bars were actually dead before work was commenced upon them.

Mr. T. TOMLINSON agreed that it was very necessary to make accurate plans showing the position of every main under the road surface. Many years ago he had represented a company seeking a concession for lighting a portion of Paris, and the City Engineer there required a very complete set of maps showing the position and depth of every main laid, including even consumers' services. The City Engineer there was able in a few moments to ascertain to an inch the position of any gas, water, or sewage pipe in any quarter of the city. He strongly approved of the author's system.

Mr. ARCHER (in reply) mentioned that the system was, of course, kept absolutely up to date, as otherwise it would be worse than useless. The various assistants reported to the mains engineer any alterations which were made in the connections, and the alterations were made in the filing system accordingly by the draughtsman. As regards seeing the connections from the boxes themselves, Mr. Archer reminded his critics that on large systems the box-covers were naturally heavy, and many of them took a considerable time to open, and it might occur that during the time of a breakdown many of these boxes would be opened unnecessarily, whereas by referring to the filing system all the information required could be obtained in a few moments. Regarding the question of the identification of the cables in the streets, a very elaborate system of maps was kept, and they never experienced any difficulty in that respect. Regarding the question of dual control, the mains engineer was entirely responsible, and all orders were issued through him; the draughtsman worked under him and kept the filing system to his instructions. Replying to Mr. Blisset's question, the 'bus-bars were always earthed before any work was undertaken in connection with the high-tension side of the sub-stations.

STARTERS FOR SINGLE-PHASE MOTORS

THE starter illustrated here has been designed by the Electrical Apparatus, Co., Ltd. (Vauxhall Works, South Lambeth Road) with the object of securing simplicity in operation, while providing apparatus which could be relied on to start single-phase motors without troublesome individual adjustments. The starter is operated by a single handle, moved in one direction only, which cannot be left in the starting position, and all parts are under one cover. If the motor does not start on the first step, the movement of the handle to the right will progressively increase the torque up to the maximum that the motor is capable of developing. This important feature is obtained by utilising both resistance and a choking coil in the stator circuits, and resistance in the rotor in the case of slip-ring motors. The use of the stator



E.A.C. STARTER FOR SINGLE-PHASE INDUCTION MOTORS.

resistance allows the rotor resistances to have comparatively low values, so that they and the choking coil can be mutually designed to the very best advantage. This is a great gain over the common method of providing a fixed stator resistance, if any, and gradually cutting out the rotor resistance, since in that case the effect of the auxiliary phase becomes less and less, completely neutralising the increase of effect of the main phase. The lever carries two brushes: one supplies current to the running phase, gradually cutting out resistance. while the other energises the starting phase through a choking coil: this phase is automatically opened, when the handle nears the full running position, by means of a quick break knife switch linked to the main handle. In the case of squirrel-cage motors, this comprises the whole of the operations to be performed. For the slip-ring type, three brushes are provided which short circuit the rotor resistances in one step in the final position of the handle. Carbon breaks are provided for all motors over 5 h.p. No-voltage and overload releases or press-button spring releases can be provided.

The starters are made in various sizes up to 50 h.p. in the open, semi-enclosed, or totally enclosed patterns.

Hampstead Electrical Showrooms.—We regret that in our description of the new Hampstead Electrical Showrooms on page 321 of ELECTRICAL ENGINEERING of June 8th, we gave the prices of 15s. for the first day, 10s. for the second day, and 5s. for the third day as applying to the hire of cookers. These prices should apply to vacuum cleaners.

Brimsdown Lamp Works.—The works had their third annual outing on Saturday, June 3rd. A special train from Waltham Cross, calling at various intermediate stations, arrived at Liverpool Street at 6.26 a.m., where the staff of the sales department and a number of guests met the train. The party of over 500 arrived at Hastings in excellent time, and dinner was partaken of at 12.30 in the Royal Concert Hall. Mr. E. Sharrer was in the chair, and was supported by Mr. J. Chiswell. The Red Hungarian Band was specially engaged for the occasion. The whole function was a great success, and the return journey was not commenced before 8 o'clock p.m. The fine June weather conduced to a perfect day's enjoyment.

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WATER POWER IN NORWAY

AT a meeting of the Faraday Society on May 2nd, a Paper was read by A. Scott-Hansen, of Christiania, dealing with the various power schemes of Norway, where, as is well-known, facilities for water power are very plentiful.

Norway, which possesses in some districts a very large rainfall, is fortunate in having splendid catchment areas, which make it easily available as a source of energy. In the district of Bergen the annual rainfall is sometimes over 158 inches, which means a fall of 16,000 tons per acre annually. A few miles behind the chain of coast mountains the rainfall is very considerably diminished on the eastern side, and it is not much over 15·8 inches. If the rainfall were evenly distributed throughout the year the Norwegian rivers would be amongst the best supplied in the world. This, however, is not the case. From October to April or May the rainfall in the mountainous districts takes the form of snow. Consequently the rainfall cannot at once be utilised. Owing to the melting of the snow floods occur in May, and are usually heaviest during June and July. Thus in order to make use of the power, considerable storage capacity is necessary. Fortunately the country is furnished with lakes of various size, which have frequently very contracted outlets, and can be easily converted into valuable reservoirs at a comparatively small outlay. In this way the watershed of Skien from Mösvand to Hiterdalsvand, the original horse-power was equal to about 50,000 h.p., but can easily be raised to 375,000 h.p.

One of the reservoirs formed by damming the mountain lake Mösvand has a surface of about 60 sq. kilometres, and has been converted into a reservoir containing about 840 million tons of water. This reservoir has increased the minimum flow into the river from 5 tons per second to 47 tons per second. Owing to this the water-power of the Rjukan factories has been increased from about 30,000 h.p. to 250,000 h.p., and this has been achieved at a cost of about £85,000. The total water-power which might be made available in Norway has been estimated at from 5 to 7,000,000 h.p., but even this is probably a low estimate. Hitherto electric power has principally been applied to light and for power purposes, and in towns and populous districts, to which it is transmitted from the waterfalls inland, or in sparsely populated districts. The cost depends on various circumstances; but it may be taken that the power stations can supply power at from 22s. to 40s. per horse-power year at the power station.

The industries able to make use of large powers, for instance, 50,000 to 100,000 h.p., are not those which only require power to actuate machinery, but industries of an electro-chemical or electrometallurgical nature. In 1906 Prof. Birkeland first communicated to the Faraday Society the results of his and Mr. Eyde 's discoveries on the fixation of atmospheric nitrogen. From this discovery an industry has arisen that will in the course of the present year make use of 170,000 to 180,000 h.p., and it is hoped will in the course of a few years employ about another 300,000 h.p. In the manufacture of calcium carbide about 60,000 h.p. are employed, and in other electro-chemical and electrometallurgical industries about 20,000 h.p., the results of developments during the last ten or fifteen years. The following are the official statistics for 1909 :—

	Tons.	Value in Kroner.
Calcium carbide	48,352	5,802,200
Calcium cyanamide	752	120,300
Nitrate of lime	9,422	1,300,300
Nitrite of soda	2,577	1,015,400
Aluminium	486	1,093,300
Ferro-silicon	2,645	449,600
Soda	179	357,400
	64,413	Kr. 10,138,500

In English money this represents about £557,480. The 1910 figures are not yet available, but the exports of nitrate of lime and nitrite of soda have increased very considerably, and another article has been added to the above list, namely, nitrate of ammonia.

Another industry which promises to be of the greatest importance is the electric smelting of iron and steel. The question of obtaining a suitable furnace for smelting iron ore appears to have been solved in the Grönwall furnace, which has been worked for some time on a commercial scale, with excellent results, first at Domnarfvet and Trollhättan in Sweden. The patent rights in Norway have been acquired by the Norsk Elektrometal, who have granted licences to the Hardanger Elektriske Jern og Staalverk, who will obtain electrical energy from the power company, A/S Tyssefaldene and to the Arendals Fosse-Compagni, who own the waterfall Böilefos, near the seaport town of Arendal. A company has also been formed to use a different type of furnace at the Tinfoss in Telemarken. At the Hardanger Iron and Steel Works they will commence with 5,000 e.h.p., which may be increased to 15,000; at Arendal, 6,000, which can be increased to 30,000, and at Tinfoss, 5,000 e.h.p., which may be increased to 10,000 or 15,000. Great hopes are entertained that other ores—copper, nickel, zinc, and so forth, will be capable of being electrically smelted, and perhaps further worked up.

Large quantities of timber are floated down the rivers in the summer from the forests, and this timber at times causes great trouble to the power stations and bridges. One of the most important power stations, now under construction, is Vamma, on the lower part of the Glommen River. The dam at Vamma is to have a height of about 90 ft., and will be one of the largest in Europe. The power station will be in the middle of the river-bed, immediately below the dam. There will be ten or twelve generating units, each for about 7,000 h.p. The power will be partly used for lighting power and partly for a factory of nitrogenous products. The difficulties encountered in building some of the pipe lines in Norway were described, and Mr. Hausen gave particulars of a great many power schemes, yet even after great engineering difficulties had been surmounted, power was now obtained at a remarkably cheap rate.

THE OLYMPIA ELECTRICAL EXHIBITION

THE Exhibition Committee have had a most effective poster prepared of which we give a reproduction here. A large number of these are being printed, and copies will be forwarded to the supply authorities, contractors, and all engaged in the electrical industry, who will be kind enough to display them prominently in their premises, or in their windows. The design of the poster is already familiar to many of our readers from the adhesive labels in use in large quantities by exhibitors, and is even more effective in the larger size.



Electric Power in Flour Mills.—Before the National Association of British and Irish Millers, recently, Mr. W. Cramp discussed systems of driving flour mills. He assumed certain combined rates of interest and depreciation, and estimated that the price of power would vary from 2d. to 6d. per sack of flour produced, and this, under certain conditions, the chief of which was that of locality. With regard to steam plant, the slow-speed horizontal engine, on account of being costly, heavy, and requiring large floor space, was dismissed in favour of the high-speed vertical type with a direct or electrical drive, because it was more economical in capital cost, floor space, and foundations. The question whether the miller should generate his own electricity or take it from the mains depended, of course, on the price per unit of supply. Though the main load of a mill was regular day and night, and the auxiliary load could be put on at times other than those of the station peak load, it would be more economical to generate it by means of a steam, gas, or oil plant, since a very large supply would not cost less than 0·3d. per unit, and for smaller quantities 0·5d. per unit. For country mills suction gas and oil engines were about equal, and when the latter was used, the Diesel engine was, in his opinion, the only one that could be considered. The exhaust steam turbine as an addition to existing plant would increase the power and economy, and of the electrical systems, the three-phase alternating-current was preferable in all cases. In very large mills, with gas engines, a producer plant should be used.

Petrol-Electric Omnibuses in London.—A number of petrol-electric omnibuses of the same type as that described in ELECTRICAL ENGINEERING, October 27th, 1910, page 678, but differing slightly in constructive detail, are being put into service by Messrs. T. Tilling, Ltd. One of the innovations is the use of a spring drive between the engine and the generator; a new design of live worm-geared back axle is used, and the engine and radiator arrangements are different. The main feature of purely electric transmission with a single generator and a single motor with control on the generator field are, however, retained. The electrical equipment was supplied by Messrs. W. A. Stevens, Ltd., Maidstone. The generator is rated at 25 kw., and runs at speeds from 350 to 1,600 r.p.m., giving voltage varying up to 350. It is designed with a falling characteristic. The weight of the whole 34-seated vehicle is 3 tons 9½ cwt., of which the electrical equipment is responsible for 1,120 lbs. The overall efficiency is given as 79 per cent.

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METAL FILAMENT LAMP PATENT LITIGATION

IN the series of actions which the Osram Lamp Works, Ltd., are commencing against some other lamp makers, they are alleging infringement, not only of the Just-Hanaman patent, but also of the "weighting" patent, which covers the method employed in the manufacture of Osram lamps for rendering the filament straight and uniform after squirting.

This patent (No. 8,563 of 1907), which was taken out by the Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft) of Berlin, describes a method of ensuring that the contraction which takes place when a filament squirted from a paste is sintered, shall be uniform along the filament. If there is a lack of uniformity, there is a danger of the spots at which the resistance is higher attaining a higher temperature, and so shortening the life of the filament. To prevent these bright spots being formed, the filament is subjected to a slight tension during the process of sintering by hanging a small weight such as a tungsten hook from the filament at the bend of the loop. This not only ensures uniform contraction, but gives the sintered filament the required pointed shape.

The Just-Hanaman patent is No. 23899 of 1908.

It was granted to Dr. A. Just and F. Hanaman, of Vienna, and describes a process of manufacturing filaments of pure tungsten by mixing finely divided tungsten or tungsten compounds such as tungstite, tungstic acid, or tungstic sulphide with an organic binding medium such as collodion, or a solution of cellulose in chloride of zinc or cupreous ammonia oxide. The filaments squirted from the resulting paste are then carbonised (in some cases after denitration), and the carbon is then removed by passing current through the filament and raising it to a high temperature in an atmosphere of steam and hydrogen. The carbon is oxidised to form carbonic oxide, and a filament of pure tungsten is left. The filaments are then rendered uniform by submitting them to the action of current in an atmosphere of volatile tungsten compounds in the presence of a large quantity of hydrogen, whereby the tungsten deposited equalises the filaments.

This patent was published in full in ELECTRICAL ENGINEERING of September 9th, 1909, after the grant of an amendment by the Comptroller.

It is under these two patents that the Osram Co. is bringing its action against the "Z" Electric Lamp Manufacturing Co., Ltd., and their agents, Messrs. Baxter & Caunter, and an action, we understand, is also to be brought against the Café Royal, who are users of "Z" lamps. Another firm which is being attacked is the Corona Lamp Works Co., successors to Mr. S. Horvath.

The Corona Lamp Works Co. have sent us a copy of correspondence which has passed between the solicitors of the Osram Lamp Works, Ltd. (Messrs. Bristowe, Cooke & Carpmael), and their solicitors (H. C. Morris & Co.). The Osram Lamp Works claim that the above patents have been infringed by the manufacture by the Corona Lamp Works Co. of "Mascot" lamps, and their sale to Messrs. Galsworthy, Ltd., who, we understand, act as sole selling agents for these. The letter asks in the usual form for an undertaking that the alleged infringements shall cease forthwith; that the lamps in stock shall be delivered up; and that full information should be given as to the number and power of the lamps already sold, so that an estimate of the amount of damage might be formed.

In reply to this, the solicitors of the Corona Lamp Works Co. have contended that their clients' lamps are manufactured by an "altogether different method, marking a great advance in the manufacture of metal filament lamps, and differing altogether from the patents above mentioned"; that their clients are prepared to indemnify their customers in respect of any proceedings which the Osram Co. may bring against them in consequence of their selling "Corona" or "Mascot" lamps; and that they will hold the Osram Co. liable for any loss or damage that they may sustain owing to the Osram Co.'s "interference with their agents or customers."

In this connection, in order to have the complete history of the matter up to date, our readers may also refer to ELECTRICAL ENGINEERING of January 26th, 1911, in which the case against Messrs. G. M. Boddy & Co. was dealt with.

Trolley Omnibuses.—We understand that the British Electrical Federation has for some months past been making inquiries into the possibilities of the trolley omnibus for rural and other districts where the expense of laying down tramways would not be justified.

REVIEWS OF BOOKS

Imperial Telegraphic Communication. By Charles Bright. 212 pp. 7¾ by 5 in. (London: P. S. King & Son.) 3s. 6d. net; abroad 3s. 9d.

AT a time when imperial matters are much to the fore in connection with the Conference, the publication in book form of a collection of Mr. Charles Bright's recent writings upon the cable communications of the world is very opportune. The matter included is mainly that contained in articles from the *Quarterly*, *Fortnightly*, *Monthly* and *Westminster Reviews*, together with the substance of a paper read lately before the Royal Colonial Institute. A readable introduction summarises the present position, and a map is included on which are marked the new state owned routes which Mr. Bright proposes in addition to the existing cables, in order to make the communications of the empire self-contained from the strategic point of view. The first few sections of the book deal with the Pacific cable question, and further articles reprinted are headed respectively Imperial Telegraphs, Imperial Consolidation by Telegraphy, Imperial Telegraphy as a popular Tariff and Communication by Cable, titles which in themselves indicate the nature of the contents, and finally the paper referred to above on Imperial Telegraphy. An appendix gives tables of cable rates.

The Elements of Graphic Statics. By W. L. Cathcart and J. I. Chaffer. 312 pp. 9¼ by 6¼ in. 159 figures. (London: Constable & Co.) 12s. net; abroad, 12s. 10d.

GRAPHICAL methods are becoming more and more popular in all branches of engineering work as their clearness, speed, and convenience are becoming realised. This book, which is founded on lectures to students of marine and mechanical engineering in America, is largely addressed to mechanical engineers. The stresses in stationary structures are, however, dealt with at considerable length, as well as the pressures and stresses in moving shafting, gearing, &c. The treatment both of the general principles and methods of meeting special problems is clear and straightforward, and the utility of the book is enhanced by the examples at the end of each chapter.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

CARBON BRUSHES.—A new and very complete list of graphitic carbon dynamo and motor brushes, made by Fabius Henrion (Nancy), is to hand from W. Geipel & Co. (72A St. Thomas' Street, S.E.).

FITTINGS.—In issuing their latest list of the well-known Benjamin wireless clusters and other fittings not requiring internal wirings, the Benjamin Electric, Ltd., call special attention to the suitability of these for temporary lighting of stands at the forthcoming Electrical Exhibition at Olympia. The list contains particulars of a considerable variety of clusters, adaptor, angle holders, complete fittings, reflectors, shades, and accessories, including weather-proof fittings for exterior lighting.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

WIRES AND CABLES.—A new list from the Sun Electrical Co., Ltd. (118-120 Charing Cross Road, W.C.), deals with wires and cables in considerable variety, including V.I.R. electric light wires, cables, and flexibles; flexibles for special purposes, such as armoured flexibles and those with a third steel conductor; bell and telephone wires; and special multiple cables for intercommunication systems.

CONDUIT FITTINGS.—The same company are also issuing a leaflet advising reduced prices of "Kalkos," and other boxes for screwed tube.

FANS.—Another leaflet from the Sun Electrical Co. gives notice of a cheap clearing line of table and desk fans available from stock.

MOTOR STARTERS.—A new and very comprehensive list of starters, speed regulators, &c., for continuous-current motors up to about 50 h.p. is being issued by the Union Electric Co., Ltd. (Park Street, Southwark, S.E.). These are of the lever pattern, with no-volt and overload releases, and can be either open, semi-enclosed, or watertight.

COOKING APPLIANCES.—A card from Simplex Conduits, Ltd., calls attention to the latest forms of electric ovens and combination cookers and grills which are on the market at favourable prices, and are guaranteed for a year.

Telephone Purchase.—According to the *Birmingham Daily Post*, it is likely that the Telephone Transfer Bill, which is to be introduced into the House of Commons very shortly, will contain clauses providing for the purchase of the two remaining municipal telephone systems at Hull and Portsmouth.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published June 8, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

11,854/10. **Electric Light Control.** R. J. AIKEN. An arrangement for the control of a number of lights or groups of lights supplied on the maximum demand system is covered by this patent, in which each light is operated by means of ordinary tumbler switches adapted to work with a detachable key, which cannot be removed while it is in the "on" position. Nine figures.

17,819/10. **Electric Cord Grips.** M. H. GOLDSTONE and J. LIGHTFOOT. In the ordinary type of cord grip, in which a tapered insulating piece of wood or other material is split down the centre, and down which grooves run to take the conductors, it is possible for the conductor to get squeezed and short-circuited. This invention is a safety device to isolate the conductors entering the electrical appliance, which consists of a grip divided into two or more pieces, the centre piece acting as an insulator between the two conductors, and they are then clamped in the usual way. Another method, getting the same result, is to have a grip of two sections so shaped that the wires cannot come together, one section fitting into the other like a knife-shaped wedge. Five figures.

20,289/10. **Electric Heaters.** E. G. BYNG and C. H. ARCHER. This invention relates to improvements in electrical heating apparatus, in which the heater is separate from the appliance, and provides a thick case of some heat insulating material, such as fireclay or earthenware. It is shaped to fit the appliance to be heated, and supports both the heating coils and the appliance itself. By this method no heat is lost by radiation. Two figures.

22,304/10. **Lamp Socket.** J. DARBY. Details in the manufacture of lamp sockets of the type in which a double break is made in each side of the circuit, are described in this patent. The controller is placed between two heads of insulating material, and rotates on an axis coincident with that of the socket. The circuit is closed by a pair of springs attached to the controller, engaging with two pairs of contacts fixed to the two heads of insulating material, the controller being operated by a pawl moving in a straight line, which is actuated by a pull chain. Ten figures.

29,309/10. **Couplings for Electrically-driven Looms.** ALLGEMEINE ELEKTRICITÄTS-GES. In electrically-driven looms, it is important to bring the motor to the desired speed before connecting it to the loom, so that with the high starting speed the shuttle is sent the entire length of the warp. This is provided for by a device in which the motor switch and the gear rod of the loom are connected to a member, which, when moved in one direction, brings the motor up to full speed, whilst in the reverse direction the loom is put out of gear before the motor is disconnected from the mains. A locking device is also provided to prevent the motor and loom from being switched on together. Four figures.

2,242/11. **Aerial Conducting Structures.** H. LANGE. An improvement in the manufacture of aerial conducting structures, in which metal ribbons are used instead of metal wires, is covered by this patent. Formerly marginal radiation was prevented at the expense of increasing the solidity of the structure, by shaping it with beaded edges and inserting wires or cords, which need not be very thick to be sufficiently solid, and yet the thicker the wire the better the radiation. In this invention, the inserted material is made of hemp or cotton, which is a favourable form to prevent radiation, and at the same time gives sufficient solidity. The metal ribbon may be bent round one or more ropes made of the above material, and the thickness can be chosen, such that the ribbons bent round them in no place show small radii of curvature, without increasing the weight as in the case of the inserted metal. This method gives a greater flexibility to the structure. Five figures.

6,350/11. **Alternating Current Arc Lamps.** KÖRTING and MATHIESEN AKT.-GES. It is known that an alternating current arc sometimes acts as a converter to direct current, which affects the magnetic system in the case of lamps fed mechanically by an armature and a solenoid, and renders the control of the lamp difficult. This is remedied by connecting the solenoid to the secondary of a small transformer, the primary being connected across the lamp. The advantage of using the transformer is that the secondary pressure can be selected as required, and the solenoid winding need not be calculated in regard to the lamp pressure, but can be identical for various types of alternating current arc lamps. Two figures.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Motors, Dynamos, &c.: FRIED. KRUPP AKT.-GES. [Separately excited direct current generators] 7,045/11; IMRAY [Static frequency converter] 11,526/11.

Miscellaneous: REGAL [Electric Jacquard apparatus] 10,363/11; SCHNIEWINDT (*firm of*) [Resistances] 11,326/11.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: GIRDLESTONE and THORKELIN, 5,806/11; KÖRTING and MATHIESEN AKT.-GES. [Alternating current] 6,783/11.

Dynamos, Motors, and Transformers: HEATHER [Induction motor control] 9,957/10; SHELTON [Electric steam generators] 22,293/10.

Electric Ignition: BATT, 21,236/10.

Electrometallurgy and Electrochemistry: JOHNSON (*Deutsche Gold & Silber Scheide Anstalt vorm*) [Electrolytic manufacture of glycollic acid] 26,546/10.

Heating and Cooking: SCHATZL [Electric furnaces] 3,533/11.

Incandescent Lamps: A.E.G. UNION ELEK.-GES. [Manufacture of tungsten filaments] 19,095/10; RUTTER [Portable battery lamps] 25,991/10.

Instruments and Meters: BESANCON [Electric hour-meter] 28,884/10.

Switchgear, Fuses, and Fittings: TAYLOR [Switches] 7,141/10; FIELD and FERRANTI [Motor starters] 12,300/10; RAILING and GARRARD [Electric cut-outs] 15,988/10; INGLEDON and INGLEDON [Connections for conduit fittings] 17,426/10; KRIZIK [Electromagnetic alternating current apparatus for adjustable purposes] 19,557/10; POOLE [Control of pressure and current regulators] 23,314/10; ALLGEMEINE ELEKTRICITÄTS-GES. [Voltage regulators] 7,668/11.

Telephony and Telegraphy: BROWN [Telegraphy] 12,664/10; CONNER [Telephone receivers] 19,517/10; BELLINI and TOSI [Antennæ for wireless work] 2,632/11.

Traction: LUDW. HEISSE (*firm of*) 12,843/10.

Miscellaneous: HENRI, HELBRONNER and VON RECKLINGTON [Sterilising apparatus] 12,948/10; PARSONS & BALL [Electromagnets and armatures] 13,525/10; MCKENZIE & HOLLAND, LTD., and PEARCE [Signal apparatus] 15,831/10; ENGEL [Lighting plants] 17,277/10; ANCHOR CABLE CO. and WOOD [Apparatus for winding bobbins] 18,034/10; BEACH [Anodes for electrolytic purposes] 20,180/10; VOIGTLAENDER [Electric fire alarm] 21,069/10; MASLIN and DE CHAVANNES [Automatic signal devices] 25,516/10; HARTMANN and BRAUN AKT.-GES. [Mounting electrodes of metal vapour apparatus] 26,747/10; MOWBRAY [Thermal electric fire alarms] 1,848/11; SIEMENS & HALSKE AKT.-GES. [Train recorder] 6,823/11.

Opposition to Grant of Patent

28,552/10. **Discharge of Electricity from Materials.** J. L. PAILLET and E. ROGER. Opposition has been entered to the grant of this patent. The specification describes the employment of tuning devices, which neutralise the high frequency currents, in combination with "Oudin's Resonator" connected with well-insulated radiating conductors to eliminate the electricity which is developed in textile and other materials during their manufacture.

Application for Amendment

25,129/09. **Block Signalling Systems.** HANS THEODORE HANSEN desires to amend this specification in order to make the claims more explicit. It deals with a method of utilising Hertzian waves, which control an apparatus on the train to put the signal at danger, and means for locking the signal in this position should a train enter the block immediately in the rear of the occupied block. The proposed amendments are detailed in the Official Journal of the Patent Office of June 8th, 1911.

Expiring and Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: F. M. LEWIS 4,557/03.

Distribution Systems, &c.: L. FIEDLER [Electric distribution] 4,704/06.

Dynamos, &c.: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., New York*) [Motors] 4,771/04; J. BURKE [Motors] 4,040/05.

Instruments, &c.: EVERSHED & VIGNOLES and S. EVERSHED [Motor meters] 3,534/00.

Switchgear, &c.: H. W. W. DIX and J. SANDFORD [Switches and cut-outs] 4,275/03; H. HOLMES & Co. and G. J. RALPH [Switches] 4,773/06.

Traction: J. P. O'DONNELL and E. C. IRVING [Electrical control of signals] 5,032/02.

Miscellaneous: W. O. DUNTLEY [Electric drills] 4,041/05; S. O. COWPER COLES [Printing surfaces] 4,684/06.

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STREET LIGHTING IN THE BOROUGH OF HOLBORN

THE Holborn Borough Council, sitting as a special committee, have reported with regard to the proposals for street lighting concerning which there has already been considerable controversy (see ELECTRICAL ENGINEERING, February 16th, p. 81; March 2nd, p. 110; March 16th, p. 141, and April 27th, p. 227). At the meeting of the Council as a committee, thirty members were present, including the Mayor, and the report was down for consideration at the meeting of the Council last night—which will take place after we have gone to press.

It will be remembered that in January, 1911, both the Gas Light & Coke Co. and the electric lighting companies submitted tenders for a re-organisation of the street lighting in Holborn. The total approximate candle-power in both cases was to be 405,000. The electric lighting companies tendered at the same time at £6,602 per annum, and the gas company at £7,527.

In spite of the higher price, the tender of the Gas Light & Coke Co. was recommended for acceptance by the Works Committee, but the Council refused to adopt this recommendation, and referred the matter back. A new specification was thereupon prepared by the Borough Surveyor, but, when its terms were considered by the gas and electric light companies, the two parties conferred, and came to the conclusion that the position was such that they could no longer continue the competition. They consequently sent in a joint tender for the lighting of the borough approximately half by electricity and half by gas, at a total price of £6,950, subject to certain objections to two clauses in the specification. The candle-power under this tender was to be 424,140, and there would be 20 1,800 c.p. lamps, 13 600 c.p. lamps, 212 400 c.p. lamps, 1 300 c.p. lamp, 4 180 c.p. lamps, and 71 690 c.p. lamps. The contract price also included the installation and maintenance of lamps and fittings, and the supply of electricity and gas. The tender is for 10 years, subject to the Council paying the sum of £4,400 if the contract is terminated at the end of five years, and smaller sums at longer periods up to 10 years.

The clauses objected to are Nos. 28 and 35. Clause 28 reads as follows:—

> The candle-power set against each lamp in the Schedule shall be the minimum power as directly measured by the Council's photometrical apparatus placed at ground-level, and in the event of same falling more than 10 per cent. below such minimum, the contractors shall be liable to a penalty not exceeding £5 for every occasion on which it is shown that the lamps are below the minimum candle-power, an average of 30 lamps taken on three successive nights to be taken as the basis of calculating the candle-power for this purpose.

The companies suggested, instead of this, a clause by which the normal reduction in candle-power should not be less than 20 per cent., two tests being taken at angles of 20 degrees and 50 degrees, and at three feet above the ground-level, the candle-power to be the average of two readings taken in any position. The apparatus to be used for testing was to be agreed between the parties, and if the candle-power was not brought up to the standard within 48 hours of the companies being notified, the Council should have the right to rectify the defect, and to charge the cost to the companies.

The Committee, in their report, regard this clause as quite unacceptable. However, as the companies offer to accept the Council's Clause 28, subject to an increase in the price of the contract by 10 per cent., the Committee recommend that the clause be retained and the additional 10 per cent. paid.

The other clause objected to, No. 35, provided that the contractors should adopt, without additional cost to the Council, any subsequent improvements in burners, lamps, or appliances that may be made. This clause the companies refuse absolutely, and the Committee now consider that it is too onerous, and that it can be well deleted without prejudice to the Council's interests.

They have therefore come to the conclusion that there is no alternative but to accept the offer of the companies for the combined scheme of electricity and gas lighting at £6,950, plus an additional 10 per cent. in respect of Clause 28, bringing the total price to £7,645.

Automatic Telephones.—Mr. A. W. Martin and Mr. T. F. Purves, of the engineering staff of the General Post Office, and Mr. J. S. Jones and Mr. J. Lee, also of the telephone and telegraph department of the Post Office, have issued a report upon their visit to the United States, which was undertaken for the purpose of investigating automatic telephones. On the whole, the report is in favour of automatic telephones, but no public exchange will be erected until experience has been obtained with an experimental exchange of this character in the G.P.O. It is also possible that, later on, experimental automatic exchanges will be erected in the provinces.

Electrical Lighting at the Fort Pavilion, Margate.—Messrs. Siemens Brothers Dynamo Works, Ltd., send us some particulars of the electrical installation at the Fort Pavilion, Margate, for which they have obtained the contract. The main concert hall will be lighted by four cut-glass electroliers, with six 9 in. projecting arms, and provided with ten 50-c.p. lamps each, and four similar electroliers with eight 50-c.p. tantalum lamps. Under the balconies there will be 14 holophane bowl fittings, each having three projecting arms; in the central bowl there will be a 200-c.p. Onewatt lamp, and 50-c.p. tantalum lamps in holophane reflectors will be placed on each of the projecting arms. Under and over the gallery there will also be four holophane bowl fittings similar to the above, but without projecting arms, containing 200-c.p. Onewatt lamps. On the stage ceiling there will also be ten holophane bowl 200-c.p. fittings. Holophane fittings are also being supplied for the Colonnade and entrance halls; ornamental brackets with etched shades will be used for the front of the gallery. In the outside entrance hall, torch fittings and flambeaux will be used, whilst for subways and outside steps cast-iron watertight fittings will be used. For external lighting there will also be 40 cast-iron standards, approximately 8 ft. high, for 100-c.p. Onewatt lamps. The footlights will be 30 ft. long, being constructed with sheet-iron reflectors, enamelled white inside and black outside. There will also be a quantity of holophane shades and accessories for use in pendants, &c. We understand that the value of the fittings will be £400, and the total cost will be £729 15s. The contracting work is placed in the hands of Messrs. Kingston & Co., of Northdown Road, Margate.

Electrical Contractors' Dinner.—The annual dinner of the Electrical Contractors' Association will be held at Frascati's Restaurant on July 3rd, under the chairmanship of Mr. G. Harland Bowden, President of the Association.

Electric v. Gas Cooking.—The Berry Construction Co. have called our attention to a letter which they have received from one of their clients after six weeks' use of "Tricity" cooking appliances. Not only is the increased convenience and cleanliness of electric cooking over gas emphasised, but it is stated that electrically-cooked joints are more tender and much less shrivelled up than when cooked by gas or coal. Some figures show the reduction of the loss of weight of the joints during cooking when cooked electrically very clearly. Thus the average loss of weight for four joints cooked, one by gas and three by coal, worked out at 29·1 per cent.; only 14·5 per cent. was loss on an average of five joints cooked electrically. The saving from the point of view of the butcher's bill is obvious.

The Stalybridge Tramcar Accident.—Colonel von Donop held a Board of Trade inquiry last week into the serious accident upon the Stalybridge tramway system on Whit Monday, when 30 passengers were injured through a car getting beyond control on a hill and finally overturning. The driver of the car, John Napper, who came from the Potteries tramway system with a good record, said he brought the car to a stop at the top of the hill where the accident occurred by means of the hand brake, and put on power to start the car again, at the same time releasing the hand brake. He says he did not apply the hand brake again, but that when he applied the Westinghouse magnetic brake it failed to act. Consequently, he could not pull up at the second stopping place on the hill, and concluding that the magnetic brake was out of order he shut it off and applied the hand brake. The cause of the car leaving the rails at the curve was, he said, due to the fact that all the passengers had crowded on to one side of the top deck. In another part of his evidence, however, the driver said that the wheels were skidding, which seems to indicate that the hand brake was used. The subsequent examination of the car showed that the magnetic brake was in good order. The inquiry was concluded, the Inspector intimating, however, that it might have to be reopened.

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LOCAL NOTES

Belfast: *Proposed New Power House.*—The City Electrical Engineer has presented a report in which he recommends the erection of a new power station with a view to providing for future requirements and the possible considerable extension of power supply in the city in the near future. He points out the disadvantages experienced in the present power house, and recommends the purchase of a site where there will be facilities for sea-going vessels to come alongside the works, and ability to secure an abundant supply of circulating water at all states of the tide. An extra high-tension system with sub-stations is suggested, and the cost of the first instalment of 4,000 h.p. is put at £89,208, exclusive of land and buildings.

Bournemouth: *Overhead Tramways.*—Mr. C. W. Hill, tramway manager, reports a considerable saving in current consumption on the tramways recently changed over from conduit to overhead working. This amounts to no less than 500 units per day, and confirms Mr. Hill's view of the enormous waste of energy which the conduit system occasioned.

Bury: *Electricity Accounts.*—The accounts of the electricity department for last year show a net profit of £1,656 after meeting all capital charges. Mr. S. J. Watson, the Borough Electrical Engineer, in his report points out that had the undertaking belonged to a private company having half its capital issued as stock and half as ordinary shares, the gross profits would have enabled a dividend of 4½ per cent. to be paid on the stock and 7 per cent. on the ordinary shares, leaving £2,606 to be carried to reserve fund. The Electricity Committee congratulate the Tramways Committee upon the large saving which has been made in the consumption by the use of tramcar meters, although, of course, this result is bad for the electricity department. The reduction in the amount of energy taken by the tramways amounted to £1,406.

Crewe: *Electric Lighting Accounts.*—The accounts of the Council's electric lighting department for last year show a net profit of £1,268 after meeting capital charges.

Eastbourne: *Electricity Accounts.*—The net profit upon the electricity undertaking last year was £2,329, of which £1,500 have been added to reserve, £632 to renewals fund, and £197 to capital account.

India: *Simla Water Power Scheme.*—According to the *Pioneer Mail*, the tenders which have been received from firms in India for the machinery required for the Simla hydro-electric scheme are now to be sent to the India Office, under orders from the Secretary of State, though such an arrangement was not contemplated in the first instance. Tenders from firms in England will then be invited, and all will be considered before the final orders are issued. This will probably cause a delay of four or five months in the completion of the scheme next year. It was originally intended that any contract entered into should be fulfilled by April 1st, 1912.

Keighley: *Tramway Accounts.*—The net surplus from the tramway undertaking for the past year was £1,205, an increase of £458 over the previous year. The Tramway Manager reports that the undertaking seems now to have got over all its early difficulties, and he expresses the opinion that continued development and improvement may now be looked for.

Electricity Accounts.—The accounts of the electricity undertaking for the past year show a loss of £527.

Lincoln: *Electricity and Tramways Accounts.*—There was a net profit of £3,323 upon the electricity undertaking last year, which is an increase of £820, and a loss of £153 upon the working of the surface contact tramways. This deficiency has been provided for out of the profit of the electricity undertaking.

London: *Bermondsey.*—The proposal of the Electricity Committee to spend £18,563 upon additional plant at the electricity works is meeting with considerable obstruction in the Council. At the last Council, the report of the Electricity Committee was referred back to the Finance Committee for the latter to submit an estimate of the Council's requirements. Several Councillors hold the view that a supply should be taken from one of the two supply companies in the district.

Marylebone: An Electrical Vehicle.—At the last meeting of the Council, a recommendation by the Electricity Committee that an electrically driven van be purchased from the Electrical Power Storage Co., Ltd., at £260, was opposed by Mr. Duncan Watson, who objected on the ground of heavy maintenance. He put the depreciation at 20 per cent. viz., £52 per annum; tyres £55; insurance, including third party risk, £15 15s.; electric current £5; battery renewals £25; driver £78; assistant £52; making a grand total of over £292. After some discussion Mr. Watson's amendment to refer the matter back to the Committee was carried.

Manchester: *New Tramway Scheme.*—Mr. J. Newton and Mr. L. Moorsom, consulting engineers, of Manchester, are said to be preparing a scheme for the construction of a tramway from Ashton-under-Lyne to Bury under the title of the Manchester Northern Tramroad. The main line will be eleven miles in length, with a four mile branch to Heywood, and a local branch to Bury. The capital proposed is £300,000.

Electricity Accounts.—The annual report and the accounts of the Corporation electricity department were presented at the meeting of the City Council yesterday. The net surplus for the year was £27,573, of which £15,000 have been transferred to relief of rates. The large Tudor storage battery (ELECTRICAL ENGINEERING, April 21st, 1910, Vol. VI., p. 261) has resulted in a very substantial reduction of the station costs at Dickinson Street and Bloom Street. A contract has been entered into with Messrs. James Howden & Co., Ltd., for a further turbo-alternator. The efficiency of the distribution system is given at 79·85 per cent., the quantity of energy lost being an increase of 2·05 per cent. on the previous year.

Middlesbrough: *Electricity Accounts.*—The net profit of the electricity undertaking last year was £2,079, against £1,296 in the previous year.

Newcastle: *Tramway Accounts.*—There was a profit of £23,703 on the tramways for 1910-11, the whole of which is proposed to be carried to reserve, bringing this fund to £98,959.

Nottingham: *Electricity Accounts.*—The electricity accounts for last year, after meeting capital charges, enabled the sum of £15,350 to be transferred to relief of rates.

Tramway Accounts.—The sum of £15,000 has been transferred to relief of rates from the tramway accounts after meeting capital charges, and placing £3,817 to reserve and renewals. The number of passengers carried increased by 611,829.

Scarborough: *Trolley Omnibuses.*—It is stated that a company is negotiating with the Scarborough Tramways Co., for the purchase of the tramways and their substitution by a system of trolley omnibuses.

Stevenage: *Provisional Order Revoked.*—The Board of Trade have revoked the Stevenage Electric Lighting Order which was granted in 1902.

Swansea: *Electricity Accounts.*—The accounts of the electricity undertaking for 1910-11 show a net profit of £2,802, which is an increase of £80 over the previous year. Owing to the increased assessment of the undertaking, rates absorbed £1,638, against £799 in the previous year.

Tramways.—A special Committee of the Corporation recommend that negotiations be entered into with the tramways company, in order to fix 30 years as the period at the end of which the Corporation may acquire the whole of the Company's undertaking.

Wood Green: *Electricity Supply.*—The result of the post card poll of the inhabitants with regard to the supply of electricity has been very unsatisfactory, as of the cards sent out, 867 were not returned, 337 were against the scheme and only 110 were in favour. The question of handing over the Provisional Order to the North Metropolitan Electric Power Supply Co., or taking a supply from the Hornsey Council, is now under consideration.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia.—The Ararat Borough Council propose to engage a consulting engineer to report upon the question of electricity supply.

Canada.—The *Board of Trade Journal* mentions that a Quebec Power Company will shortly be inviting tenders for 10,000 h.p. dynamo and turbine. The address may be obtained from 73 Basinghall Street, E.C.

Crewe.—A loan is to be taken up for mains extensions.

Dudley.—An expenditure of £6,500 is proposed upon electrical extensions.

Limerick.—The Electricity Committee recommend a loan of £7,000 for extensions at the electricity works.

Stoke-on-Trent.—A Local Government Board inquiry was held yesterday into the scheme for unifying the electric supply of the several towns comprised in the new county borough of Stoke. The estimated cost of the scheme is £60,000.

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Wharfedale.—A company is in course of formation for the supply of electricity in Wharfedale and the surrounding districts of Otley, Ilkley, Guisely, Yeadon, &c. Messrs. Newstead & Wade, solicitors, of Otley, are acting in the matter.

WIRING

Beckenham.—The Electricity Committee invite tenders for the electric wiring of houses in their district. Particulars from the Borough Electrical Engineer.

Belfast.—New art gallery in Botanic Gardens.

Buxton.—New Cottage Hospital.

Cheltenham.—A scheme for the erection of new municipal offices is under discussion.

Chichester.—The Council chamber is to be wired for electric lighting.

Colchester.—New wing to Infirmary. Architects, Messrs. Goodey & Cressall, St. Peter's Chambers, High Street.

Dover.—Additional Barracks. Director of Barracks Construction, 80 Pall Mall, S.W.

Eastbourne.—Proposed sanatorium for consumptives.

Edinburgh.—New school at Bellevue Park.

Gateshead.—New Lunatic Asylum. Architects, Messrs. G. T. Hine and H. Carter Pegg, 35 Parliament Street, Westminster.

Mansfield.—New wing at hospital.

Pudsey.—New Masonic Hall, Church Lane. Architects, Messrs. J. Kendal & Sons.

Rochdale.—Nurses' home at the Workhouse. Architect, Mr. H. H. Clough, Butts Avenue, Rochdale.

Rotherham.—Smallpox Hospital. Borough Engineer.

Stockport.—Extensions to hospital in Dialstone Lane. Architect, Mr. J. Jepson, 35 Great Underbank.

Tettenhall.—The Tettenhall church is to be wired for electric lighting.

Walthamstow.—Proposed new Town Hall.

MISCELLANEOUS

Aberdeen.—Four new tramcar bodies and electrical equipments are required.

Australia.—The Deputy Postmaster-General, Brisbane, invites tenders by July 19th for 2,150 telephones. Specifications, etc., can be obtained at 72 Victoria Street, S.W. or 73 Basinghall Street, E.C.

Birmingham.—The electricity department requires a supply of electrical accessories for the year ending July 31st, 1912. Tenders to the City Electrical Engineer by June 26th.

London: *Battersea.*—The further conversion of street gas lamps to electric lighting is recommended at an estimated cost of £1,368. The number of posts to be dealt with is 432.

TENDERS RECEIVED AND ACCEPTED

Aberdeen.—The tender of the Tudor Accumulator Co., Ltd., has been accepted for the electrical welding of tram rail joints at £2 14s. per joint.

Bath.—The tender of the Diesel Engine Co., Ltd., for a Diesel oil engine coupled to a Dick, Kerr 450 kw. generator, at £5,451, is recommended for acceptance. The tender of Messrs. Dick, Kerr & Co. for a 300 k.v.a. motor-alternator at £1,140 is recommended for acceptance.

South Shields.—The Electricity Committee recommend the acceptance of the tender of the British Westinghouse Co. for new generating plant at £7,792.

Wrexham.—A Local Government Board inquiry was held last week into an application for a loan of £4,145 for extensions to the electricity works. The local gas and water companies opposed the loan.

York.—The tender of the Tudor Accumulator Co., Ltd., at £1,625, has been accepted for replating the battery at the electricity works, and the supply of an automatic reversible booster, switchboard, cables, &c.

Among important orders received by the British Westinghouse Co., we note the following: Underground Electric Railway, one 1,200-kw. rotary, transformers, and switchgear; Metropolitan Railway, one 1,000-kw. rotary converter; Borough of Poplar, three 250-kw. rotary converters and switchgear; Cardiff Corporation, one 700-kw. rotary converter and transformers; Stoke-on-Trent, three 600-kw. and two 300-kw. rotary converters; Glasgow I. & S. Co., one 40-kw. rotary converter, one 47 k.v.a. transformer and control gear; C. W. Fairweather, two 250 h.p. A.C. motors, one 37 h.p., one 35 h.p. sq. cage motors, two starters, and two 625 k.v.a. transformers; Cleveland and Durham, two 600 k.v.a. transformers; Prestwich County Asylum, one booster set and one balancer set; Reunert & Lens, one 400-kw. alternator; Kuishin Tanko Kisen K. Haisha (Takata & Co.), two 500-kw. three-phase, 50 per cent. 3,500 v. 3,600 r.p.m. turbo-alternator set, two surface condenser air pumps, motors, transformers, etc.; Greenock Corporation Trams, sub-station switchgear; Earl's Court Exhibition, 4,500 illumination holders; Oldham Corporation, twelve sets magnetic brakes with skid-proof attachments; Aberdeen Corporation, sub-station switchgear.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic copper bars net c.i.f. port of arrival, quoted on Tuesday night, was £57 10s. to £58 per ton (last week £56 15s. to £57 5s.).

Customs Changes.—A decision recently given, allows a rebate of 3 per cent. ad val. off the 15 per cent. ad val, duty upon British car fittings for tramways and railways imported into British South Africa. Insulating paper, letheroid and cloth for electrical purposes is now allowed in free.

The Electrical Apparatus Co.—Mr. T. G. Travis, formerly of the British Westinghouse Co., has been appointed as Lancashire and Yorkshire representative of the Electrical Apparatus Co., and will shortly open an office in Manchester.

Coronation Arrangements.—Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston, N.E.) inform us that they have made arrangements to hold their offices and stores at Dalston open during Thursday and Friday, 22nd and 23rd inst., from 9.30 a.m. until the official time of extinction of Coronation illuminations, 12.30 a.m., and are holding stocks of lamps and accessories used in connection with Coronation illuminations, holding themselves ready as far as possible to deliver goods or render assistance if necessary in answer to telegraphic or telephonic requests. A section of the Dalston staff will be in attendance at 39 Upper Thames Street, and, in addition, a staff of engineers will make periodical visits over the illuminations for which Messrs. Siemens are responsible.

Dissolutions of Partnerships.—T. P. Shillcock and J. H. Payne, electrical engineers, 10 Gothic Arcade, Snow Hill, Birmingham, have dissolved partnership. J. H. Payne continues.

Bankruptcies.—The trustee in the bankruptcy of A. E. Felgate and W. Storey, trading as Felgate & Storey, Electrical Engineers, 10 Queen Victoria Street, Reading, has been released.

The trustee in the bankruptcy of C. Rix, trading as Budgwater & Wright, Electrical Engineers, 78 York Road, London, W., has been released.

Liquidations.—Improved Electric Traction, Ltd., is to be wound up voluntarily. Mr. H. M. Gowar, Birkbeck Bank Chambers, High Holborn, is liquidator. A meeting of creditors will be held to-day at the above address.

Creditors of Arc Lamps, Ltd. are requested to send in their claims to H. B. Clark and G. E. Corfield, the liquidators, Crown Buildings, Crown Court, E.C. by July 7th.

The Engineers' Standardised Publications Association, Ltd., is to be wound up voluntarily. Mr. J. D. B. Innes, of Craven House, Kingsway, and J. C. Butler, 23 Powis Square, W., are liquidators.

The last day for receiving proofs of claims in the reconstruction of the Uxbridge & District Electric Supply Co. is June 20th. The liquidator is the Senior Official Receiver, 33 Carey Street, W.C.

Change of Address.—Messrs. Vickers, Ltd., announce that their address and registered offices are now Vickers House, Broadway, Westminster, London, S.W., and their telephone number 10110 Gerrard (8 lines). Their telegraphic address will continue to be "Vickers, London."

Canadian Agencies.—A Lancashire firm manufacturing electric light fittings, radiators, and electrical accessories wishes to extend its business in Canada.

A Lancashire firm manufacturing lifts and hoists desires to appoint first-class agents in Canada.

Further information can be obtained from 73 Basinghall Street, E.C., in the first case, and 17 Victoria Street, London, S.W., with regard to the second inquiry.



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APPOINTMENTS AND PERSONAL NOTES

Mr. E. Kilburn Scott has been appointed Lecturer in Electrical Design at University College for the session 1911–12, in succession to Mr. H. M. Hobart, resigned.

An East Coast of Scotland Electric Supply Company has a vacancy for a switchboard attendant. (See an advertisement on another page.)

The salary of Mr. G. Tough, Engineer and Manager of the Coventry Electricity Department, has been increased from £450 to £550 per annum. In making the recommendation, the Chairman of the Electricity Committee pointed out that the gross profits upon the Coventry undertaking were the largest of any municipal electricity undertaking, and the prices to consumers were the lowest. At the same time the salary they paid their engineer was also one of the lowest, and the increase had been recommended by the Committee without any application from Mr. Tough.

Mr. Patrick, Charge Engineer at the York Electricity Works, has resigned, and a successor is required at a salary of £91, rising to £110 per annum.

Mr. E. J. Jarvis, of Torquay, has been appointed Junior Assistant Electrical Engineer at Devonport.

The Motherwell Lighting Committee have appointed Mr. J. A. Wishart, at present Mains Engineer, to be Electrical Engineer in succession to Mr. Williams, resigned. The commencing salary is £250 per annum.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Peel-Conner Telephone Works.—The first annual meeting was held on Monday, when the report and accounts given in our last issue were adopted. Mr. Hugo Hirst, chairman, who presided, gave a short history of the company, pointing out that its formation was impossible under the old system, by which the National Telephone Company purchased their plant principally abroad. On the Post Office taking over the management, however, every encouragement was given to those connected with the production of common battery telephone exchanges in this country. The company's plant had found great favour with purchasers in consequence of the great success of the Glasgow exchange, and as a result they had a considerable number of repeat orders from the Post Office and also many orders from abroad. In view of the fact that the company had to thank the broad-minded and patriotic policy of the Post Office for calling the company into existence, Mr. Hirst thought it his duty to express himself upon the attacks that have lately been made regarding the future management of the telephone system by the Post Office, and gave reasons for holding the opinion that the telephone system should be in the hands of the Post Office. As regards the allegations that the Government could not work the system so efficiently as a company, he pointed to the fact that the whole of the National Telephone Company's staff would be taken over by the Government; therefore, there was no reason, even if the Post Office engineers were incapable, which it was obviously absurd to suggest, that the system could not be managed just as efficiently in the future as in the past. Finally, Mr. Hirst threw out the suggestion that the Post Office should bring telephone mains in close proximity to all houses in the same manner that electricity mains are brought to premises, leaving it to local contractors to make the necessary connections. This, he thought, would lead to a great development. There was no discussion on the accounts, and the proceedings terminated with the usual vote of thanks.

Potteries Electric Traction Co.—The accounts for 1911 show a net profit of £27,384, against £27,290 for the previous year. A 2 per cent. dividend is recommended on the ordinary shares, placing £2,302 to depreciation and £7,525 to renewals, carrying forward £406.

Lisbon Electric Tramways Co.—The accounts for 1910 show considerable increases in passengers carried and receipts, notwithstanding the revolution in Lisbon in October, when the company's operations were entirely suspended for three days. The company is still at issue with the municipality with regard to certain contracts, and in consequence of the unreasonable demands which the company think the Corporation are making, the matter is to go to the Law Courts.

Companies Struck off Register.—The name of the South Western Electrical Co., Ltd., will be struck off the register of joint stock companies within three months unless cause is shown to the contrary.

Karlgoorlie Electric Power & Light Co.—The accounts for 1910 state that although the plant was only lightly loaded for the first eight months of the year, owing to the fire at the Boulder Mines, the profits show an increase over those of the previous year, and a further sum of £4,000 has been added to reserve for depreciation and renewals. The tramways company have exercised their option of continuing to take current at the existing price for a further period of five years.

Callender's Cable Construction Co.—The annual meeting was held on Thursday, and Mr. T. O. Callender, the managing director, said that the anticipations that they formed some years ago were at last being fulfilled. Never had the electrical supply industry been in a healthier position than at present. With regard to foreign trade, he mentioned an instance in which a very large order for cables had been expected, but that, owing to pressure brought by the German Ambassador upon the supply company in question, the order had been placed in Germany. This position was becoming a very serious one, and he and other friends engaged in the supply of electrical machinery of various sorts had discussed the necessity of forming some kind of bank or financial association to help them to fight these very heavy influences. One of these days—it might be this year or next—they would come to the shareholders and ask them to assist the directors to form such an institution.

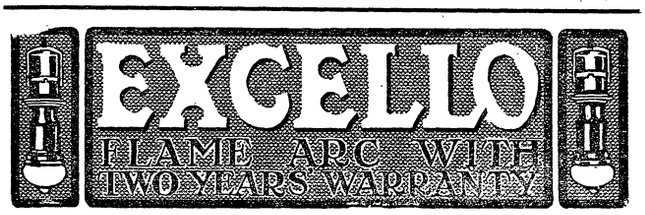
Brush Electric Engineering Co.—At the annual meeting on Wednesday last week, Mr. E. Garcke referred to the unfortunate position of the company, and incidentally pointed out that under the new Insurance Bill of the Government their expenses would be increased by over £2,000 per annum, which was a very heavy item for a business which was not clearing its charges. The only consolation they seemed to have was that the cumulative effect of these successive burdens must be to hasten the coming change in the attitude of public opinion in respect to our home industries. During the last few months there had been a decided revival of business in the electrical engineering industry, and the company had entered the current year with a much larger volume of orders than in the previous year. This circumstance, coupled with the fact that the new orders secured this year were a much larger volume of orders than in the previous year. This circumstance, coupled with the fact that the new orders secured this year were at prices above the average, justified the hope that they would turn the corner this year. With regard to the position of the company, he suggested that the best thing to do was to reduce the capital at once rather than to let the debits stand in the hope of gradually wiping them off out of profits on future orders, but, in reply to a suggestion by a shareholder, he said he did not think there was any necessity to form a committee of shareholders, although the directors would welcome the advice or assistance of individual shareholders.

Aron Electricity Meter.—The accounts for the year to March 31st, 1911, show a net profit of £27,521, and a 6 per cent. dividend is recommended on the ordinary shares, transferring £5,000 to reserve, £7,000 to expenses of debenture issued, and carrying £5881 forward. This is the first ordinary dividend since 1900.

Northern Electricity Supply Co.—There was a loss of £2,777 for 1910, which makes a total debit balance of £5,756.

Underground Electric Railways Co. of London.—A circular has been issued to the shareholders, summarising the principal points of the Act of Parliament under which the Lots Road power-house is to be leased to the London Electric Railways Co. and the Metropolitan and District Railways Co. for 999 years. It is proposed that the lease shall take effect on July 1st, and that the price is to be £2,200,000 of power-house rent charge stock at par. A Joint Committee is to be formed, with an equal number of representatives of the two railway companies to take over the management of the power-house.

British Electric Traction Co.—The report for the year to March 31st shows that the traffic receipts from the associated companies have improved to a marked extent. For the most part, however, these increased profits have been added to the reserve and renewal funds, or have been otherwise applied in strengthening the position of the companies. Consequently, the profit of the British Electric Traction Co. has not increased by so large an amount as would otherwise have been the case. After meeting the debenture interest for the year, there is a balance of £60,047, and a dividend of 3s. per share is recommended on the preference shares, transferring £25,000 to reserve and carrying forward £10,832. Last year the amount carried to reserve was only £15,000. The report points out that opportunities for promoting new electrical undertakings in this country with a prospect of reasonable profit under present conditions continue to be restricted, but the directors hope that some foreign enterprises which have engaged their attention will mature during the current year. Sir Charles Rivers Wilson proposes to resign the chairmanship, and Mr. E. Garcke has been appointed to succeed him. The report also makes mention of the fact that the directors will place proposals before the shareholders at an early date for a reorganisation of capital.



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ELECTRICAL ENGINEERING

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AUCTIONEERS

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46, WATLING STREET, LONDON, E.C.

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The Engineering Journal of the Electrical Industry

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CORONATION HOLIDAYS.

In consequence of the Coronation Holidays our offices will be closed from Thursday, June 22nd, to Saturday, June 24th, inclusive.

Advertisement copy for our issue of June 29th should be sent us AT ONCE.

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I.M.E.A. CONVENTION AT BRIGHTON.

(*June 27th—30th.*)

Copies of "Electrical Engineering" may be obtained at Messrs. W. H. Smith & Son's Railway bookstalls at Victoria, London Bridge, East Croydon, and Brighton; at the Grand, Metropole, York, and Albion Hotels, Brighton; and also at Messrs. John Beal & Sons, 55 East Street, Brighton.

SUMMARY

The 16th Annual Convention of the Incorporated Municipal Electrical Association will be held at Brighton and Portsmouth next week under the presidency of Mr. John Christie, Borough Electrical Engineer, Brighton. In accordance with our usual custom, we are publishing portraits and short biographies of the President and those members who are down to read papers and to open discussions. We are also publishing a brief description of the Brighton Electricity Works which will be visited on the Tuesday, and a detailed article on the new 3,000-kw. alternator there, the steam consumption tests of which show a consumption of only 13lbs. per kw.-hour. A description follows of the locomotive shops of the London, Brighton & South Coast Railway, which will be visited on the Thursday. These are electrically driven, and take about 1½ million units a year from the Corporation. A list of members and visitors who, up to the time of our going to press, have intimated their intention of being present at the Convention, is also published. (Pages 341 to 347, and 350.)

The Holborn Council, after having themselves, as a Special Committee, recommended the acceptance of the combined tender of lighting the borough partly by electricity and partly by gas, has now been referred the question once more to the Works Committee for a further report. (Page 348.)

Mr. Justice Swinfen Eady gave judgment on Saturday upholding the validity of the Bremer flame arc lamp patent, and deciding that the Electrical Co., Ltd., infringed the Bremer lamp in their "Sunshine" flame arc lamp. (Page 348.)

The annual report of the Electrical Inspector of Factories and Workshops (Mr. G. Scott Ram) has been issued with the report of the Chief Inspector of Factories and Workshops. (Page 348.)

An Appeal Court consisting of the Master of the Rolls and Lords Justices Farwell and Kennedy is hearing the appeal of the Postmaster-General against the judgment of the Railway and Canal Commission upon the preliminary points in relation to the transfer of the National Telephone Co.'s undertaking to the State. (Page 349.)

A letter from Mr. H. L. Webb answers some remarks on the telephone transfer made recently by Mr. Hirst. (Page 349.)

Among the specifications published by the Patent Office on Thursday last was one by S. G. Brown on telegraphy. T. H. Parsons and A. E. J. Ball dealt

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with electromagnets and armatures, and a method of preparing tungsten filaments was described by the A. E. G. Union Elektricitäts Ges. The grant to J. Lysaght, Ltd., and B. Beddoe of a patent relating to zinc condensers, has been allowed, on appeal to the Law Officer of the Crown. An invention by R. Bosch for an electric igniter for gas engines has expired after the full term of fourteen years. (Page 351.)

A PROPOSAL to sell the Worcester electricity undertaking has been rejected.—Considerable opposition was offered last week to the Stoke-on-Trent scheme of extensions.—The Irish High Court has set aside Mr. Lynden Macassey's award with regard to the purchase of the Cavehill and Whitewell tramways.—Mr. Stanley Clegg reports that the yearly cost of repairs of the G.B. surface contact system is £18 per annum above the Company's guarantee.—A number of arc lamps are being changed over to 500 c.p. incandescent lamps at Tunbridge Wells.—There was a loss of £5,938 upon the Stalybridge tramways last year. (Page 352.)

THE Wednesbury Council proposes to spend £2,550 upon new mains and services; the Manchester Corporation £12,186 upon generating plant, and £50,000 on mains; Taunton £2,500; Walsall £17,840; Aldershot £2,500; Redditch £5,850; Newcastle-under-Lyme £5,400; and Stoke-on-Trent £6,750 upon new generating plant; electrical measuring and telephone instruments, dynamo and booster, &c., are required in Australia, and overhead tramway equipment in New Zealand. (Page 352.)

NEGOTIATIONS are said to be proceeding between Marconi's Wireless Telegraph Co., and the British and Colonial Governments for large extensions to wireless telegraphy. At the meeting of the British Electric Traction Co., last week, the appointment of a committee of shareholders was agreed to on a show of hands, but was rejected on a poll. (Page 354.)

THE Electrical Congress at Turin will be held from September 10th to 17th. A complete list of the Papers and subjects for discussion is given. (Page 354.)

ARRANGEMENTS FOR THE WEEK

TUESDAY, JUNE 27TH.

I.M.E.A.

10 a.m. Annual Convention at Royal Pavilion, Brighton; (1) Presidential address, by J. Christie; (2) "Electricity Supply Viewed from the Municipal Committee's Standpoint," by Councillor H. Leese; (3) "Modern Wiring Practice," by J. W. Beauchamp.

2.45 p.m. Visit to Southwick power station and other works.

8 p.m. Reception and conversazione by Mayor and Mayoress, at the Royal Pavilion.

WEDNESDAY, JUNE 28TH.

I.M.E.A.

10.15 a.m. At Municipal College, Portsmouth: (1) "Internal Combustion Engines Working on the Diesel Principle," by H. L. Howard; (2) "Internal Combustion Engines for Power Stations (Gas Engines and Producer Plants)," by R. M. Carr.

2 p.m. Visit to H.M. Dockyard power house, and a ship of the "Dreadnought" class.

"*Dynamicables.*"

7.30 p.m. Dinner at Trocadero.

THURSDAY, JUNE 29TH.

I.M.E.A.

10 a.m. At Royal Pavilion, Brighton:—Discussions: (1) "Purchase of Fuel," to be opened by Mr. C. E. C. Shawfield; (2) "Street and Shop-front Lighting," to be opened by Mr. A. H. Seabrook.

2.45 p.m. Visit to Corporation electricity sub-stations and L.B. and S.C. Rly. locomotive workshops.

7 p.m. Annual Dinner at the Dome.

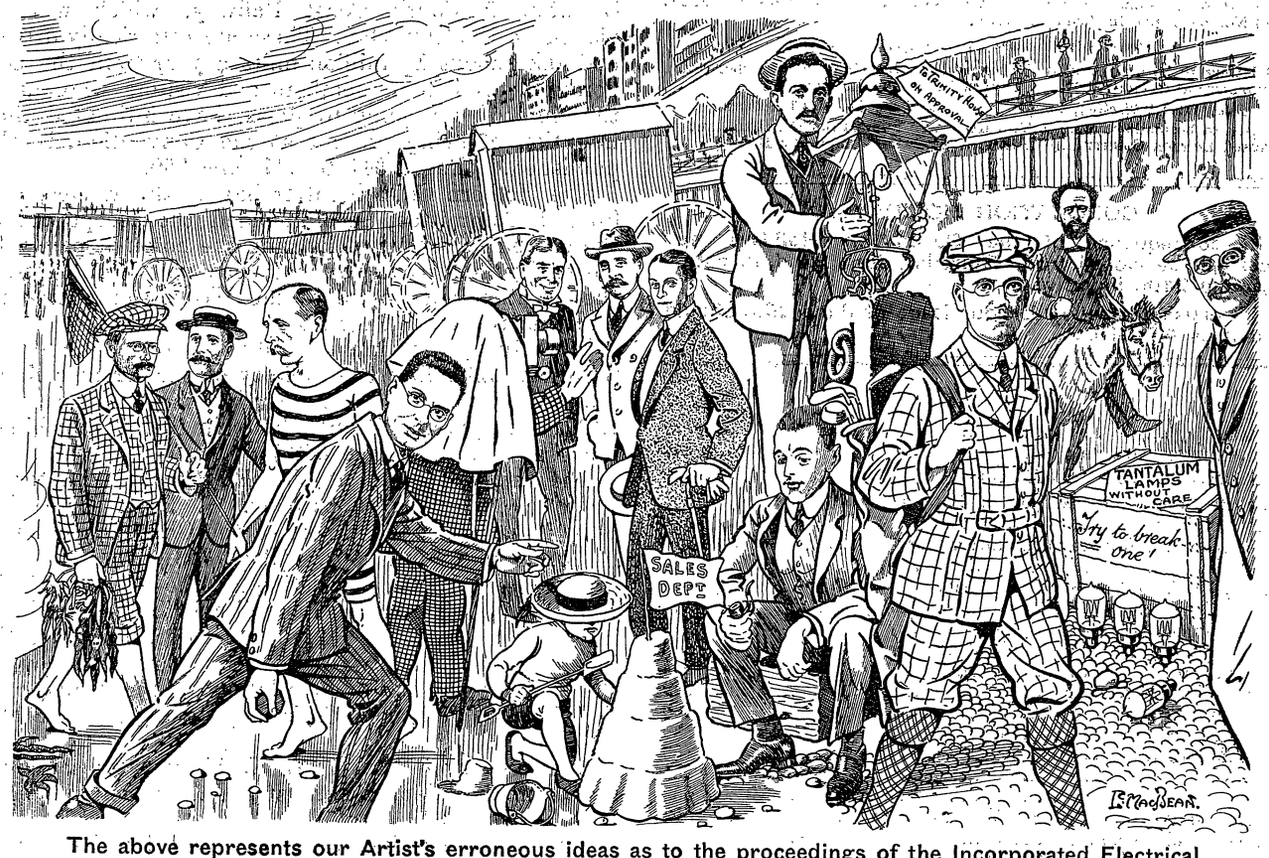
FRIDAY, JUNE 30TH.

I.M.E.A.

10 a.m. Annual General Meeting, at the Royal Pavilion, Brighton.

Physical Society.

5 p.m. At Imperial College of Science, London: (1) "On the Effect of a Narrow Saw-cut on the Edge of a Conducting Strip on the Stream Lines in the Strip, and on the Resistance of the Strip," by Prof. C. H. Lees, F.R.S.; (2) "The Capacity of Co-efficients of Spherical Electrodes," by Dr. A. Russell; (3) "Exhibition of the Benkö Primary Battery," by W. R. Cooper.



The above represents our Artist's erroneous ideas as to the proceedings of the Incorporated Electrical Association meeting at Brighton next week.

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THE I.M.E.A. CONVENTION

THE Incorporated Municipal Electrical Association will hold its Sixteenth Annual Convention in Brighton and Portsmouth from Monday to Friday next week, under the Presidency of Mr. John Christie, Chief Electrical Engineer to the Brighton Corporation.



COUNCILLOR H. LEESE, Chairman Stoke-upon-Trent Electricity Committee, who will read a Paper on "Electricity Supply Viewed from the Municipal Committee's Standpoint."



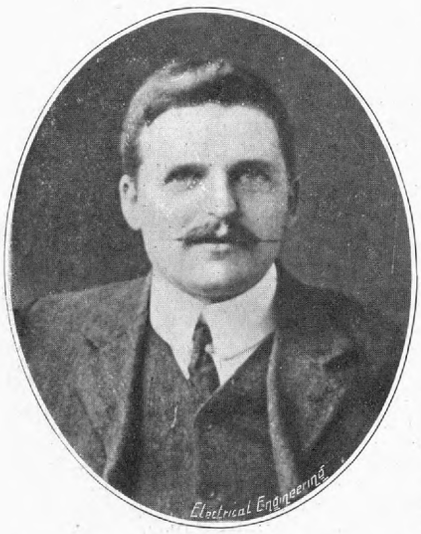
THE PRESIDENT.

MR. JOHN CHRISTIE,
Chief Electrical Engineer, Brighton.

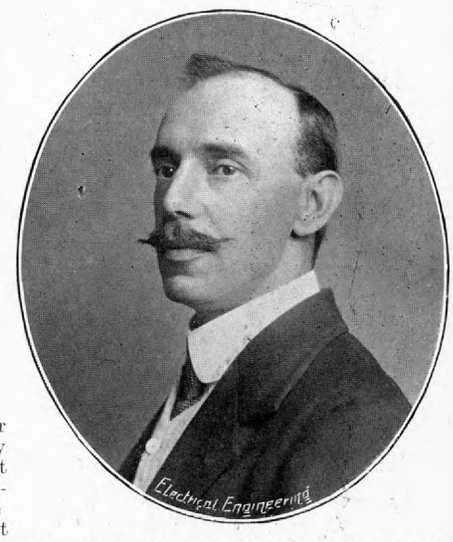
MR. JOHN CHRISTIE, the President, is engineer and manager of the Brighton Corporation Electricity Works. He will be forty-three years of age next month, and is a native of Glasgow. His apprenticeship and early experience was as a marine engineer, and he started his electrical work at Messrs. Crompton's works at Chelmsford. His first municipal job was as second engineer to the St. Pancras Electricity Works, in which situation he was for about a year, and, after a few months in the testing department of Messrs. Siemens Bros. and Co., at Woolwich, he proceeded to Glasgow as second engineer at the Corporation Electricity Works. Early in 1894 he was appointed chief electrical engineer at the Londonderry Corporation Electricity Works, which at that time only supplied public lighting. He remained there for four years, and in 1898 he returned to Glasgow as power-house superintendent, under Mr. W. A. Chamen, who was then city electrical engineer. He remained there 2½ years; but his work was not confined to the charge of the generating station, as he also assisted Mr. Chamen in superintending the installation of the plant at the Port Dundas Power Station, which was under erection during that period. In the summer of 1900 he was appointed engineer and manager to the Brighton Corporation Electricity Works, when Mr. Arthur Wright retired from the position of chief engineer and started his practice as consulting engineer, retaining his association with the Corporation in that capacity. The Brighton electricity undertaking was then a far smaller one than it is now, but in June, 1906, the present new turbine power station at Southwick was opened by Mr. John Burns, and Mr. Christie has been responsible for its running and management. For many years Mr. Christie has taken the keenest interest in the affairs of the Incorporated Municipal Electrical Association, and although, owing to his retiring disposition, he has never been prevailed upon to read a paper and has seldom spoken in discussions, yet his work upon the Council and the committees has been in-



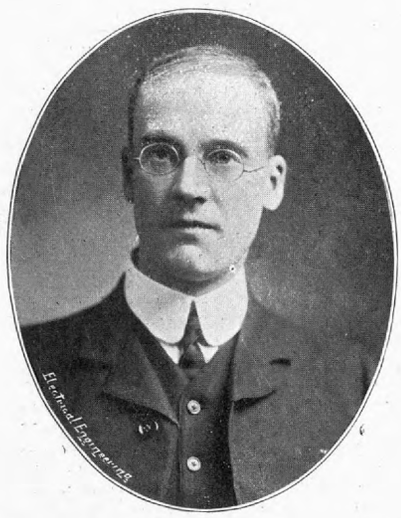
MR. W. J. BEAUCHAMP, Chief Electrical Engineer, Tunbridge Wells, who will read a Paper on "Modern Wiring Practice."



MR. H. L. HOWARD, Chief Electrical Engineer, Barking, who will read a Paper on "Internal Combustion Engines working on the Diesel Principle."



MR. R. M. CARR, Chief Electrical Engineer, Leek, who will read a Paper on "Internal Combustion Engines for Power Stations: Gas Engines and Producer Plants."



MR. C. E. C. SHAWFIELD, Chief Electrical Engineer, Wolverhampton, who will open a discussion on "Purchase of Fuel."



MR. A. H. SEABROOK, Chief Electrical Engineer, Marylebone, who will open a discussion on "Street and Shop Front Lighting."

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valuable, and he is one of the most popular members of the Association.

AUTHORS OF THE PAPERS.

Councillor H. LEESE, Chairman of the Stoke-on-Trent Electricity Committee, who will read his Paper on "Electricity Supply from the Municipal Committee's Standpoint" after the Presidential Address has been delivered on June 27th, was first elected a member of the old Stoke-on-Trent Council in 1903, and served on that body until March, 1910. He was then elected to the newly formed Federated Council. He was a member of the Stoke Electricity Committee for seven years, and in September last year was elected Chairman of the Electricity Committee of the new County Borough. A £60,000 scheme, which will remodel the electric supply of the various towns comprised in the new County Borough of Stoke-on-Trent, is in hand, and the L.G.B. inquiry in connection with the loan was held last week.

Mr. J. W. BEAUCHAMP, Chief Electrical Engineer to the Tunbridge Wells Corporation, will read a Paper on "Modern Wiring Practice." Mr. Beauchamp served his pupilage with a London firm of engineers, and afterwards spent about five years with London contractors. Following this, for two years he managed a manufacturing business in Birmingham, a post which he relinquished to join the staff of the Sheffield Electricity Department. Seven years ago he was appointed chief assistant electrical engineer under Mr. S. E. Fedden, remaining in that position until he was successful in being appointed chief electrical engineer to the Tunbridge Wells Corporation in succession to Mr. Horace Boot, who is now consulting engineer to that body.

Mr. H. L. HOWARD, chief electrical engineer to the Barking Council, will read a paper at Portsmouth, on "Internal Combustion Engines Working on the Diesel Principle." Mr. Howard, who is now thirty-eight years of age, was educated at the City of London School, and received his technical education at King's College. He served his time with Messrs. S. Z. de Ferranti and Co., after which he took a post with the City of London Electric Lighting Co., as assistant in the testing department. Three years later he joined the British Insulated Wire Co., and was three years with them as contract superintendent. He was next station superintendent with the Leicester Corporation for 2½ years, and then chief assistant mains engineer at Manchester for 3½ years, after which he obtained his present appointment as engineer and manager of the Barking Council's electricity works, which he has held for the last five years.

Mr. R. M. CARR, chief electrical engineer, Leek, will follow Mr. Howard, with a paper on "Internal Combustion Engines for Power Stations (Gas Engines and Producer Plants)." He commenced his engineering career with the North-Eastern Marine Engineering Co., at Sunderland and Walsend, afterwards gaining experience in turbine work with Messrs. C. A. Parsons, Newcastle-on-Tyne. He joined the staff of the Post Office Engineering Department in 1896, and remained in the service three years. In 1899 he was appointed chief assistant at Bexhill, and succeeded to a similar appointment at Maidstone two years later. He was appointed by the Leek Urban District Council to act as clerk of works during the erection of the gas engines and electrical plant at Leek, and on the commencement of the supply, in 1904, was retained as chief engineer and manager. Mr. Carr acts as consulting engineer to the council, and on his advice a bituminous producer gas plant was installed in 1908, which has proved a great success.

Mr. C. E. C. SHAWFIELD, Chief Electrical Engineer and Manager to the Wolverhampton Corporation, will open a discussion on June 29th on the "Purchase of Fuel," a subject upon which he has spoken with authority at previous meetings. After a course at the Durham College of Science, Newcastle-on-Tyne, Mr. Shawfield was articled for three years with the Newcastle-on-Tyne Electric Supply Co., and subsequently passed through the works of Messrs. Robey & Co., of Lincoln. In 1896 he was appointed chief assistant electrical engineer to the Wolverhampton Corporation, and in June, 1898, succeeded Mr. Harman-Lewis (who resigned through ill-health) as chief engineer. The addition of the tramway load and a considerable increase in the power demand since Mr. Shawfield became chief engineer, has necessitated very large additions to the plant, all of which he has designed and carried out.

Mr. A. H. SEABROOK, Engineer and General Manager of the Marylebone Electric Supply Department, will open a discussion on Street and Shop Front Lighting. Mr. Seabrook served his apprenticeship with Messrs. Crompton & Co., Chelmsford. He was subsequently assistant engineer at Yarmouth and Hampstead, and later engineer and manager of the Barking Council's electricity undertaking. This latter position he resigned in 1905 on his appointment as engineer and manager of the West Ham electricity undertaking. Mr. Seabrook completely reorganised the technical side of the West Ham undertaking, especially in regard to the supply in the Silvertown district, but it was his vigorous policy in developing the commercial side of the business which brought him into prominence whilst at West Ham. Mr. Seabrook's two particular weaknesses, viz., sales departments and tariffs, have brought him considerable criticism at Marylebone, the management of which undertaking he took over in 1909.

WORKS TO BE VISITED

THE BRIGHTON ELECTRICITY WORKS

THE Corporation Electricity Works at Southwick, which supplies electric light and power to Brighton, is of comparatively recent date, although the electricity undertaking itself is one of the oldest municipal electric light undertakings in the United Kingdom, dating back to 1891. The original generating station in North Road was, however, converted to a sub-station when the new works at Southwick, 3½ miles from the centre of the town, were opened in 1906. The latter station, designed by Mr. Arthur Wright, is situated on the east arm of Shoreham Harbour, so that heavy colliers can be moored alongside the boiler-house, and sea-water is used for condensing purposes. Its present capacity is 10,200 kw., and it supplies three-phase current at 8,000 volts to the sub-station, where conversion takes place by means of transformers and rotary converters and motor generators to 115, 230, and 460 volts for lighting and power, and 550 volts for the tramways.

The works are arranged with a boiler-house on each side of the engine-room, but only one boiler-house is in use at present. The entire condensing plant is placed immediately below each turbine, and the switchboard gallery at one end of the engine-room. At present there are 9 B. & W. boilers, each capable of evaporating 18,000 lbs. per hour. The superheaters are separately fired. Steel chimneys are used, with induced draught. The arrangements for coal handling and weighing are well thought out and merit inspection.

In the engine-room are four 1,600-kw. Westinghouse double-flow turbo-alternators, and a 3,000-kw. Richardson-Westgarth-Siemens turbo-alternator, which has been erected this year. Fig. 1 is a general view of the engine-room, from a photograph which Mr. John Christie, the Corporation Electrical Engineer, has kindly given us. We are indebted to Mr. Christie for showing us over the works, and the other works which are to be open for inspection at the Convention, and for supplying us with much of the data in these articles. The long steam pipes seen connected to alternate sets in Fig. 1 are due to the fact that these sets are arranged to be fed alternately from the second boiler-house, and these long pipes may therefore be regarded merely as temporary expedients. Photographs and drawings and a detailed description of the new Richardson-Westgarth set, together with a curve showing the extremely low steam consumption obtained at the reception tests, are published below in a separate article.

The sea-water for condensing is drawn from the harbour by separate centrifugal pumps for each set. Trouble was experienced last year through the pipes having become clogged by mussel-spawn. Steps have been taken to prevent a recurrence of this, and the circulating water pipes are now accessible for inspection, cleaning, and repair.

A feature of the engine-room is the Graham loud-speaking telephone, enabling the switchboard attendant to communicate with the sub-station. A Lea recorder enables a record of the steam consumption to be kept.

The switchboard is of the Westinghouse remote-control pattern, and this has recently been moved by the works staff to give more room in the engine-room.

Five armoured lead-covered 3-core cables connect the works to the North Road sub-station, the distance being 4·7 miles by the route which has had to be followed.

At the North Road sub-station there are two 1,500-kw. rotaries with air-blast transformers and induction regulators, five 500-kw. and two 880-kw. induction motor-generators, and a 300-kw. motor-generator balancing set. These are all of the Westinghouse make with the exception of two sets, which consist of the old original dynamos used at North Road, to which induction motors have been coupled in place of the old Willans engines. It is also interesting to note that there are small workshops in North Road, where, in addition to the repairing work, the lead service boxes used in the network are made, and the copper connections for these are cast.

During the year ended March 31st last, 10,285,680 units were sold, the maximum load on the feeders was 5,140 kw., and the load factor 22·8 per cent., a very large figure for a residential

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district, in which only about one-fifth of the units supplied are for the tramways. The good load factor is largely accounted for by the supply to the locomotive shops of the London, Brighton, and South Coast Railway, described on another page, which consumed 1½ million units. From the accounts for the year 1910–11, recently published, it appears that something under ¾d. per unit was charged for this supply. For lighting the charges are from 6d. to 1d. per unit on a sliding scale, for general power supply from 2d. to 1d., for a small bulk supply to the Hove Corporation and the Adrington district 5d. and 1d. per unit, for supply to the Brighton tramways 1·2d., and for public lighting 1¾d., exclusive of maintenance and renewals. The average price obtained per unit was 2·08d. The number of prepayment meters on the mains continues to increase, and there are now no less than 405, which represents a fair proportion of the total number of 5,239 consumers. The fuel costs were 0·38d. per unit, the total "works" costs 0·73d. per unit, the total costs (exclusive of capital charges) 1·01d., and, inclusive of capital charges, 2·05d. per unit. The gross profit on the undertaking for the year was £49,266, representing 6·07 per cent. of the total capital, and the net profit, after deducting interest and sinking fund, £4,752.

Visitors to Brighton for the Convention will also have an opportunity of seeing the public illuminations. About 3½ miles of the sea front are being lighted with 10,000 lights hung about 2 ft. apart in festoons.

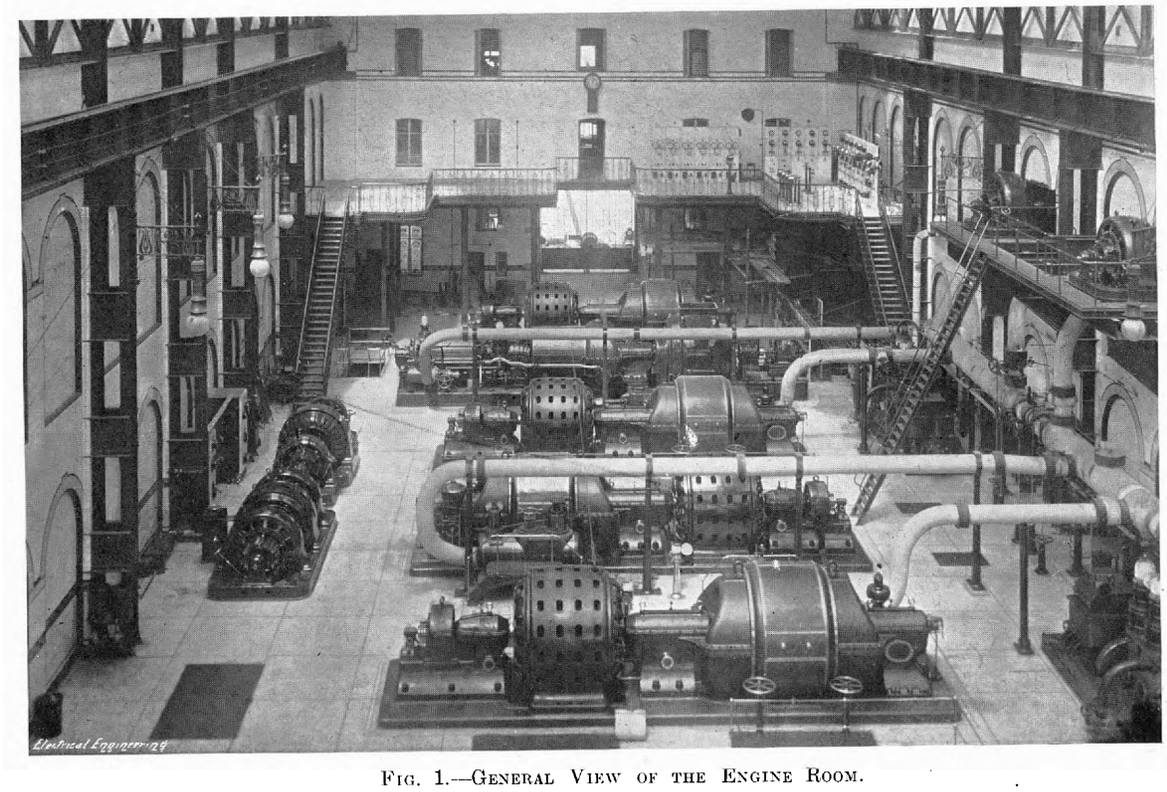


FIG. 1.—GENERAL VIEW OF THE ENGINE ROOM.

THE NEW 3,000-KW. TURBO-ALTERNATOR AT THE ELECTRICITY WORKS

As has been mentioned above, the latest extension to the generating plant at the Southwick power-house consists of a 3,000-kw. Richardsons, Westgarth steam turbine coupled to a Siemens alternator. The turbine is of the two-cylinder Parsons type to the designs of Messrs. Brown, Boveri & Co., Ltd., and is of the same type as the 6,250-kw. set at the Dunstan power-house of the Newcastle-upon-Tyne Electric Supply Co. The same pattern, as manufactured by Messrs. Brown, Boveri & Co., has been adopted extensively on the Continent, and Messrs.

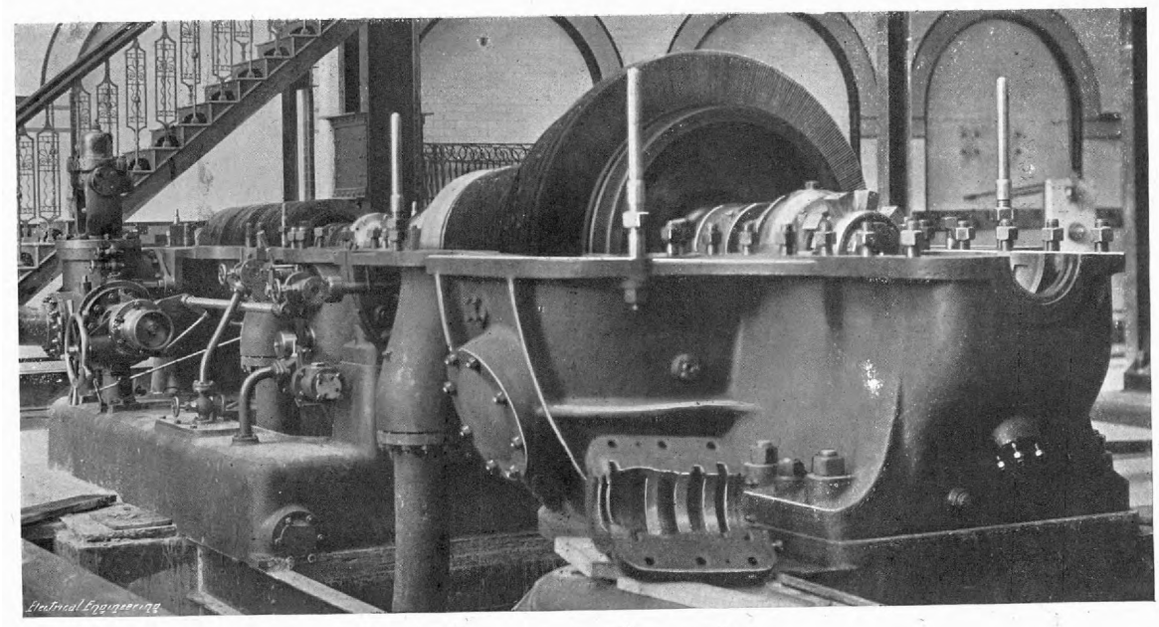


FIG. 1.—TURBINE DURING INSTALLATION.

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C. A. Parsons & Co. have supplied sets of this type for the Lots Road power-house of the Underground Railways Co. of London.

The two-cylinder Parsons type is an improvement upon the single-cylinder type, as it allows greater economy to be obtained by increasing the number of rows of blades without increasing the distance between bearings. Owing to the smaller pressure drop per row of blades, the velocity of the blades, and therefore the diameter of drum, may both be reduced, and in consequence the two-cylinder turbine has a greater blade height with a reduced clearance ratio, which results in a considerably improved consumption. This construction allows a comparatively small high-pressure drum to be used, practically of uniform diameter and therefore free from distortion troubles. The steam pressure at the inlet to the low-pressure cylinder does not exceed approximately 50 lbs. per sq. in., so that the low-pressure cylinder is not subjected to any high temperatures. In the low-pressure portion the numbers of rows of blades have been increased very considerably as compared with the single-cylinder type, thus still further improving the efficiency of this portion. Fig. 1 shows the turbine during installation. The high-pressure rotor can be seen on the extreme left, and it will be noticed that this is comparatively short and of uniform diameter. Steam is admitted to the turbine through a double-beat valve controlled by the governor through an oil relay, details of which are seen in Figs. 3 and 4.

The valve gear consists of a double-beat valve Q (Fig. 4), actuated by the spring-loaded piston O, which is under control of the oil under pressure entering at S from the main lubricating system. The controlling pressure of the oil is determined by the vertical position of the sleeve K (Fig. 3) and the spring-controlled governor J. If the speed increases, the governor J lowers the position of the sleeve K, thus increasing the outlet area of the oil pipe T', which diminishes the pressure of the oil under the piston O (Fig. 4), resulting in a corresponding closing of the double-beat inlet valve Q. When the speed of the turbine decreases, the position of the sleeve K is raised, whereby the exit area of the oil pipe T' is decreased with the opposite result. The oscillating movement of the valve, which practice has shown to be an advantage for very close governing, since all moving parts of the gear are kept in constant motion, is obtained by the very simple device of making the upper governing edge of the rotating sleeve K at an angle with the axis. The exit area of the oil pipe T' is thus varied slightly once in a revolution of the shaft, with the result that a tremor is produced in the valve Q and its piston and rod, which is in synchronism with the revolutions of the shaft D. Thus the undesirable wavelike fluctuations in the steam pressure produced by the ordinary oscillating motion are avoided.

The alternator is of Messrs. Siemens Bros. Dynamo Works, Ltd., standard type, and is designed to give 3,000 kw. at 0·85 power factor, three-phase, 50 cycles, 8,000 volts, 1,500 r.p.m. After a three hours' continuous run on full load, plus one hour on 25 per cent. overload, the temperature rise is guaranteed not to exceed 75° F. on any part, the same heating limit applying after a continuous run of three hours on full load, plus fifteen minutes on 50 per cent. overload. The machine will also carry a continuous output of 3,500 kw. with the same temperature limit.

The stator frame is fully enclosed, and is ventilated by means of a fan attached to one end of the rotor. A special air intake and air outtake is provided. The cooling air passes through an air-filter connected to the inlet situated in the basement beneath the machine, and the heated air passes out through the aperture at the top of the stator frame. The filter is of the vertical screen type, and manufactured by the Buffalo Forge Co., Ltd.

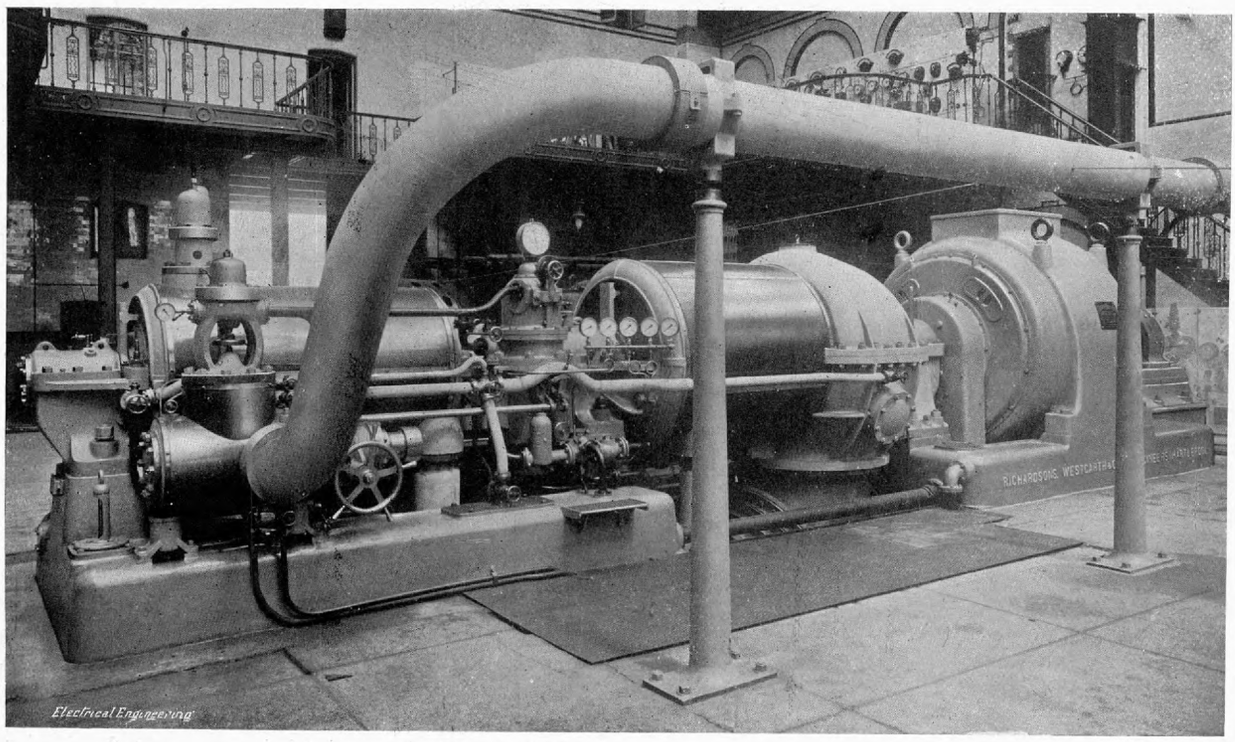


FIG. 2.—TURBO-ALTERNATOR COMPLETED.

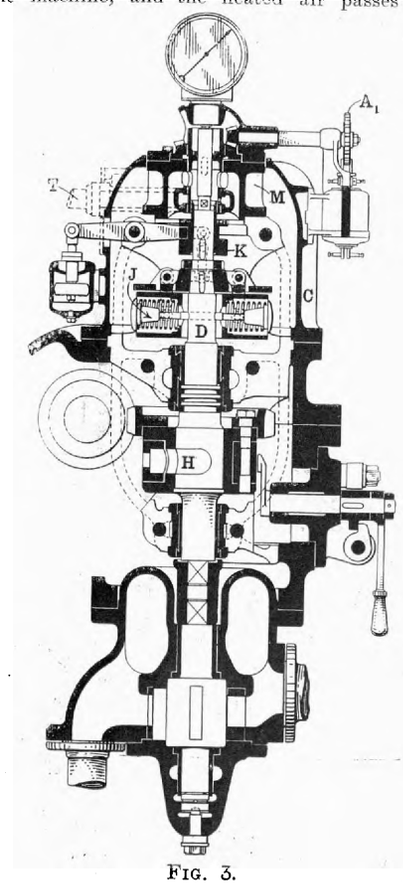


FIG. 3.

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The stator coils are of the pull-through type, and are wound in semi-open slots, and the end connections of the coils are supported in the most substantial manner.

The rotor is of the cylindrical type, with a distributed winding. The windings are carried in equi-distant open slots closed by metal wedges, and the end-connections are held down by forged steel winding covers, which are machined inside and out, and registered at either end on machined surfaces. The shaft is particularly ample in section.

Cool air is drawn through the rotor by means of a second fan, also attached to the rotor. The core end-supports and

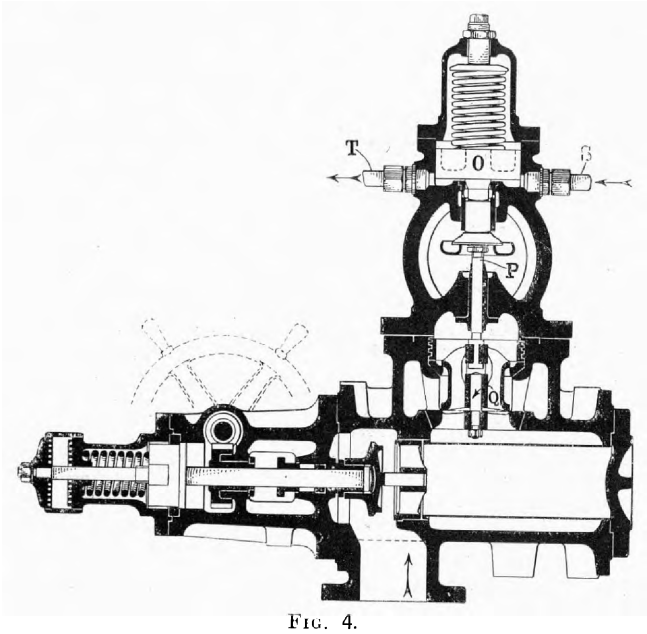


FIG. 4.

winding covers are provided with grooves carrying adjustable balance weights.

Both the stator and rotor are ventilated on Siemens' patent axial system, which consists in the provision of ducts passing through the active iron in a direction parallel to the shaft of the machine. These ducts are so situated that the cooling air comes into the most intimate possible contact with the active copper and iron which requires to be cooled. It should be noted that with the axial system of ventilation the hottest parts of the machine will be those remote from the air intake, viz., the ends of the stator and rotor respectively, and these are immediately accessible to a thermometer.

The slip rings are of steel, and the brushes of copper carbon.

The exciter is driven from the main shaft by means of a flexible coupling, and has its own bedplate and bearings, which are mounted on an extension of the turbine bed. The bearings are arranged for forced lubrication.

The alternator pressure is adjusted by means of a series regulator in the alternator field, and a shunt regulator in the exciter field. Both are operated by hand-wheels carried on a single pillar, the drive being by means of concentric spindles.

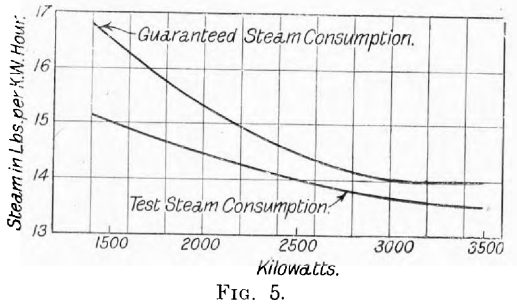


FIG. 5.

The temperature rises obtained on test were well within guarantee, and the machine runs without vibration, and is almost noiseless.

In Fig. 2 the complete turbo-alternator is shown, this view giving a good impression of the valve gear.

The guaranteed steam consumptions of this set are given in one of the curves of Fig. 5, the conditions being 180 lbs. steam pressure, superheated to 530° F., and a vacuum of 28·25 ins. In this figure are also plotted the results of the preliminary trials reduced to guarantee conditions (for permission to reproduce which we are indebted to Mr. Christie). In one of the tests, with a load of 3,550 kw., steam pressure 200 lbs. per sq. in., steam temperature 523° F., and vacuum 28·46 ins., the consumption was only 13·0 lbs. per kw.-hour (exclusive of auxiliaries, the consumption of which is only in the order of 1 per cent. of the total).

The condensing plant was made by the turbine builders, and is of their standard "Contraflo" type, fitted with a vacuum augmentor and Edwards air-pumps. The condenser has a cooling surface of 5,000 sq. ft., and is guaranteed to maintain a vacuum of 28·25 ins. when dealing with 53,500 lbs. of steam per hour, and supplied with 6,000 gallons of water per minute at 70° F. During the turbine tests, the water temperature was 63° F., and a vacuum of 28·25 ins. was maintained without using the augmentor.

THE L.B. & S.C. RAILWAY LOCOMOTIVE WORKS

THE locomotive works of the London Brighton and South Coast Railway at Brighton have just been entirely rebuilt, and are now driven electrically. Current is supplied by the Brighton Corporation, as has been mentioned in the article on an earlier page, and during the last year some 1½ million units were consumed. The maximum current taken is about 2,500 amperes at 230 volts. The aggregate h.p. of the motors is over 2,000. Independent drive is employed for all the larger machines, but the smaller machines, including the rolls for thin plate work, are all run off line shafting.

Four feeders of one square inch section run from the North Road sub-station to the works switchboard, and are connected through duplicate B.T.H. meters. The switchboard is of standard Westinghouse design, and seven-power circuits are taken

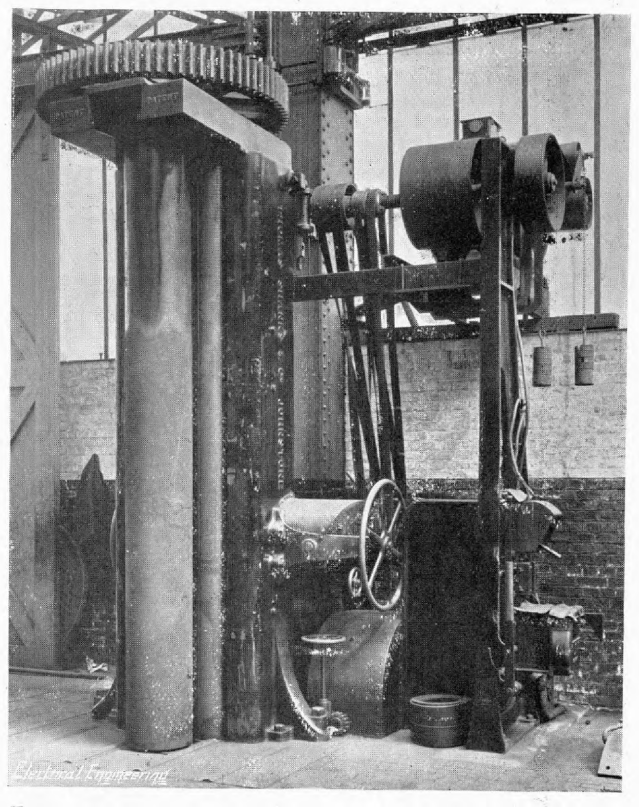


FIG. 1.—VERTICAL PLATE BENDING ROLLS IN BOILER SHOP.

from it through double-pole switches, and on one pole a circuit-breaker, and on the other a fuse.

The boiler shop is divided into three bays, and has on the west side a small bay which is used as a store for plates, tubes, &c., and is served by a 5-ton three-motor travelling crane, converted from rope to electric driving. In the west bay is a 12-ton crane, similarly converted, in the centre bay a new 20-ton crane, and in the east bay a converted 12-ton, and a new 20-ton crane. All these are three-motor cranes, the motors by the Lancashire Dynamo Company, and the crane-work by Craven Bros., Ltd.

In the transverse bay, at the South end of the boiler shop, is placed the riveting plant, consisting of two hydraulic riveters, an hydraulic jib crane, and a 15-ton three-motor electric crane, by Vaughan and Son, Ltd. The latter travels on rails 41ft. from the floor, and is operated entirely by a tramway-type

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controller, placed so that the operator can work the 17ft. gap riveting machine with his right hand, while adjusting the work held up by the crane to a nicety, by working the controller with his left. The line shafts are driven through helical

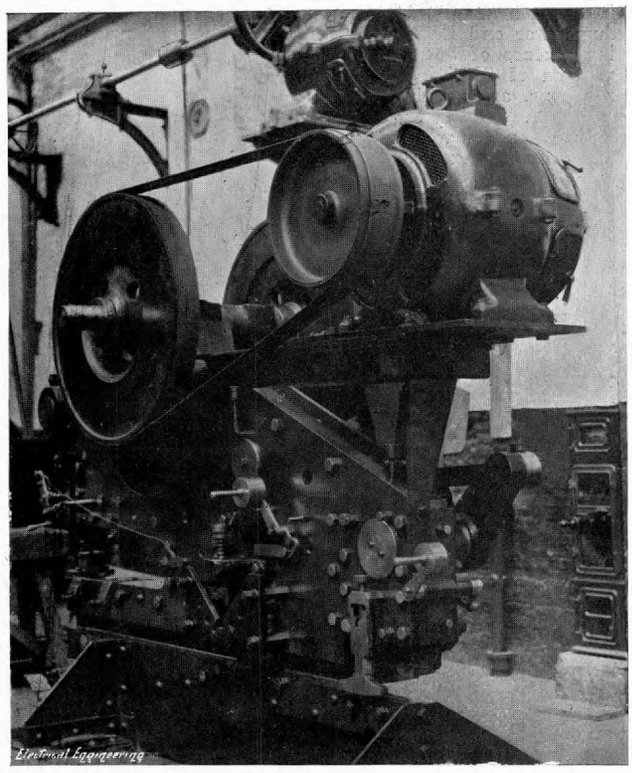


FIG. 2.—SPLITTING SHEARS AND PUNCH IN BOILER SHOP.

gears by 15 and 30 h.p. G.E.C. motors, this practice being carried out in the other departments also.

Air is largely used for hoisting, drilling, caulking, &c., and is supplied at 100 lbs. pressure throughout the works by two "Sentinel" air compressors, by Alley and MacLellan, each driven at 225 r.p.m. by 70 h.p. Hall motors, the air being accumulated in large reservoirs placed at convenient points in the various departments.

The large punch and shear deals with plate up to 1 inch thick, and was formerly driven by a steam engine attached to the main casting. It is now worked by a 30 h.p. G.E.C. motor.

The vertical rolls in the boiler shop (Fig. 1) are by Thomas Shanks, and are adapted for rolling plates up to 12 feet wide by 1 inch thick. They are driven by a 30 h.p. G.E.C. motor, through a short belt, tension being maintained by a weighted jockey pulley mounted on a pivoted arm. Through a worm and bevel drive the same motor also supplies power for a 2-ton jib crane, fixed above the rolls for handling the plates and taking out the rolls when necessary.

Near by is a set of horizontal rolls by Craig and Donald, of their patent 5-roll type, also capable of dealing with plates 12 feet wide by 1 inch thick. These are driven through spur gearing by a 30 h.p. G.E.C. motor. The starters for both these rolls are Adams' "Igranic," fitted with no-voltage and overhead release, as are all the starters throughout the works.

Two splitting shears, with attachment for punching and bar cropping, are driven by 15 and 10 h.p. G.E.C. motors respectively. These shears, which are by Pels, can shear plates of any width or length, owing to the plate construction of the frame. They are seen in Fig. 2, which also shows one of the motors for the main shaft drive.

The erecting shop has two bays, 570 feet long, and 55 and 45 feet wide respectively, in each of which are two 35-ton three motor cranes, those in the west bay being 40 feet span, and made by Vaughan and Co., with motors by J. P. Hall and Co., and the two in the east bay 53 feet 6 inches span, by Craven Bros., with motors by Lancashire Dynamo Company. The two shops can accommodate, for repairing purposes, about 56 engines of the various types, and the usual output of repaired engines is from six to seven each week.

The machine shops are driven by motors working line shafts, the machines being grouped according to requirements. At the south end (Fig. 3) is a large 23-feet planing machine, to which has been fitted a "Mitchell" drive, a pair of belts being alternately tightened and loosened for the power and return strokes by a striker, communicating power to the rack wheel and pinion from a 30 h.p. motor, by the Lancashire Dynamo Company.

In the smiths' shop all the smiths' fires are provided with down-draught hoods, the flame and smoke being exhausted by large exhausters placed at either end, and driven in one case by a 70 h.p. Hall motor, and in the other by a 30 h.p. G.E.C. motor. The gain in headroom and the good lighting due to this arrangement is very apparent. The furnaces for the drop stamping battery are also worked on the same principle, a 15 h.p. G.E.C. motor driving a Sturtevant exhausting fan for the purpose. It is interesting to watch the drop stamping, in which, by the use of dies, heavy parts are quickly finished which would otherwise have entailed the expenditure of hours of highly-skilled labour. We may also mention that oil fuel is employed for all the bolt fires.

A 5-ton three-motor Craven crane traverses the smiths' shop and yard, the down-draught system having been adopted to render this most convenient arrangement possible.

At the north end of the smithy is the grinding shop, the stones in which are driven by two 30 h.p. G.E.C. motors, and under the floor of this shop is the pump room, containing the driving gear of two treble barrel deep well pumps by

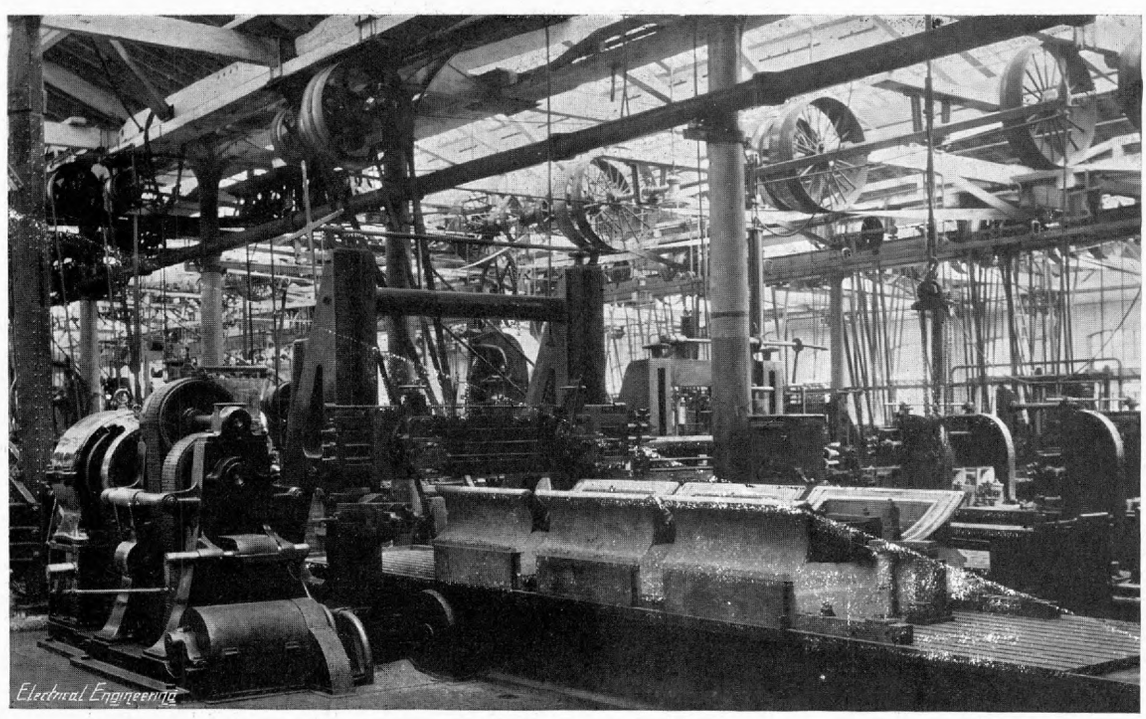


FIG. 3.—MACHINE SHOP WITH LARGE PLANING MACHINE, WITH MITCHELL DRIVE IN FOREGROUND.

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Tangye, arranged to be driven independently or together, by a 70 h.p. Hall motor. Formerly they were worked by a beam engine. These draw water from a well 160 feet deep, and provide the chief water supply of the works, station, and locomotive running sheds. The frame building shop is served by

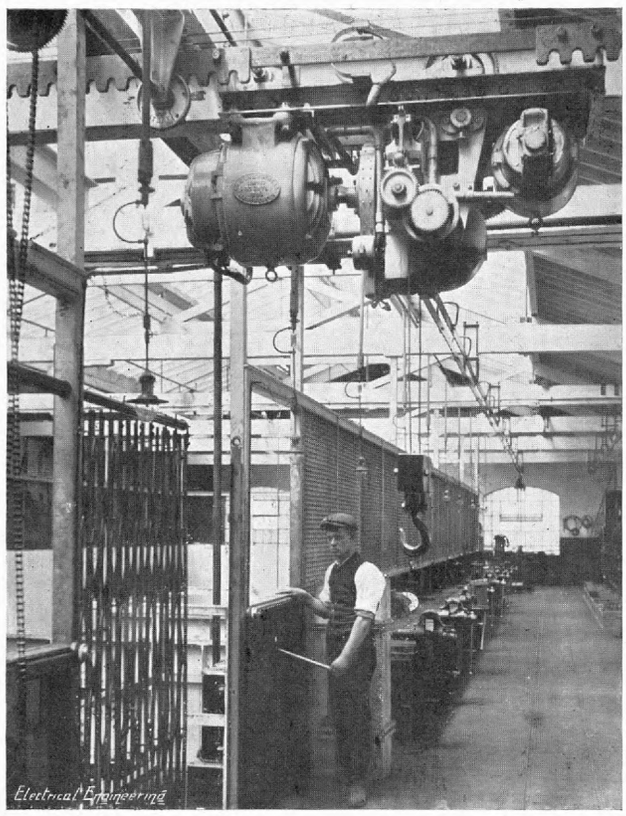


FIG. 4.—JIGGER CRANE, FRAME SHOP GALLERY.

a 10-ton three-motor Vaughan crane, operated from the floor, and a gallery above accommodates the millwrights and Westinghouse brake fitters. Heavy parts and packages of small details are conveyed from the shop below up to the gallery, or vice-versa, by a 2-ton jigger crane (Fig. 4), which travels on a rail slung to the roof principals. By means of toothed arms



FIG. 5.—BASCULE CRANE.

engaging in pin wheels, the crane, in conveying material to the galleries, opens and shuts scissor doors in the gallery fencing, to protect the men working near from falling through to the floor below, as might be the case were the gates to remain open at the option of the crane attendant.

The cylinder and frame machining shops adjoin the frame shop, and noticeable in the frame machining shop is the large frame slotting-machine, with a bed 45 feet long by 7 feet wide, which has three drilling and slotting heads. This machine is driven by an independent 25 h.p. motor. In the cylinder shop the machines are grouped and driven by 15 and 30 h.p. G.E.C. motors. A group of axle lathes is driven from a line shaft, which is driven by a 30 h.p. G.E.C. motor by means of a Westinghouse chain drive.

The wheel shop is well equipped with a number of wheel lathes, all driven by independent motors, most of which are 15 h.p. Lancashire Dynamo Co.'s, some of the lathes being new and others converted to electric driving by Craven Bros. A 7-ton three-motor crane, by Vaughan, is provided for dealing with the wheels, and is operated from the floor, automatic knock-offs being fixed at each end of the shop in case of the attendant stumbling or losing charge of the crane.

Material is carried from shop to shop, wheels transferred from road to road, trucks loaded and unloaded and shunted by a novel type of travelling electric crane (Fig. 5). This has a bascule jib, which can perform a complete circle of 17 ft. 6 in. radius, and has a range in any vertical plane of 14 ft. 6 in. The motors are totally enclosed, and are of $5\frac{1}{4}$ b.h.p. at 380 r.p.m. for the hoisting, 4 b.h.p. at 450 r.p.m. for slewing, and $8\frac{1}{2}$ b.h.p. at 420 r.p.m. for travelling The motors are driven by accumulators having an output of 15 b.h.p. for one hour, at 220 volts, these accumulators acting also as a counterweight to the load on the bascule jib. Charging plugs are provided in various convenient parts of the works, where the batteries may be recharged during meal hours, &c.

We must express our indebtedness to Mr. D. Earle Marsh (the locomotive superintendent of the L.B. and S.C. Railway) for permitting us to inspect the works, and for supplying us with photographs and the particulars which are embodied in this article.

SOME OF THE OTHER WORKS OPEN FOR INSPECTION

The "Electrobus" Charging Station.—The Brighton, Hove, & Preston Omnibus Co., Ltd., have sixteen electric omnibuses in use. These are each equipped with 46 Tudor cells of 500 ampere-hour capacity (at the 5-hour rate), which are charged at a charging station, described in detail in ELECTRICAL ENGINEERING of June 24th, 1909 (Vol. V., p. 576). The average time occupied for charging is about five hours. The Stevens regenerative system of charging is employed; boosters are connected in the battery circuit, but they run as motors during the earlier stages of the charge, thus interposing a back E.M.F. between the line pressure and the battery terminals; at the latter period of charge, when a higher pressure is required, they run as actual boosters. This is effected by a potentiometer rheostat in the fields of the boosters.

Volk's Electric Railway.—It is interesting to note that this railway is nearly 28 years old. Current is supplied by an old $2\frac{1}{2}$-kw. Kapp machine, originally driven by a gas-engine, and now by a motor, and a Parker motor-generator of the same capacity. Current is taken from the Corporation mains, and a small buffer battery is connected on the low-tension side. The line is narrow-gauge on the third-rail system. It is fitted with an interesting device, designed by Mr. Volk, for cutting off the current from the third rail at level crossings and on public ways when the train is not on the section.

The Reason Manufacturing Co.'s Works.—Members wishing to visit these works are requested to communicate with the Reason Manufacturing Co., Ltd., of Lewes Road, Brighton. They will be shown the Reason electrolytic meter in process of manufacture and on test, the company's arc lamps, outside electric lighting fittings, and adapted fittings, fuse and service boxes, &c., and the manufacture of taximeters is also being carried on.

Allen West & Co.—The works of this firm adjoin those of the Reason Manufacturing Co. One of the specialities of this firm is a range of controllers particularly adapted for workshop motors, a feature of which is the use of hinged fingers with helical springs instead of the usual plain phosphor-bronze springs, and all-mica insulation. Another is a special form of stamped resistance grids.

The Brighton Corporation Car Sheds and Workshops.—These are also in Lewes Road, and are open to inspection by members and visitors.

At Portsmouth on Wednesday, June 28th, members will, by permission of the Lords Commissioners of the Admiralty, have an opportunity of inspecting H.M. Dockyard power-house and a ship of the *Dreadnought* class. The Portsmouth Corporation Lighting and Tramway power-houses will also be on view.

A LIST OF MEMBERS AND VISITORS ATTENDING THE CONVENTION WILL BE FOUND ON P. 350.

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STREET LIGHTING IN THE BOROUGH OF HOLBORN

THE Holborn Borough Council seems determined not to arrive at a decision with regard to its street lighting. After having resolved itself into a Special Committee to consider the subject, and having recommended the acceptance of the joint tender of the Electric Lighting & Gas Companies as set out on page 335 of our last issue, the Council on Wednesday solemnly referred its own recommendation to the Works Committee, for further consideration.

At the meeting on Wednesday, Alderman Green expressed the hope that the Council would not adopt the recommendation to accept the combined tender, using mainly for his argument the point that the candle-power of 425,000 was excessive for the needs of the Borough, being 50 per cent. greater than that which was recommended as necessary by the Works Committee last year. Curiously enough, although seven speakers took part in the discussion, the majority of whom were not in favour of the Committee's recommendation, none drew attention to the fact that the Electric Lighting Companies had offered to carry out the lighting at a cheaper price than the joint tender, although a vague reference was made to the Town Clerk's opinion that the Electric Lighting Companies' offer did not constitute a tender. The Councillor who made this remark, however, mentioned that he had not received any explanation of why this was so. With the exception of Alderman Green, nobody gave any cogent reason why the report should be sent to the Works Committee for consideration, but the amendment to do so was carried by 25 to 7.

One fact which seemed to weigh with many of the Councillors was that it would be necessary for the Council to repay the Companies by annual instalments the sum of £9,000, expended upon the columns, lamps, lanterns, &c., which at the end of the 10 years' contract would belong to the Council. This item, it appears, has never been before the Works Committee, and they seemed to be quite unaware of the need for this expenditure. The Finance Committee, in a special report, called attention to the fact that it would be necessary to get the sanction of the L.C.C. to this annual payment, as it includes the payment of interest, and in the absence of such sanction would leave the members of the Council with the risk of being surcharged by the amount representing the interest. Consequently, the Finance Committee recommend that the words, "Subject to the sanction of the L.C.C. being first obtained to the form and principle of the contract," should be added to the recommendation to accept the tender, or in the alternative that the Works Committee negotiate with the Companies in order to purchase at once the columns, lamps, lanterns, &c. This point will now be considered by the Works Committee.

Incidentally we may mention that there was hanging upon the walls of the Council Chamber a plan of the proposed street lighting under the combined tender, from which we noted that practically all the main thoroughfares in Holborn and the central portion of the Borough were given to electric lighting, whilst the side streets were for the most part allocated to gas.

THE BREMER FLAME ARC LAMP PATENT

Again Upheld by the Courts

MR. JUSTICE SWINFEN EADY gave judgment on Saturday in the action taken by the British Westinghouse Co., Ltd., against the Electrical Co., Ltd., for infringement of the Bremer flame arc lamp patent, No. 18,786 of 1902. The action, which was reported in our issues for May 4th, p. 233, and May 11th, p. 248, relates to the Electrical Co.'s "Sunshine" flame arc lamp, which it was alleged contains every essential element of the Bremer specification, one of the carbons being swung by a device acting at its lower end, and there also being a horizontal feed mechanism, thus giving the floating feed of the Bremer lamp. The Westinghouse Co., it will be remembered, brought a similar action against Mr. G. Braulik in 1909, and were successful in the Appeal Court last year in getting judgment in their favour, and the Bremer patent upheld (ELECTRICAL ENGINEERING, Vol. VI., p. 122). The Electrical Co. denied infringement, and also alleged anticipation, the specifications chiefly relied upon in this connection being the United States specifications of Graham, No. 268,218 of 1882, and Crosby No. 553,335 of 1896. Another American specification by Wright was also mentioned as of importance. The evidence for the defence, however, was somewhat different to that in the Braulik case, as further working models made in accordance with the Graham specification were exhibited. Judgment was again given in favour of the Westinghouse Co., the Judge holding that the patent was not rendered invalid through anticipation, and that the Electrical Co.'s lamp was an infringement.

In giving judgment, Mr. Justice Swinfen Eady first said that he was bound by the construction put upon the Bremer specification by the Appeal Court in the action against Mr. Braulik. With regard to anticipation, he was satisfied that Graham did not contemplate or describe in his specification anything intended to obtain a floating feed. There was no mention of floating or of any horizontal movement of the carbons in the arm striking the arc. The essence of Graham's specification was his device for regulating the feed of the carbons. Crosby, in his opinion, was further off floating than Graham, and must be dismissed for the reasons set forth by Lords Justices Fletcher-Moulton and Buckley in the previous action. Wright, from the point of view of floating, was quite a hopeless lamp. The contention of the defendants in this action was that the substance of Bremer's patent was to be found in Graham, Crosby, and Wright, and adding common knowledge. In his opinion that contention could not be supported. The Bremer patent was for a lamp of a certain definite type, and was a distinct advance upon anything that had gone before. It had enabled the flame arc lamp to come into commercial use, and it had given to a definite type of lamp a floating horizontal feed in a definite manner, quite superior to anything that had gone before. In his opinion, the invention was new and useful, and subject matter for a valid patent.

The infringement in this case seemed clear. The defendants had taken plaintiff's lamp, although with variations. They pivoted the guides, with the result that there was a larger mass to be moved, but it made no difference in principle whether they merely moved the electrode and its holder or whether they regarded the whole frame as being the electrode holder, pivoted that, and then operated it as near the bottom as possible. Horizontal floating was obtained in the same manner in each case. He therefore gave judgment for the British Westinghouse Co., and granted an inquiry as to damages, delivery up, and a certificate of particulars of purchase.

It was agreed that the delivery up should be stayed on condition that notice of appeal was given within fourteen days.

ELECTRICITY IN FACTORIES AND WORKSHOPS

THE annual report of the Chief Inspector of Factories and Workshops for 1910 refers in the opening summary to the continued advance in the use of electric power in factories. The reports of the inspectors of the different districts contain various references to electrical matters. In the South-Eastern Division a few cases of lead poisoning in accumulator factories are mentioned, but, on the whole, the regulations are reported to be fairly well observed, and considerable improvement in this respect is reported by the superintending inspector of the Midland District, who also writes:—"Electricity seems to be playing a valuable part in industrial life. Workshops, so called, are being changed into factories through the facility with which the electric motor can be installed." Advance in the use of electric furnaces for steel manufacture is mentioned in the report for the North-Eastern Division, and in the Northern Division attention is called to the introduction of mercury vapour lamps for lighting composing rooms at Dundee, where the workers report that they no longer suffer from headache, and that the eye-strain is less than when gas or ordinary electric lighting was used.

The report of the Electrical Inspector (Mr. G. S. Ram) is now incorporated in the main report, and covers the first year when the new regulations have been in force. It is remarked that while many occupiers have taken trouble to ascertain whether their installations are in conformity with the requirements, a large number have done nothing pending instructions from the inspectors. Reports from some of the inspectors show, however, that a good deal has been done in getting some of the more obvious defects remedied, such as bare conductors, fuses, switches, &c., protected, and defective switches repaired. Dealing generally with the accidents, it is pointed out that while more accidents causing burns occur with continuous-current apparatus, the fatalities with one exception were all on alternating-current systems. The inspector for South London men-

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tions several cases where the supply authorities' fuses were not properly sealed, and Mr. Ram deals with this question generally, pointing out that this is often done on purpose in factories in order to enable the consumer to renew fuses himself, and to avoid loss of time in case of a breakdown. Ordinarily, service fuses are sealed up by the supply authorities and are exempt from the regulations; if, however, the occupier has access thereto, necessitating the exposure of live metal, the regulations must be complied with.

Non-compliance with the regulations is not limited to old installations, and two cases of installations put in by well-known contractors are mentioned, where only half the prescribed passage-way had been provided behind the switchboard. In one of these an accident had resulted. Speaking generally as to the effect of the regulations, Mr. Ram writes:—"Before the establishment of the regulations, the questions arising were discussed in reference to the points of safety or danger. Now that the regulations are in force and the numerous points are crystallised under the different regulations, the matters are considered in reference to the question of compliance or non-compliance." It is again pointed out that unsuitable and dangerous apparatus is often supplied by electrical manufacturing firms, and Mr. Ram recapitulates some of the recommendations regarding connector plugs, &c., made in previous reports. As is well known, these have been largely taken advantage of by manufacturers, and one firm even endeavoured to annex the idea themselves by applying for a patent, the granting of which was successfully opposed by the Home Office. Attention is drawn to a tendency to the use of fuses or switch fuses for very large currents under conditions where circuit-breakers would be safer and more suitable. General improvement is recorded in the design of circuit-breakers and oil-switches, particularly as regards prevention of the possibility of explosion of the latter due to the hydrocarbon gases produced by arcing under the oil. The practice of acceptance of the lowest tender seems to be responsible for a good deal of the unsatisfactory and dangerous work.

A classified table of accidents gives a total of 282 non-electric accidents during the year (including 5 fatalities) at public supply stations, and 35 at other stations. The electrical accidents are classified as follows:—At switchboards when engaged in ordinary routine work, mostly due to faulty design of apparatus or to mistakes on the part of the switchman, 15 in public stations and 2 in other stations; cleaning, repairing, &c., at live switchboards or other live conductors, 16 (including 2 fatalities) at public stations and 7 in other stations; cleaning, repairing, or other handling of switchboards or apparatus supposed to have been made dead, 5 (including 1 fatality), all to skilled persons at public stations; adjusting brushes and cleaning commutators, 2 in public stations and 1 in other stations; of the remaining miscellaneous electrical accidents, 7 (including 1 fatality) were in public stations and 3 in other stations. The mechanical accidents are somewhat fewer than in the previous year. The electrical accidents are also fewer, the number of fatalities, 4, being, however, the same. The actual figure, 45, for the public supply stations, is remarkably small, and compares with 58 and 76 for the two previous years. The 276 electrical accidents, including 5 fatalities, in factories other than electrical stations in 1910 are classified as follows:—Arcing of switches, 48; arcing of fuses, 13; shock or burns from fuses when replacing fuse-wires, 28 (including 1 fatality); portable apparatus, connectors and flexible wires, unprotected conductors, switches, terminal fuses, &c., 21 (including 1 fatality); working on or near live conductors, skilled persons 34, unskilled persons 17; miscellaneous accidents in electrical manufacturing works, mostly in testing operations, 30 (including 1 fatality); adjusting brushes and cleaning commutators, 7; miscellaneous, 24 (including 1 fatality). The total is greater than last year by about 7 per cent., which is probably below the increase in the use of electricity; the number of fatalities is 5, as compared with 8 for the previous year.

THE TELEPHONE TRANSFER
Hearing of Appeal

THE Appeal of the Postmaster-General against the judgment of the Railway and Canal Commissioners, upon the preliminary legal points raised in connection with the transfer of the National Telephone Co.'s undertaking to the Post Office, commenced before the Master of the Rolls and Lords Justices Farwell and Kennedy on Wednesday last week. By a majority the Railway and Canal Commissioners held that the portion of the Postmaster-General's notices of objection relating to taking over lines not on the metallic circuit system, and lines along, upon, or across any railway worked, or about to be worked, by electric power, were not specific enough, and were, consequently, invalid. On the other hand the Court held that the notices relating to certain specific lands, buildings, and plant were good notices, but, as the Company's contention is that, if any part of the notice is bad, the whole of the notice is bad, the Company have cross-appealed on this point. The Postmaster-General is also appealing against the decision of the Railway and Canal Commissioners, who, by a majority, held that the words "suitable for the requirements of the Postmaster-General," which were made use of in the purchase agreement, related to the quality of the plant, and not to the quantity; in other words, the Postmaster-General cannot refuse to take over plant merely because it duplicates plant in an area where the Postmaster-General has erected a competing exchange.

The arguments, which are the same as those which were made before the Railway and Canal Commissioners (*Electrical Engineering*, May 18th, p. 267, and June 1st, p. 307), are still proceeding. The Attorney-General and the Solicitor-General have concluded the case for the Post Office, but Sir Alfred Cripps, K.C., has not yet finished his argument for the company. Mr. Danckwerts, K.C., will follow Sir Alfred Cripps.

CORRESPONDENCE

THE TELEPHONE TRANSFER.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—The views of Mr. Hirst on this subject, so fully expounded at the meeting of a manufacturing company, and so widely circulated in the Press, deserve some comment. It may be, perhaps, considered cynical to suggest that those views are somewhat coloured by a lively sense of orders to come; but I am impelled to that suggestion, both because Mr. Hirst's published opinions are in direct opposition to those of almost every member of the electrical industry having knowledge of the subject and of most of the technical, financial, and lay Press, and because the Post Office looks like being the only future customer in this country for the company for which Mr. Hirst was speaking.

As a business man Mr. Hirst should find some difficulty in advocating so ardently the transfer of a business which under commercial management is operated at 58 per cent. of the gross receipts, to a department which operates the same business at over 74 per cent. of the gross receipts. The difference represents over 3 per cent. on the capital employed, which much more than offsets the lower rate of interest at which Government can raise capital as compared with a company or a Telephone Authority.

The telephone service is at present very little developed in this country, a state of affairs which *is*—Mr. Hirst to the contrary notwithstanding—very largely the fault of the Post Office, as the Post Office telephone policy has been obstructive from the very beginning.

To accelerate the development of the telephone, which has been artificially restricted for years past, requires large expenditure of capital. Mr. Faithful Begg, in a recent Paper before the London Chamber of Commerce, put the capital required for the next ten years to develop the telephone adequately in the United Kingdom at £116,000,000. Is it likely that the Post Office, which earns a bare 3 per cent. on its telephone business, will be able to induce the Treasury or Parliament to invest any such sum in a Government telephone monopoly? It may be argued that when the National Company's business is taken over the telephone profits of the Post Office will be greatly increased. So they will—for a year or two. But in time the same causes, relentless as the tides, which have turned the telegraphs into a losing business, will wipe out the telephone profits; it is only a matter of time, if the telephone becomes a Government monopoly, when the Postmaster-General of the day will tell a thin and bored House that the telephones, like the telegraphs, are "past praying for."

As to pushing the telephone business, if that is not done by a trained business department, much confusion would result. One powerful argument for a Telephone Authority is that under such management the very important question of business relations with the public would be adequately dealt with.

I am, &c.,

HERBERT LAWS WEBB.

35 Old Queen Street, S.W.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

METERS.—A leaflet from Messrs. Gillespie and Beales (Amberley House, Norfolk Street, Strand, W.C.) gives particulars of the "Alva" continuous current Watt-hour meter for two and three wire circuits. This is a motor meter of the commutator type.

GLOVER'S ALMANAC.—In accordance with their usual custom, Messrs. W. T. Glover and Co. are issuing, at this season of the year, their well-known and deservedly-popular almanac, with humorous, technical, and artistic embellishments to the sheet for each day. Judging by the copy we have been favoured with, this issue fully maintains the high reputation of its predecessors.

HOLOPHANE FITTINGS.—A card from Simplex Conduits, Ltd., illustrates a few of the many designs of special fittings for Holophane glassware, in which this firm specialise.

CHAINS.—A new catalogue from Hans Renold, Ltd., deals very fully with bush roller chains and sprockets.

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MEMBERS AND VISITORS ATTENDING THE I.M.E.A. CONVENTION

THE following is a list of the Members and invited guests who had intimated their intention of attending the Convention up to the time of our going to press.

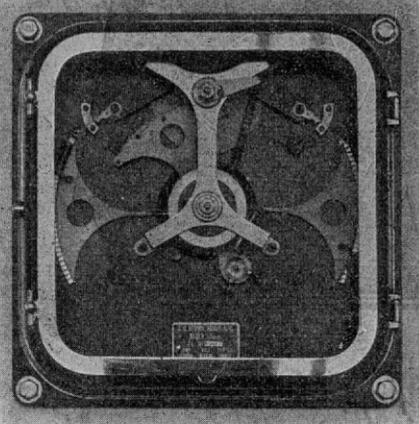
The abbreviation *Ch'n* stands for Chairman of the Electricity Committee, *C'r* for member of the Electricity Committee, *E.E.* for Chief Electrical Engineer.

Acland, R. L. (*E.E.*, Chesterfield).
Allan, P. F. (*Siemens Brs. Dynamo W'ks*).
Allen, S. T. (*E.E.*, Carlisle).
Anderson, A. B. (*Ferranti, Ltd.*).
Angus, H. W. (*E.E.*, Eccles).
Arden, G. D. (Southampton).
Aron, Prof. (*Aron Elec. Meter, Ltd.*).
Ashworth, Jas. (*Ch'n*, Heywood).
Atchison, C. C. (*E.E.*, Rochdale).
Atkinson, H. S. (*Ch'n*, Cleckheaton).
Ayton, F. (*E.E.*, Ipswich).
Bache, W. J. (*E.E.*, Cheltenham).
Bailey, W. (*Ch'n*, Greenock).
Balmforth, C'r (*C'r*, Doncaster).
Barbour, R. H. (*Electl. Apparatus Co.*).
Barker, E. A. (*E.E.*, Barnsley).
Bastian, J. (*Bastian Meter Co.*).
Beauchamp, J. (*E.E.*, Tunbridge Wells).
Bell, A. R. (*E.E., Uxbridge Co.*),
Bell, J. (*E.E.*, Aberdeen).
Billington, G. (*Ch'n*, Salford).
Binns, W. (*E.E. Trams.*, Reading).
Bishop, H. C. (*E.E.*, Newport).
Black, A. S. (*E.E.*, Southport).
Blackler, E. T. (*Ch'n*, Torquay).
Blackman, A. S. (*E.E.*, Sunderland).
Bland, A. V. (*C'r* Morecambe).
Blascheck, C. A. (*E.E.*, Canterbury).
Bloxam, T. W. (*E.E.*, Belfast).
Bolam, J. H. (*E.E.*, Weymouth).
Boot, Horace (London).
Boyd, W. J. (*Ch'n*, Londonderry).
Bremner, Ashton (*Acting E.E.*, Walsall).
Britton, S. E. (*E.E.*, Chester).
Brodie, Ald. (*Ch'n*, Blackpool).
Brooking, J. H. C. (*St. Helen's Cable Co.*).
Brydges, J. K. (*E.E., Eastbourne*).
Bruce, J. G. (*E.E.*, Willesden).
Bumpus, Ald. A. A. (*Ch'n*, Loughboro').
Burbidge, A. H. (*E.E.*, Kilmarnock).
Burman, J. B. (*C'r*, Birmingham).
Burnett, H. R. (*E.E.*, Barrow-in-Furness).
Campion, R. H. (*E.E.*, Dewsbury).
Carr, R. M. (*E.E.*, Leek).
Chattock, R. A. (*E.E.*, Birmingham).
Chisholm, G. S. (*Siemens Bros. & Co.*).
Clarke, R. (*Ch'n*, Worcester).
Clegg, S. (*E.E.*, Lincoln).
Cramb, A. C. (*E.E.*, Croydon).
Cridge, A. J. (*Electrical Co.*).
Christie, J. (*E.E.*, Brighton).
Cleary, Jas. (Brighton).
Clothier, J. H. (*E.E.*, St Annes-on-Sea).
Clough, A. (*E.E.*, Liverpool).
Cloughton, G. (Portslade).
Colville, G. H. (*Vice-Ch'n.*, Swansea).
Cooke, W. F. (*C'r*, Nelson).
Cooke, W. H. (*E.E.*, Luton).
Cooper, A. G. (*E.E.*, Colne).
Cooper, W. (*Vice-Ch'n*, Bolton).
Coupe, H. (*Ch'n*, Rawtenstall).
Couzens, H. H. (*E.E.*, West Ham).
Couzens, H. W. (London).
Coveney, A. (*E.E.*, Erith).
Craig, G. (*Ch'n*, Leith).
Crawford, W. (London).
Crawter, F. W. (*Chloride Co.*).
Croager, A. (London).
Croot, G. (*Ch'n*, West Ham).
Cross, Ed. (*E.E.*, Rotherham).
Crowther, J. A. (*E.E., Wallasey*).
Crowther, J. W. (*C'r.*, Sheffield).
Davies, Ald. R. C. (*Ch'n*, Chester).
Day, A. A. (*E.E.*, Bolton).
Day, C. (*Mirrlees, Bickerton & Day*).
Denton, H. H. (*E.E.*, Crewe).
Deverill, A. G. (*Brush Elec. Eng. Co.*).
Dexter, W. A. (*Mirrlees Watson Co.*).
Dick, J. R. (*Lucy & Co.*).
Dickinson, E. (*Ch'n*, Wigan).
Dixon, H. L. (*E.E., Leatherhead Co.*).
Dormann, E. (*E.E., Aron Elec. Meter*).
Duxbury, Ald. R. D. (*Ch'n*, Bury).
Eckersall, H. (*W. T. Glover & Co.*).
Ellaway, A. G. (*Ch'n*, Birmingham).
England, H. (*Ch'n*, Wakefield).
Eunson, D. M. (*E.E.*, Cambuslang).
Fawcett, Abraham (*C'r*, Halifax).
Fedden, S. E. (*E.E.*, Sheffield).
Fellingham, E. (*C'r*, Brighton).
Ferguson, R. F. (*E.E.*, Hastings).
Field, M. B. (*Ferranti, Ltd.*).
Foulds, H. (*Birmingham Elec. Dept.*).
Fox, E. J. (*Stewarts & Lloyds*).
Francis, O. F. (*E.E.*, Kirkcaldy).
Freir, W. E. (*Light Rly. & Try. Journal*).
Friederichs, H. F. (*E.E.*, W. Hartlepool).
Frisby, W. (*E.E.*, Colchester).
Furness, C. (*E.E.*, Blackpool).
Gatehouse, T. E. (*Electrical Review*).
Gibb, Thos. (*Ch'n*, Aberdeen).
Gibson, S. C. (*E.E.*, Nuneaton).
Gill, J. C. (*E.E.*, Peterborough).
Good, W. F. (*Ch'n*, Maidenhead).
Goslin, E. T. (*E.E., Glasgow Trams*).
Gregory, J. P. (*B. T-H. Co.*).
Hall, T. (*E.E.*, Burton-on-Trent).
Halmshaw, C'r (*Vice Ch'n*, Doncaster).
Hamilton, C. K. (Southsea).
Hammond, R. (London).
Hargreaves, T. W. (*Vice-Ch'n*, Burnley).
Harrison, Haydn (London).
Hawkins, H. J. (*E.E.*, Salford).
Hawtayne, W. C. C. (London).
Heald, J. (*Ch'n*, Lancaster).
Helme, D. (*E.E.*, Nelson).
Hewlett, E. H. (*E.E.*, Mansfield).
Higham, C. (*Vice-Ch'n*, Blackburn).
Hoadley, E. E. (*E.E.*, Maidstone).
Hodgkinson, S. (*Ch'n*, St. Annes-on-Sea).
Hogarth, L. B. (*E.E.*, Morecambe).
Hollingsworth, E. M. (*E.E.*, St. Helens).
Hopkinson, A. H. (*J. Hopkinson & Co.*).
Howard, H. L. (*E.E.*, Barking).
Huddleston, J. S. (*Siemens Bros. & Co.*).
Hurlbatt, E. J. (*Dick, Kerr & Co.*).
Jackson, J. (*Ch'n*, Partick).
Jackson, Ald. Wm. (*Ch'n*, Todmorden).
Jackson, W. A. (*E.E.*, West Bromwich).
Johnstone, Ald. M. (*Ch'n*, Carlisle).
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Lewis, A. (*Ch'n*, Kettering).
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MacLean, A. B. (*Craigpark Cable Co.*).
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Marshall, R. (*E.E.*, Ayr).
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Miller, Ald. D. B. (*Ch'n*, Croydon).
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New, M. (*General Electric Co.*).
Newington, F. A. (*E.E.*, Edinburgh).
Newington, S. W. (*E.E.*, Oldham).
Nisbett, G. (*B. I. & H. Cables*).
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Pauls, S. (*E.E.*, Middleton).
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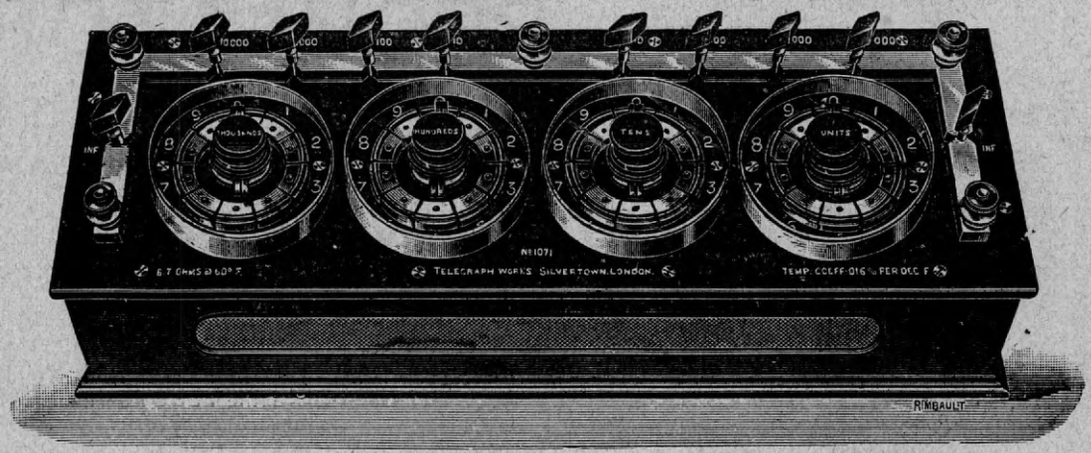
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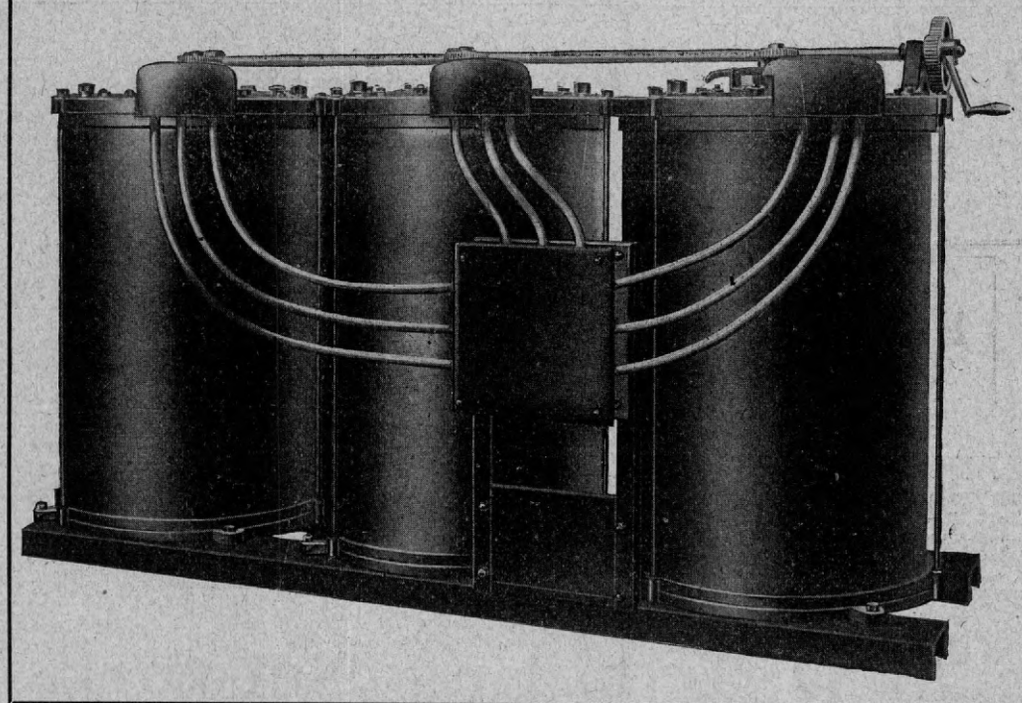
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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published June 8, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

12,664/10. **Telegraphy.** S. G. BROWN. The chief object of this patent is to render the transmission and reception of signals, especially in cable telegraphy, more distinct, and to protect the instruments from the action of Hertzian waves, and other outside influences, both electrical and mechanical. The relay described in the author's patent No. 11,135 of 1908, and which is used in this invention, being very sensitive to these outside sources, is encased in metal or other suitable material, together with its coils and conductors, and is provided with anti-vibration supports. The apparatus also includes a zero regulator, comprising a supplementary local winding and a current controlling device, and the relay contacts are arranged between the divided winding of the local regulating magnet of the relay. Twelve figures.

13,525/10. **Electromagnets and Armatures.** J. H. PARSONS and A. E. J. BALL. With electromagnets which have an armature reciprocating across the poles, jamming is likely to take place owing to the pivots wearing or through the structure becoming strained. This is obviated by constructing the armature in the form of a roller with a pivot at each end, and mounting it in a frame with pivots and slots, so that it is free to roll to and fro over the pole face and keep contact with it, and its motion can be transmitted to suitable apparatus. To increase the range and efficiency of the magnetic pull the pole can be shaped to an angle of about 15°, and a greater effective range of motion obtained. Instead of forming slots in the frame, the armature may be connected to the frame by pivoted links. In order to protect the pole and roller from rust and small particles of iron, they are electroplated. Four figures.

15,988/10. **Electric Cut-Outs.** MAX J. RAILING and C. C. GARRARD. This invention relates to cut-outs or fuse-holders, in which the fuse is supported inside a tubular structure of porcelain or other material, the idea being to prevent injury to the person placing them in circuit. It consists of an improved means for securing a shield and a handle to the fuse bobbin fitted with end contacts. The handle, which can be of wood or other insulating material, is attached to the fuse-holder, and between these two the shield, preferably of vulcanised fibre, is placed, being attached to the handle of the fuse-holder by means of a suitable projection on each of the contact pieces of the bobbin, and tapped to receive fixing screws, which pass through the ends of the handle, through suitable distance pieces, to the shield and fuse-holder, thus clamping the whole firmly together in a readily detachable manner. Two figures.

17,426/10. **Connecting Electrical Conduits to Fittings.** W. B. and A. K. INCLEDON. A means of ensuring proper metallic contact between T-shaped fittings and tubular conduits is covered by this invention, which consists of keeping the interior of the circular socket parallel for a short distance within, so as to fit the conduit, and then from the parallel part, of tapping further in and slightly tapering inwardly, with a V-shaped quick pitch screw thread, the threads being arranged so that when the plain end of the conduit is pushed into the socket and given a small turn, they will scrape the coating of enamel or other substance from the end and thus make proper contact. Two figures.

19,095/10. **Tungsten Filaments.** A.E.G. UNION ELEKTRICITÄTS GES. In the method of preparing tungsten filaments, where a binding material is used with the metal, a porous structure is left, in which the particles of metal are loosely combined, and the fusing together in the subsequent sintering operation is incomplete. This is particularly noticeable when the sintering is done by heating the filaments in a hydrogen atmosphere in an electrical furnace. The high temperature which is required, however, quickly destroys the material of the furnace, and this invention subjects the filaments to a preliminary treatment before sintering, which brings the particles into close combination. They are heated to a temperature of about 700—900° C. in ammonia or other gases containing nitrogen, so as to convert them into a nitrogen compound, which is again decomposed in the sintering operation.

Opposition to Grant of Patent

4,667/09. **Zinc Condensers.** J. LYSAGHT, LTD., and B. BEDDOE. The grant of this patent has been allowed after appeal to the Law Officer of the Crown. It relates to improvements in zinc condensers. A tube partially closed with a plug composed of a mixture of lime and carbon is attached to the outlet of the condenser. When the plug gets hot, the carbon prevents the entrance of oxygen, and also the ignition of the zinc vapour, while the lime reacts on any chlorides of ammonia or zinc that may be present.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.
Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: BERRY [Distributing system] 12,926/10; RASMUSSEN [Insulating composition] 28,834/10.

Dynamos, Motors, and Transformers: BRITISH THOMSON-HOUSTON CO. (*General Electric Co.*) [Transformers] 13,694/10; [A.-C. motors] 19,359/10.

Electrometallurgy and Electrochemistry: HERING [Electric furnaces] 15,139/10.

Heating and Cooking: GEISSINGER [Automatic electric heat control] 29,463/10.

Incandescent Lamps: UPTON [Means for fitting bulbs in sockets] 17,873/10; LUDECKE and IMPERIAL LAMP WORKS (*Brimsdown*), LTD. [Manufacture of metal filaments] 132/11; SCHALLER, 9,815/11; EARLE [Automatic lighting and extinguishing] 13,052/10.

Storage Batteries: DUNNE [Secondary batteries] 21,922/10.

Switchgear, Fuses, and Fittings: ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Switches] 13,195/10; [Starters] 13,224/10; [Controllers] 13,325/10; [Electro-mechanical controlling devices] 17,110/10; LITTLER [Circuit-breaker] 16,485/10; DICKSON [Switches and signs] 18,359/10; THOMPSON (*Wirth, Beck, and Knauss, Firm of*) [Electrically-operated mechanisms] 24,808/10.

Telephony and Telegraphy: SIEMENS & HALSKE AKT.-GES. [Telephone exchange circuits] 22,013/10; [Exchanges with automatic call distributors] 27,860/10; GARDNER and FERGUSON [Apparatus for causing electrical impulses] 27,223/10; DR. ERICH F. HUTH GES. and HIRSCH [Wireless telegraphy apparatus] 5,248/11.

Traction: SPEIGHT and WALMSLEY [Ears for overhead conductors] 21,522/10; SOC. VEDOVELLI, PRIESTLEY ET CIE. [Suspension chain for H.-T. transmission wires] 27,174/10.

Miscellaneous: DU BELLE [Electrical mechanism for typewriters] 13,910/10; SIEMENS BROS. DYNAMO WORKS, LTD., KIEFFER, KLOSS, and CROWLEY [Centrifugal fans] 18,349/10; BAUER [Appliances for producing X-ray pictures] 25,205/10; LEEDS FORGE CO. and FERGUSON [Electric lighting from variable-speed dynamos] 28,695/10; CROMPTON & CO. and BURGE [Means for converting electric currents] 29,726/10; TAYLOR [Railway signalling apparatus] 917/11; SAUL [Motor tractors for agriculture purposes] 13,932/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Switchgear, &c.: SCHRODER [Time switches] 7,416/11; ELEKTROMOTOREN-WERKE HERMANN GRADENWITZ [Remote control systems] 10,550/11; MONARD [Signal and point control] 10,740/11; ALLGEMEINE ELEKTRICITÄTS GES. [Motor control] 12,921/11.

Instruments: SCHOTT & GEN. [Electrolytical measurement of electricity] 10,792/11; SOC. ANON. DES ETABLISSEMENTS LACOUR BERTHIOT [Telemeters] 12,319/11.

Miscellaneous: SOC. ANON. "LE DETECTIVE" [Electro-thermic contacts for fire bells] 12,450/11; RENNERT [Automatic fire alarms] 12,485/11; WHALTON [Electric hammers] 12,742/11.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

15,411 of June 28th, 1897. **Electric Igniter for Gas Engines.** R. BOSCH. This invention relates to an electric ignition apparatus with stationary armature placed between the poles of one or more powerful magnets, around which a suitably actuated envelope is suspended and moves to and fro.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: CROMPTON & CO. and A. J. HODGSON, 5,164/04.

Distribution Systems, &c.: BRITISH THOMSON-HOUSTON CO. (*General Electric Co.*) [Electric insulating compositions] 4,925/06.

Dynamos, &c.: OTIS ELEVATOR CO. (*Otis Elevator Co.*) [Dynamo-electric machines] 5,003/06; F. W. HOWORTH (*Maschinenfabrik-Oerlikon*) [Dynamo-electric machines] 5,037/06.

Instruments, &c.: J. E. LEA [Meters] 4,961/06.

Telephony, &c.: H. H. LAKE (*Direct Line General Telephone Co.*) [Telephone systems] 4,362/05; W. D. SHAW-BROWNE and S. A. WILLIAMS [Telephones] 5,093/06; L. DE FOREST [Wireless Telegraphy] 5,258/06.

Traction: E. M. PRESTON and A. F. ROCK [Railway Signals] 5,306/04.

Miscellaneous: K. R. ODMAN [Electric lifts] 21,146/06.

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LOCAL NOTES

Barking: *Electricity Extensions.*—The Barking Traders' Association have decided to engage counsel to oppose an application by the Council to the Local Government Board for sanction to a loan of £11,400 for extensions to the electricity works.

Barrow-in-Furness: *Electricity Accounts.*—There was a deficit of £759 upon the working of the electricity undertaking last year. The sum of £900 was spent out of revenue upon new street lamps.

Belfast: *Cavehill and Whitewell Tramways.*—Judgment was delivered in the King's Bench Division, Dublin, last week, with regard to the objection of the Belfast Corporation to the validity of Mr. Lynden Macassey's award as to the purchase price which the Corporation should pay for the Cavehill and Whitewell tramways. The Corporation objected to the award on the ground that it was excessive by reason of the basis which was adopted by the arbitrator for valuing the undertaking. The arbitrator refused to value the undertaking except as a going concern, but the Court now held that this was a wrong basis, and that, consequently, they had jurisdiction to set it aside. The price given by the arbitrator was £56,155, and the Court have set the award aside, and remitted the matter to the arbitrator for him to make a new award not later than November 1st. The reason for the decision of the Court is that Mr. Macassey, in the arbitration, had placed a wrong construction upon the agreement between the parties by which the Corporation were to purchase the tramways.

Burnley: *Tramway Accounts.*—The tramway accounts for the past year enabled the placing of £5,000 to reserve, and £4,049 to relief of rates. The reserve fund now stands at £46,096. The Committee have decided to cover the remaining 21 cars with top covers.

Dover: *Electricity Accounts.*—There was a net profit of £922 upon the electricity undertaking last year. This is the first time a profit has been made since the Council took over the undertaking from the company, and the profit has been utilised in the reduction of the outstanding deficit, reducing this to £4,424.

Glasgow: *Tramway Accounts.*—The accounts for the year to May 31st, after meeting sinking fund and interest, show a net profit of £68,678, against £52,028. The total number of passengers carried was 237,967,307, against 222,730,571.

Electricity in Theatres.—The City Magistrates have been requested to consider the appointment of a special inspector for dealing with electrical fire risks in theatres and music halls. It was decided not to recommend such an appointment, as this work is at present efficiently carried out by the chief officer of the fire brigade and the electrical engineer.

Kettering: *Action by Borough Electrical Engineer.*—Mr. W. A. Walker, Engineer and Manager of the Corporation Electricity Works, recovered £10 damages against the proprietors of the *Northampton Mercury*, last week, for libel. It appears that in the report of a case regarding an assault which took place in the Kettering Electricity Works, and in which Mr. Walker's name was mentioned, the process of sub-editing allowed Mr. Walker's name to appear immediately after a line which said that somebody else was the worse for drink. Mr. Walker complained that this inferred that he was the worse for drink, and, although the proprietors of the paper in question inserted in two successive weeks an explanation and apology, Mr. Walker desired greater publicity in open court.

King's Lynn: *Electricity Accounts.*—There was a net profit of £1,033 upon the working of the electricity undertaking last year. Of this, £300 are to be transferred to relief of rates. The charge for private lighting is to be reduced to 4d. per unit.

Lincoln: *G.B. Tramway.*—In his report upon the working of the G.B. Surface Contact Tramways, at Lincoln, last year, Mr. Stanley Clegg states that the system has now been running for 5½ years; the life of the stud-heads had only been estimated at 5 years, and it was necessary to renew them, as most of them had worn below the road level. The carbon in various parts of the track was also renewed, and the total cost of repairs during the year amounted to £263. The total amount spent in repairs on the G.B. system since 1906 is £539, an average of £108, or £18 per annum in excess of the amount guaranteed by the G.B. Company, but Mr. Clegg thinks there is no need to anticipate that by the end of the ten years' guarantee given by the Company this excess amount will still appear. The re-carboning should be finished this year, and for the next two or three years the cost of maintenance should be very considerably reduced.

Russia: *New Electrical Work.*—A Reuter telegram from St. Petersburg states that an inter-departmental Commission has passed a very favourable report on the project submitted to the Government by Mr. C. H. Stewart, an English engineer, for the construction of water power electricity works in the Caucasus. It is proposed to establish two generating plants, one on the banks of the river Terek, and the other on the mountain of Gokycha.

Stafford: *Electricity Accounts.*—There was a net profit of £607 on the electricity accounts for last year, and from the accumulated balance of £752, the Electricity Committee recommend the transfer of £600 to depreciation account.

Stalybridge: *Tramway Board's Account.*—The accounts of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board show a deficiency for the past year of £5,938 on the tramways. The loss will be borne equally by the four corporations concerned.

Stoke-on-Trent: *The New Electricity Scheme.*—Mr. H. R. Hooper, Local Government Board Inspector, held an enquiry last week into an application by the Corporation for sanction to borrow £60,000 for the purpose of erecting a new generating station for the unification of electric supply in the new federated town. The proposal is to erect a new power station in Hanley, using the existing stations in Hanley, Burslem, Stoke, and Longton as sub-stations. The details of the scheme are as follows: buildings, £9,415; generating plant, £29,056; sub-station plant, £8,435; extra high tension mains, £13,494. Mr. C. H. Yeaman Borough Electrical Engineer, and Mr. J. F. C. Snell, who is advising the Corporation, gave evidence regarding the scheme, among the opponents to which are the Northern Electricity, Power, and Gas Co., North Staffordshire Railway Co., and a number of individual ratepayers, including Mr. H. Coates, who was at one time chairman of the Hanley Electricity Committee. The evidence of the engineers was to the effect that it is impossible to face next winter without further generating plant, and that it was much more economical to concentrate in one large power station than to extend the existing smaller stations.

Sunderland: *Electricity Accounts.*—There was a net profit of £1,189 upon the electricity undertaking last year. The total units sold were 10,800,000 as compared with 7,000,800 units in the previous year.

Taunton: *Electricity Accounts.*—The accounts of the electricity department for last year show a net profit of £105.

Tunbridge Wells: *Street Lighting.*—A number of arc lamps have been changed to 500 c.p. incandescent lamps.

Warrington: *Electricity and Tramway Accounts.*—The accounts of the electricity and tramways undertakings for the past year show profits of £2,667 and £2,344 respectively, the bulk of which has been transferred to relief of rates.

Worcester: *Position of Electricity Undertaking.*—At the last meeting of the Corporation, a discussion took place as to the position of the electricity undertaking, and the loss which it is alleged to be making. The Chairman of the Committee contended, however, that the Committee paid last year £202 as income tax, and obviously they would not have done so had there been no profit. As a matter of fact, they were making a profit of £3,000 a year, but it was absorbed in repayment of loans. Alderman Millington contended that the undertaking should be sold, and suggested that he knew persons were were willing to buy it now. An amendment to the adoption of the Electricity Committee's report to the effect that negotiations should be entered into for the sale of the undertaking, was lost by a large majority.

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GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Aldershot.—An application has been made to borrow £2,500 for extensions at the electricity works.

Australia.—Tenders are invited, says the *Board of Trade Journal*, for the supply of a dynamo and booster, storage battery, and accessories, switchboard, cables, and wires, by the Mortlake Butter and Cheese Factory Co., Ltd., Victoria, by August 14th. Specifications, &c., from Messrs. F. A. M'Carty and Co., 31, Queen Street, Melbourne. Fee, 10s. 6d., returnable. A specification may be seen at 73, Basinghall Street, London, E.C.

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The Brisbane Metropolitan Water and Sewage Board invite tenders, by January 30th, 1912, for the installation and erection of electric generating plant and pumping plant. Particulars from the Secretary, Albert Street, Brisbane.

Manchester.—A Local Government Board enquiry was held last week concerning a loan of £12,186 for additional generating plant, and £50,000 for new mains and services.

Newcastle-under-Lyme.—A loan of £5,400 is to be applied for by the Electricity Committee.

Redditch.—A loan of £5,850 is to be applied for by the Electric Lighting Committee.

Rotherham.—The Electricity Department invite tenders, by July 8th, for a year's supply of single vulcanised bitumen-covered cables of various sizes. Particulars from Borough Electrical Engineer.

Rugeley.—The Council have an electric lighting scheme under consideration. A proposal has been placed before it by a firm of electrical engineers.

Stockton-on-Tees.—A Local Government Board inquiry was held, last week, into a loan of £6,750 for extensions to the electricity plant.

Taunton.—A loan of £2,500 is to be applied for in connection with extensions to the electricity department.

Walsall.—The sum of £17,840 is to be expended on electrical extensions.

Wednesbury.—A loan of £2,550 is to be applied for in connection with new mains and services.

WIRING

Bexhill.—Infants' school. Architect, H. B. Burke-Downing, 12 Little College Street, Westminster Abbey, S.W.

Bristol.—Mission hall in St. Mark's Road.

Dumbarton.—Proposed new baths.

Exmouth.—Police station and petty sessions room. Devonshire County Architect, Exeter.

Londonderry.—Tenders are invited, by July 7th, for the electric lighting and fitting of the new Guildhall. Particulars from City Electrical Engineer.

Pontypool.—New church.

Pontypridd.—Infants' school at Wood Road. Borough Surveyor.

Southampton.—New out-patients' building at the Royal Southampton Hospital.

Stoke-on-Trent.—Enlargement of Goldenhill school buildings. Architects, A. R. Wood and Son, Town Hall, Tunstall.

Taunton.—New Council school.

MISCELLANEOUS

Australia.—The Deputy Postmaster General, Melbourne, invites tender, by August 8th, for the supply of electrical measuring instruments and telephone instruments and parts. Copies of specification at 72 Victoria Street, S.W.

New Zealand.—The *Board of Trade Journal* states that tenders for the supply of overhead tramway material, feeders, &c., for the Wanganui tramways, are invited by August 4th. Tenders to the Secretary, Gonville and Castlecliff Tramway Board, Ridgeway Street, Wanganui. Copies of specification, &c., may be seen at 73 Basinghall Street, London, E.C.

Rotherham.—Tenders are invited, by July 8th, for a year's supply of ampere-hour meters. Borough Electrical Engineer.

TENDERS RECEIVED AND ACCEPTED

Bristol.—The following tenders have been accepted: W. Geipel and Co., open type arc lamp carbons, £345 15s.; Sloan Electrical Co., Ltd., flame arc lamp carbons, £371; Sykes and Sugden, Ltd., conduit, £199; British Westinghouse Co., A.C watt-hour type meters, £385 15s.

Nelson.—The Council have accepted a tender of the Tudor Accumulator Co. for the replating of the storage battery and its general maintenance for a period of ten years, and also for the supply of a booster balancer machine and switchgear.

Salford.—The tender of the Hadfield Steel Foundry Co., Ltd., Sheffield, for special tramway work, at £2,304, has been accepted.

Royal Society of Arts.—The Albert medal of the society for the current year has been awarded to the Hon. C. A. Parsons, F.R.S., for his work on steam turbines.

Damages for Electric Shock.—At the Westminster County Court last week a carpenter named William Potts was awarded £50 damages against the Metropolitan District Railway Co., for an electric shock. It was stated that he was standing on Putney Bridge Station platform in a pool of water after a heavy rain shower, and that he received an electric shock, which threw him on to the rails and severely injured him.

MISCELLANEOUS BUSINESS NOTES

The North British Rubber Co.—This company have taken a large stand at the forthcoming indiarubber exhibition, where their comprehensive exhibit will embrace practically everything of indiarubber and vulcanite.

Bankruptcies.—The public examination of Mr. E. M. Oppermann took place last week. The liabilities are returned at £2,425, and the assets at £12. In 1905 the debtor formed the "X" Electric Accumulator Co., Ltd., of which he was manager, at a salary of £500 per annum. This company failed in 1906, and the "X" Syndicate was formed to take over the business. He was managing-director of this company until it went into compulsory liquidation in 1908.

Change of Address.—Mr. J. G. Lorrain, Consulting Engineer and Chartered Patent Agent, informs us that from 24th inst. his address will be:—Staple Inn Buildings, Holborn, W.C.

Trolley Omnibuses.—The trolley omnibus services in Leeds and Bradford were opened on Tuesday.

Forthcoming Publication.—Messrs. J. J. A. Churchill (7, Great Marlborough Street, W.) inform us that they have in preparation a volume entitled "Who's Who in Science," forming a book of reference, containing the names, appointments, and achievements of the world's foremost men of science, and edited by Mr. H. H. Stephenson.

Immingham Docks.—We have received from Messrs. W. H. Jackson & Co., of Grimsby, a copy of a publication entitled "The Port of Grimsby and Immingham," which gives interesting general information about the new docks at Immingham in three languages, and points out their great facilities in connection with many branches of commerce.

Hartlepool Tramways Arbitration.—On Wednesday, Mr. Justice Bray, in the King's Bench Division of the High Courts, reserved judgment in an action which raises an interesting legal point in connection with the purchase of the Hartlepool Electric Tramways Co.'s undertaking by the Hartlepool Corporation. Arbitration proceedings were concluded a short time ago, by which it was agreed between the parties that the sum of £12,963 should be taken as the agreed sum to be paid by the Corporation for the tramways within the Borough. At the same time, the arbitration proceeded under protest by the Corporation in the following circumstances. The original provisional order for the Hartlepool Tramways was obtained in 1895 by Messrs. Sellon & Ashby, who transferred it to the Hartlepool Tramways Co. for the sum of £990. This transfer, however, did not receive the sanction of the Board of Trade, and the Corporation raised the point as to whether either Messrs. Sellon & Ashby or the Hartlepool Tramways Co. had a good title to the tramways. Mr. Atherley Jones, K.C., who appeared for the Tramways Co., argued that inasmuch as Messrs. Sellon & Ashby had not received statutory sanction to the transfer of the Order, they were still "Promoters" for the purposes of the Tramways Act, and that the money should be paid to them. It was immaterial, he said, to whom the Corporation paid the money, so long as they had a good title to the undertaking, and Messrs. Sellon & Ashby, in conjunction with the Tramways Co., would take all the necessary steps to see that the Corporation, when they had paid the money, would have a good title to the tramways. Mr. Balfour Browne, K.C., who appeared for the Corporation, argued that Messrs. Sellon & Ashby had transferred their powers to the Tramway Co., and therefore were no longer concerned in the matter. At the same time, the transfer had not been sanctioned, as provided for by Parliament, and consequently in a legal sense the Tramway Co. were trespassers on the streets of Hartlepool, and the Corporation, in his opinion, had no legal power to pay either party. He believed that they would be surcharged by the Local Government Board if they paid the money over in the present circumstances. It seemed to him that the tramways at present belonged to nobody, and the only way to put the matter right was to apply to Parliament for a new Provisional Order or an Act of Parliament which would clothe the Company with the necessary powers. The Corporation would not oppose an application to Parliament of this sort. Mr. Justice Bray said it seemed to him that he could only refuse to order the Corporation to pay the money over to Messrs. Sellon & Ashby if he could see that there was not a good title to the undertaking. It appeared to him that Messrs. Sellon and Ashby had never sold their right to work the tramways, because they had entered into an invalid sale, and consequently they still had a good title. Judgment will be given later.

OSRAM·LAMPS

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COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Marconi's Wireless Telegraph Co.—It is anticipated that the annual report, which will shortly be published, will show a sufficient balance to pay off the arrears on preference dividends and also to pay a dividend on ordinary shares. According to the *Yorkshire Daily Observer*, important negotiations are proceeding between the company and the British and Colonial Governments, with regard to a proposal to link up all the colonies.

Westinghouse Electric and Manufacturing Co. (U.S.A.).—The gross earnings for the year to March 31st were $3,819,312 more than in the previous year. The directors recommend the payment of the accumulated preferred stock dividends.

Victoria Falls & Transvaal Power Co.—The profit on the last year's working was £157,749, compared with £50,534 in 1909, and after meeting the preference dividends the sum of £37,400 was carried forward. An additional power station is being erected at Vereeniging, from which transmission lines will be carried to the Rand.

British Electric Traction Co.—At the annual meeting last week the report and accounts given in our last issue were adopted. Sir Charles Rivers Wilson, the retiring chairman, presided. In giving a short retrospect of the Company's history, he said that their earlier anticipations had not been realised owing to a large extent to the introduction of a large and disturbing element of local politics. If it were possible to increase the average fare per passenger by only a small fraction of a penny, they would be able to earn sufficient profits, notwithstanding the higher wages and other advantages to the workpeople which municipal tramway undertakings offered, and which large tramway companies had been forced to follow. The main reason why the British Electric Traction Co. was not now paying larger dividends was that the considerable investments which they had in their associated companies were not adequately remunerative for the reasons he had stated. So far as the present position was concerned, an improvement had taken place last year, and it was being fully maintained during the present year. The scheme for dealing with the arrears of dividends upon the preference shares was a rearrangement, and not a reduction, of capital. The directors did not despair of being able to formulate a scheme which would be acceptable to both classes of shareholders. A long discussion took place at the end of the Chairman's speech, and a resolution calling for the appointment of a shareholders' committee was carried on a show of hands. The directors, however, demanded a poll, with the result that the appointment was rejected by 6,047 to 2,982 votes.

NEW COMPANIES

VENNER TIME SWITCHES, 6 Old Queen Street, Westminster. Capital, £7,000. To adopt an agreement with R. F. S. Venner, R. C. Griesbach, and E. E. Sharp.

ELECTRIC FITTINGS COMPANY (1911), 38 Conduit Street, London. Capital, £5,000. To acquire the existing company at the above address.

J. J. GUEST & CO., Coventry.—Capital, £20,000. Electrical and mechanical engineers.

PATENT SERIES LIGHTING CO., Halifax.—Capital, £5,000.

SAMUEL HARTFORD & CO., *Liverpool.*—Capital £1,000. Manufacturers of and dealers in wires, cables, &c.

CAVENDISH ELECTRICAL CO., 130, Great Portland Street.—Capital, £5,000. Manufacturers of, and dealers in, medical electrical apparatus.

Wireless Telegraph Notes.—The official report of Thursday afternoon's proceedings at the Conference of Colonial Premiers states that Sir Joseph Ward moved a resolution with regard to extending the use of wireless telegraphy throughout the Empire, with the ultimate object of establishing a chain of British State-owned wireless stations which in emergency would enable the Empire to be to a great extent independent of submarine cables. Mr. Herbert Samuel, Postmaster-General, agreed with the proposition, but the Government did not think it advisable at the outset to establish the system in every direction simultaneously. The Government proposed that a beginning should be made with a chain of six stations, one each in England, Cyprus, Aden, Bombay, Straits Settlements, and Western Australia, and from there would be linked up to New Zealand. Later on South Africa would be connected. It was suggested that the United Kingdom should bear the cost of the first three stations, that India should bear the cost of Bombay station, and that New Zealand and Australia should bear the cost of the stations in their respective territories.

THE ELECTRICAL CONGRESS AT TURIN

THE International Congress of the Applications of Electricity, at Turin, is fixed for Sept. 10th-17th. The following subjects are down for discussion. The names of those presenting reports on these subjects are given in brackets. Electrical and mechanical characteristics of modern electric generators, with special reference to very high speed machines (P. Behn-Eschenberg); present state of technical progress in the manufacture of staticnary and traction batteries (Dr. Beckmann); on the simultaneous running of several generating plants, all feeding the same system of network; the selection of the transmission and distributing pressure and the design of switchboards and sub-stations in large electrical installations, taking into account both economy in first cost and continuity of service (P. Torchio); underground high tension networks in metallic connection with overhead lines (1. Grosselin); present state of research in reference to abnormal rises in pressure and means of their prevention and protection of the system (J. Faccioli); construction and use of automatic circuit breakers (E. Ragonot); methods of cooling transformers of moderate power; converters, rectifiers and motor generators (S. P. Thompson); the problem of frequency transformation (P. Bunet); three-phase variable speed motors, with special reference to rolling mills and paper mills (G. Sarli); technical and economical influence on the lighting industry of the new metallic filament-lamp and the metallised carbon arc lamp (D. Wedding); monophase traction versus three-phase traction on main lines; high tension continuous current traction versus monophase traction on suburban lines (F. J. Sprague); overhead line construction for electric railways (G. L'Hoest); direct production of steel from ores by means of the electric furnace (R. Catani); sterilisation of water by processes employing electricity (Dr. Erlwein); electricity meters, with special reference to different kind of loads (H. C. Sharp and A. Durand); Government control of meters (A. Denzler); rational methods of commercial measurement of electric power (G. G. Ponti); the problem of increasing the load factor in central stations (G. Sartori); application of electricity to submarine boats (A. Bezzi); long distance wire telephony (F. B. Jewett); wireless telephony (V. Poulsen); automatic telephone exchanges as a means of economy and improvement in telephonic communication in large cities (H. Milon); research on secrecy in wireless telegraphy (P. O. Pedersen); present and future development of electric heating (C. A. Rossender); comparative study of the direct and indirect methods of taxing electricity in different countries (M. Bonghi and Dr. Frey); Government regulations in reference to the electric transmission of power (E. C. Ericson and H. Schreiber); distribution of electric power for agricultural purposes (Mr. Leclerc); the various systems of multiple telegraphy (Major W. A. J. O'Meara). The following papers are also announced: Mr. P. Boucherot (Paris), "Les phénomènes électromagnétiques qui résultent de la mise en court-circuit brusque d'un alternateur"; Dr. Hallo (Karlsruhe), "Cascadenumformer"; Mr. H. Stockar (Zurich), "Aluminium für elektr. Leitungen"; Ing. E. Soleri (Turin), "Gli estremi limiti di applicabilità dei cavi ad alta tensione"; Mr. J. Routin (Lyons), "Régulateurs automatiques"; Mr. J. Neher (Geneva), "Misuratori elettrici a tariffa multipla"; Ing. A. Dina (Palermo, Italy), "Su alcuni metodi di prevenzione delle sovratensioni interne"; Mr. S. Q. Hayes (Pittsburg), "Commercial apparatus for 100,000 volts service"; Prof. R. Arnò (Milan), "Watt-voltamperometri elettrodinamici e a induzione"; Prof. R. Arnò (Milan), "Di una soluzione del problema della compra-vendita razionale dell'energia elettrica"; Ing. P. Lanino (Rome), "La trazione elettrica in riguardo alle esigenze del servizio ferroviario"; Dr. W. Kummer (Zurich), "Ueber die Ausbildung der Triebfahrzeuge für elektrischen Vollbahnbetrieb mit Einphasenwechselstrom"; Ing. Guillaume Gyaros (Budapest), "Traction électrique appliquée aux lignes vicinales spécialement par rapport au système du courant continu à haute tension"; Dr. Osuke Asano (Tokio), "Progress in electrical installation in Japan"; Mr. J. A. Montepellier (Paris), "La technique de l'accumulateur électrique notamment en ce qui concerne l'accumulateur alcalin fer-nickel"; Mr. Etienne de Fodor (Budapest), "Etat actuel de la question de la destruction des ordures en combinaison avec les usines électriques"; Mr. Leon Gaster (London), "The international outlook in scientific illumination"; Dr. Charles P. Steinmetz (Schenectady); Mr. le Prof. Quirino Majorana Calatabiano (Rome), "Ricerche di telefonia senza fili"; Dr. A. E. Kennelly (Cambridge, U.S.A.), "The rotating electric current field"; Mr. T. C. Martin (New York), "The electrotechnical industries of America"; Mr C. O. Mailloux (New York), "Electrification of railroads."

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SUMMARY

In his Presidential Address to the Incorporated Municipal Electrical Association at Brighton, on Tuesday, Mr. Christie spoke in favour of the flat rate system of charging, but advocated the development of restricted hour charges for power, &c., mentioning bakers' ovens as a good field for extension in this direction. While in favour of municipal powers for selling and hiring, he was opposed to any general extension of municipal wiring or the selling of electric light fittings. Councillor Leese followed with a Paper made up of a number of interesting notes and comments from a Committeeman's point of view. This included also two curves showing the variation in the cost per kw. of turbo-alternators with size, and the comparing the steam consumptions of units of different outputs. Speakers in the discussion endorsed Mr. Leese's contention that profits should not be allocated to relief of rates, and Councillor Smith of Glasgow stated authoritatively that the President of the Local Government Board held this view. The other Paper on Tuesday was on Modern Wiring Practice, by Mr. J. W. Beauchamp. He recommended that the supply authority, since they could not enforce regulations as to details of wiring, should issue "official" model specifications. He next reviewed existing practice at considerable length, bringing out several interesting points, and expressing his opinion freely on various technical details. Mr. Beauchamp and several speakers regretted that the new edition of the Institution Rules condemned ordinary slip-joint conduit systems, but one of the other speakers said that they would not have them installed on any pretence whatever. Some interesting comparative prices for wiring were quoted, and wires simply threaded through the joists without casing were warmly advocated by three speakers. Stannos wiring was also discussed. On Wednesday, at Portsmouth, two Papers were discussed. One by Mr. H. L. Howard dealt with Diesel engine plant, and gave figures in support of the author's contention that, even in the case of a very large electricity works, Diesel engine plant would involve lower capital cost and lower works costs than steam or gas plant. The Diesel engine was described and illustrated, and its advantages enumerated. In the other Paper, Mr. R. M. Carr advocated gas engines and producer plants for small stations. (Pages 357 to 362 and 365 to 369.)

Railless trolley services have been inaugurated in Leeds and Bradford, and are the first of their kind in this country. Each car is equipped with a pair of under-running trolley poles, and is driven by two 20 h.p. motors, one driving each rear wheel through worm gearing and side chains. (Page 363.)

A new form of steam trap of the float type, in which only a small relay valve is marked by the float, so that a very large main valve can be employed, is described in a short article. (Page 364.)

We illustrate an illuminated car which has taken part in the Coronation festivities at Bradford. (Page 364.)

A simple form of current gauge is described in a short article. (Page 369.)

Electricity has played a prominent part in the Coronation illuminations. We describe the principal features of some notable installations in London. (Page 370.)

Among the specifications published by the Patent Office on Thursday last was one by G. Berry on series transformer switchgear, and another on transformers by the British Thomson-Houston Co. Crompton and Co. and H. Burge dealt with converters, and the Adams Manufacturing Co. described motor starters. A patent for copper refining, which had expired, has been restored to L. Juman. Opposition has been

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entered to the grant of a patent to P. Marino on separators for primary batteries, and a printing telegraph system by H. A. Rowland has expired after the full term of fourteen years. (Page 372.)

THE Postmaster-General will shortly introduce a Bill authorising the transfer of the National Telephone Co. to the State. This Bill will authorise an expenditure of £4,000,000 upon the development of the telephone system, in addition to the £2,000,000 already authorised.— A system of travelling scholarships is to be established in the Post Office in order to enable Post Office engineers to study the telephone abroad.— The whole of the Company's staff will be taken over at the end of the year.—In the Court of Appeal yesterday the Master of the Rolls and the Lords Justices Farwell and Kennedy gave judgment in the case between the National Telephone Co. and the General Post Office, a decision being given in favour of the Post Office. (Page 372.)

THE accounts of several of the electricity undertakings have been published during the week. Profits are reported from Barrow-in-Furness, Finchley, Luton, South Shields, Oldham and Sunderland, but at Clacton-on-Sea and Dudley the result has been a deficit.—The L.C.C. tramway service over Battersea Bridge commenced traffic last week. (Page 373.)

TENDERS are invited for gas engine plant, battery and street lighting equipment for Swinford; Local Government Board enquiries have been held at Bispham, Carlisle and Worcester, and an application for a loan of £5,000 is to be made at Torquay; and a Diesel engine and dynamo is required for Aldershot. (Page 374.)

THE American Marconi Co. is stated in the report to be more than self-supporting. Steps are to be taken for the protection of the Marconi patents in America. The Marconi International Marine Communication Co. reports a profit of £10,765, and a dividend of 5 per cent. is recommended. The accounts of Messrs. J. G. White and Co. show a net profit of £91,466. The Rosherville Station of the Victoria Falls and Transvaal Power Co. is stated in the report to be nearly completed. (Page 375.)

ARRANGEMENTS FOR THE WEEK

THURSDAY, JUNE 29TH (TO-DAY).

Institution of Civil Engineers.

10 a.m. Continuation of Conference on the Training of Engineers.

9 p.m. Conversazione at the Albert Hall.

I.M.E.A.

10 a.m. At Royal Pavilion, Brighton:—Discussions: (1) "Purchase of Fuel," to be opened by Mr. C. E. C. Shawfield; (2) "Street and Shop-front Lighting," to be opened by Mr. A. H. Seabrook.

2.45 p.m. Visit to Corporation electricity sub-stations and L.B. and S.C. Rly. locomotive workshops.

7 p.m. Annual Dinner at the Dome.

FRIDAY, JUNE 30TH.

I.M.E.A.

10 a.m. Annual General Meeting, at the Royal Pavilion, Brighton.

Physical Society.

5 p.m. At Imperial College of Science, London: (1) "On the Effect of a Narrow Saw-cut on the Edge of a Conducting Strip on the Stream Lines in the Strip, and on the Resistance of the Strip," by Prof. C. H. Lees, F.R.S.; (2) "The Capacity of Co-efficients of Spherical Electrodes," by Dr. A. Russell; (3) "Exhibition of the Benkö Primary Battery," by W. R. Cooper.

MONDAY, JULY 3RD.

Electrical Contractors' Association.

6.30 p.m. Annual dinner at Frascati's Restaurant.

WEDNESDAY, JULY 5TH.

National Electrical Manufacturers' Association.

12 noon. Council meeting at the Institution of Electrical Engineers.

3 p.m. Special general meeting at the Institution of Electrical Engineers.

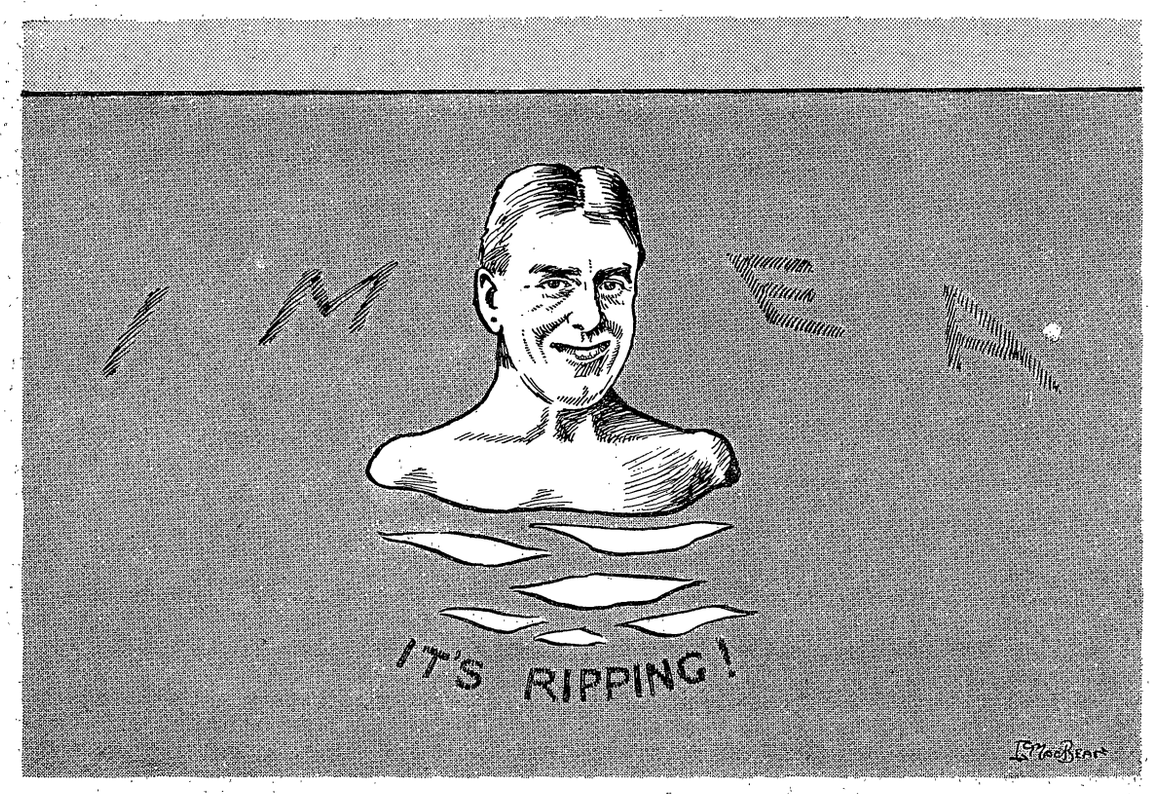
THURSDAY, JULY 6TH.

National Electrical Manufacturers' Association.

2.30 p.m. Council meeting at Offices of Association.

Institution of Electrical Engineers.

9 p.m. Conversazione at Natural History Museum, South Kensington.



MR. JOHN CHRISTIE (President of the Incorporated Municipal Electrical Association, which is meeting at Brighton this week): It's Ripping!

(With apologies to the S.E. & C. Railway's Herne Bay poster.)

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SIXTEENTH ANNUAL CONVENTION OF THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION

THE sixteenth annual Convention of the Incorporated Municipal Convention Association was opened at Brighton on Tuesday. Councillor C. Thomas Stanford, M.A., J.P., the Mayor of Brighton, offered the Association an official welcome, and referred to the pride which the Council and town generally have in their electrical undertaking, and also their pleasure at the selection of Mr. John Christie, their electrical engineer, as President. The attendance at the Convention is a record one, more members being present than on any previous occasion, and the number of ladies who have accompanied them is also a record one. After a vote of thanks to the Mayor for his welcome, Mr. Christie delivered his Presidential Address, which we give in a slightly abbreviated form below.

PRESIDENTIAL ADDRESS.

BY J. CHRISTIE.

(Engineer and Manager, Corporation Electricity Department, Brighton.)

Mr. Christie commenced his Address by thanking the members for having paid the town of Brighton the compliment of selecting her engineer as their President for a second time. The previous occasion was fifteen years ago, under the presidency of Mr. Arthur Wright. The Association then numbered only 114, and the capital represented was about £3,000,000; now there are 407 members, representing practically the whole of the municipal electrical undertakings throughout the kingdom, and a capital of £41,000,000.

So far as he could ascertain, Mr. Christie continued, Brighton could claim to have been first in the field with regard to both electric lighting and traction. The first electric railway in this country had been started there in August, 1883, through the enterprise of one of their respected townsmen, Mr. Magnus Volk, and the dynamo now driving it had been in regular daily use for upwards of a quarter of a century. In 1891 one of the earliest experiments in electric lighting in this country had been carried out under the auspices of the Brighton Corporation; the installation consisted of six arcs, each lamp being run off its own separate machine. The following year Messrs. Hammond & Co. laid down a small plant which supplied a series of arc lamps installed in the business premises of several of the leading tradesmen, and this was, Mr. Christie believed, the first instance of a central station for the public supply of electricity to be established in this country; and during these twenty-nine years the inhabitants of Brighton had always enjoyed the use of electricity as an illuminant. In those days it had been rather a luxury, costing in the neighbourhood of 2s. per unit, and in spite of this good price the enterprising promoters had obtained little but experience as a reward. Series arc, and later multiple-series incandescent lighting, gave place to the 2,000-volt A.C. house to house transformer system. In 1891 the Corporation obtained a Provisional Order, and shortly thereafter commenced a two-wire D.C. supply with underground mains, competing with the company. In 1893 the company was bought out for £5,000, and the old plant disposed of. After that the two-wire system was changed to a three-wire system, H.T. single-phase alternating current was again introduced to meet the demand in the outlying area at times of peak load, later the voltage of the supply in these districts was doubled, and continuous current once more displaced the alternating. In 1905 the North Road Works as a steam generating station was superseded by the new three-phase turbine waterside station at Southwick [see description in last week's ELECTRICAL ENGINEERING]. To meet the continually increasing demands in the outskirts of the town, sub-stations, either equipped with 3-phase A.C. plant or internal combustion engines, will shortly be put in. The consumption per head of population last year amounted to 78 units, which constitutes a record for a non-industrial town of 132,000 inhabitants.

Brighton was the home of the maximum demand system of charging. Although, said Mr. Christie, this system is undoubtedly the most equitable from both the consumers' and suppliers' point of view, even at Brighton, where it was first evolved, it became unpopular with the majority of consumers, and by insisting on retaining it the Council were steadily losing good business. Three years ago, therefore, it was abolished for all new business. To those consumers who elected to retain it the price was raised from 7d. and 1d. to 6d. and 2d. per unit, the alternative offered being a flat rate of 4d. per unit for domestic and shop lighting, and 3d. per unit for hotels, churches, &c., with special rates to very large consumers. This change of policy fortunately came into force just as the metallic filament lamp came into general use, and to-day everyone is satisfied with the result, including some 20 per cent. of the remaining consumers on the maximum demand system who obtain their supply at less than the flat rates.

Before leaving the subject of the maximum demand system, the President mentioned that when discussing the matter with Mr. Wright some months ago, Mr. Wright had put forward as his belief that we might ultimately come to a fixed charge per square foot of floor area, have no meters, and allow consumers to use the supply for any purpose without other restriction.

Mr. Christie then referred to the development of a day-load power supply on the restricted hour basis, which was also first introduced in Brighton. This class of business comprises engineering shops, printing works, laundries, breweries, mineral water factories, refrigerators, saw mills, ventilating and domestic machinery, and a lucrative business has also been obtained in charging the accumulators of electro-buses and motor-cars. From these sources a day load of some 3,000 h.p. connected has been attained, consuming last year almost 3,000,000 units, and this has so improved the load factor that there have been marked economies in works costs. Practically all the small isolated steam plants in the area have now been displaced by electric motors, and the consequent diminution of the smoke nuisance is a matter of no small importance in a health resort like Brighton. Electrically-operated bakers' ovens, Mr. Christie continued, are a commercial success. These make demands from 25 to 100 kw. each, and are usually only wanted between 11 p.m. and 6 a.m., when our plant and mains are otherwise comparatively idle. It would be feasible to cut the price per unit for this class of business to something like ½d. per unit, which figure, he is informed, can effectively compete with the existing methods of heating these appliances, whilst the advantages in the way of cleanliness and ease of regulation are all in favour of electricity.

The remainder of the Address dealt chiefly with the vexed question of selling, hiring, and wiring powers. Mr. Christie considered that it was most essential for the supply authority to possess powers to sell and hire out motors, &c., as in most provincial towns the average contractor was not in a position financially to establish a hiring system, and the prospective user for similar reasons was unable to purchase these accessories through the contractor. Brighton has enjoyed powers to sell and hire, but not to wire, since 1901, but never exercises them if there is any possibility of a consumer doing a deal through his contractor, and no insurmountable difficulty has yet been experienced in arranging for the consumer's contractor to carry out the necessary wiring. It is also found that consumers who could afford to buy their motors outright prefer to continue to hire from the Corporation, and to have the assurance of knowing that all their stock of spares and the resources of the department are at their disposal in case of trouble. The rental charged for motors is some 20 per cent. of prime cost, which includes insurance, cleaning, oiling, adjustment, and regular inspection. This just pays its way with a bare margin of profit, writing off the cost in ten years, but the department undoubtedly gains by the increased sale of energy. This policy, said Mr. Christie, must be extended to the hiring of heating and cooking appliances, which are daily coming into more general use. He pointed out that the money necessary to put these powers into force can only be raised after a Local Government Board inquiry, which should be sufficient guarantee that they will not be abused. No fewer than twenty-eight undertakings, involving a capital outlay of upwards of £11,000,000 sterling, already possess them, and this is a very strong argument in favour of our legislation being revised so as to allow of all authorities being treated alike.

On the wider question of wiring, supplying, and selling electric light fittings, Mr. Christie candidly confessed that he is not in sympathy with municipal authorities carrying out this work themselves except under very exceptional circumstances. Supply authorities, he said, can no more afford to ignore the

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existence of *bonâ fide* contractors than these firms can afford to take up an attitude hostile to the interests of the supply undertaking, and by friendly co-operation much unnecessary expense in the way of elaborate showrooms, canvassing and publicity organisation can often be saved without detriment to the undertaking in any way. He is convinced that in certain instances this so-called business getting has been overdone. A suitable showroom to interest consumers and to demonstrate the use of the latest novelties in systems of lighting, power, heating and cooking apparatus, is most desirable, and if judiciously operated in conjunction with the collector's office, it forms one of the most valuable advertisements an undertaking can possess, but he does not consider that it is by any means always necessary actually to sell the goods to ensure success.

Embarking in retail trading, carrying out wiring installations, &c., may only boost up an artificial and temporary demand, necessitating the raising of additional capital to meet it, and seldom yielding an adequate return on the outlay incurred.

Incidentally, Mr. Christie expressed the opinion that all undertakings where possible should have the collection of their accounts in their own hands, thus enabling the department to get into personal touch with the consumer, and to deal promptly first hand with any complaints that may arise. Some three years ago the Brighton Electricity Department took over the collection of their own accounts, and the results have been most satisfactory in every way, whilst the bad debts have been reduced by no less than 60 per cent. A capable engineer as Publicity Officer to assist and advise consumers free of cost as to the lay-out of their installations to the best advantage is also a necessity. Mr. Christie says that at the present time there is a dearth of suitable men, and urges young engineers who possess the necessary personal qualifications to specialise in this department.

Alderman G. PEARSON (Chairman of the Bristol Electricity Committee) proposed a vote of thanks to the President for his address. This was seconded by Mr. C. E. C. SHAWFIELD (Chief Electrical Engineer, Wolverhampton), and was carried with acclamation.

REPRESENTATION ON THE COUNCIL.

Before the Papers were read, the President mentioned that the Council had received a number of letters from some of the smaller Councils, urging that they should be represented upon the Council of the Association. This, he said, was a matter for the annual general meeting, and could only be dealt with then. He mentioned this at the commencement of the Convention in order that the members could talk the matter over before the annual general meeting.

ELECTRICITY SUPPLY VIEWED FROM THE MUNICIPAL COMMITTEE'S STANDPOINT.

BY COUNCILLOR LEESE, J.P.

(*Chairman of the Stoke-on-Trent Electricity Committee.*)

The chairman of a committee, said Councillor Leese, has to occupy a somewhat thankless position. He acts as spokesman of his committee and interpreter of his engineer's reports; at the same time, he is the buffer between the oft conflicting forces of other municipal departments and his own, and the recipient of workmen's and consumers' grievances. To illustrate his duties as interpreter, Mr. Leese gave some examples of the peculiar questions a chairman is sometimes called upon to answer, and incidentally suggested that it would be simpler if engineers always spoke of lbs. of steam per Board of Trade unit instead of per kw.-hour.

It fell to Mr. Leese's lot, as the Chairman of the Electricity Committee of the district formed by the Federation of the six Pottery towns last year, extending roughly 10 miles from north to south, by about 2 miles in breadth, to deal with the scheme for amalgamation and extension. Four of the six towns had their own electricity works :—

Town.	Date of Opening.	System.	No. of sets.	Capacity of plant (Kw.).
Burslem...	1905	3-wire D.C. 220 and 440 v. ...	4	1,250
Hanley ...	1894	Single-phase A.C. 2,200 v. ...	5	2,000
Longton...	1901	3-wire D.C. 230 and 460 v. ...	3	500
Stoke ...	1904	3-wire D.C. 240 and 480 v. ...	4	800

The Burslem Works are 3 miles north of the Hanley Works, the Stoke Works are about 2½ miles from the Longton Works, the Hanley Works being about 1¾ miles north of Stoke and 3 miles north-west of Longton. The Burslem Works supply a district (Wolstanton) outside the federated area and Tunstall in addition, while Stoke obtained powers to supply Fenton (which is between Stoke and Longton), but had not done more than run one main to that portion of the borough.

The aggregate winter peak load in 1910 considerably exceeded the plant capacity available, after allowing for reasonable spares, and was only carried with difficulty in the case of two of the stations.

After visits to several other stations and several special meetings, it was decided not to make additions to the small plant in the existing stations, but to build and equip a new power station, as nearly as possible in the centre of the area of supply. This will be connected with the four existing stations by trunk mains, and will contain two 1,500 kw. turbo-alternators with the necessary equipment of boilers, switchboards, &c. The D.C. plant at Burslem and Stoke and the A.C. single phase at the Hanley Works will be retained for peak loads so long as it is economical to do so. The problem is complicated by two of the works having destructors combined with them and by the difficulty of coupling two alternating systems and still maintaining flexibility.

In selecting the turbo-alternators, a frequency of 50 cycles per sec. and a speed of 3,000 r.p.m. were chosen. The curve, Fig. 1, was prepared to illustrate the relation of cost per kw.

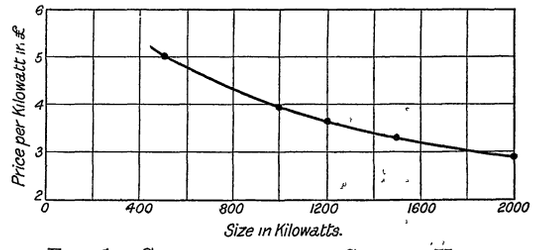


FIG. 1.—COST PER KW. AND SIZE OF UNIT.

to size of plant, and Fig. 2 to show the relation between steam consumption and size of unit, the ordinates showing the percentage increase in steam consumption compared with that of a 5,000 kw. set. The rapid rise for sizes below 1,500 kw. is noticeable.

Two interesting curves were also shown which explained how an increase in the morning, afternoon, and evening peaks in Hanley last year actually increased the costs, in spite of improvement in load factor, owing to its having been necessary to run an additional set of old make and small size to take these peaks.

The next question dealt with in the Paper was the allocation of profit from electricity undertakings. The author's opinion was that after allowing for depreciation, and building up a reserve fund to meet unforeseen contingencies, arrangement should be made to give the consumer the benefit either by extra discount or some other method. One of his reasons for objecting to profits being handed over for relief of rates was that a large manufacturer who was already supplied with electricity for power purposes at the lowest charge it

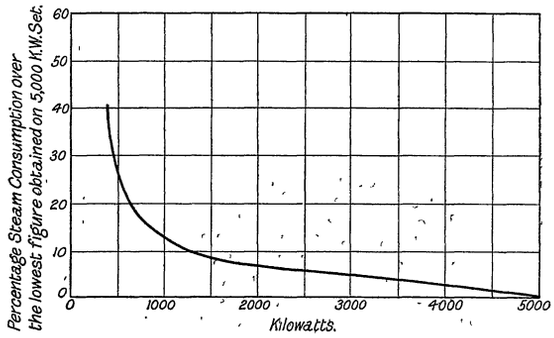


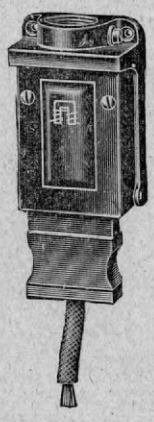
FIG. 2.—STEAM CONSUMPTION AND SIZE OF UNIT.

was possible to make would have a greater benefit in reduction of rates than the small consumer. Moreover, if a price must be charged in order to produce a profit for the reduction of rates, then it would seriously handicap committees in popularising the use of electricity by the poorer classes. When the six Potteries towns were federated, a clause was inserted in the Federation Act which compels the gas and electricity committees, in the event of a profit being made in any one year, to adjust the price of electricity and gas so as to absorb that profit.

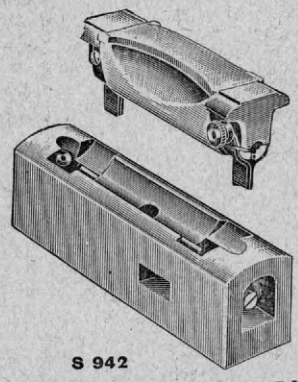
The author then mentioned the difficulty of convincing a council that the *average* price is not the cost price of electricity. Owing to this the non-manufacturer too often jumps to the conclusion that manufacturers are supplied below cost, when the power rates are low because of the long hours of use. In this connection the author regretted that none of the published tables give particulars showing the price for lighting and power separately. It is the absence of such information, he says, which renders it necessary at

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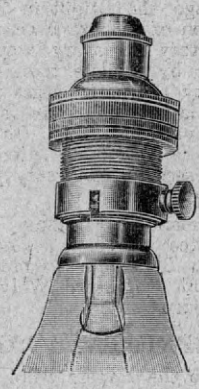
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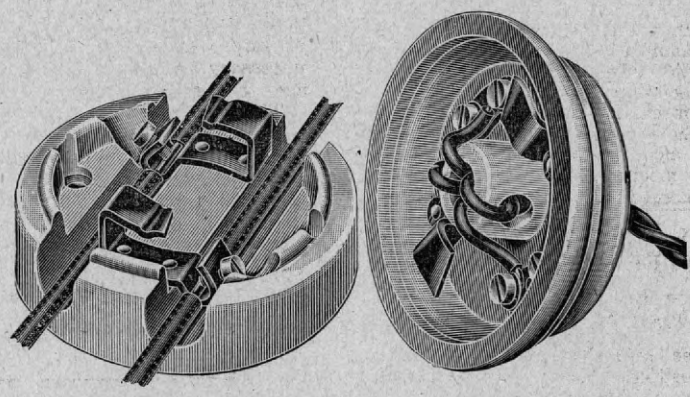
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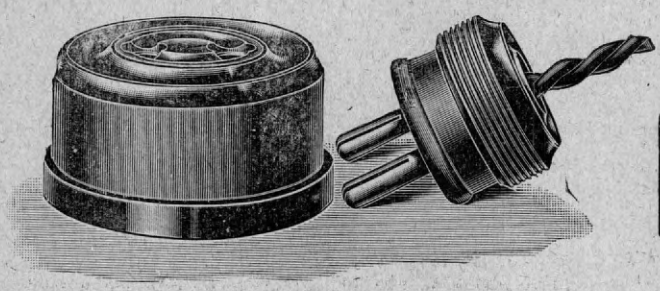
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times to instruct one's engineer to send out a "catechism" to which sarcastic reference is occasionally made without much ground. In portions of Stoke-on-Trent area, large power users get supply at ½d. per unit. This figure is sufficient to cover the cost of generation, but it does not allow for sinking fund and interest on mains. In the author's opinion, the charge should be compounded of cost of generation added to the cost of distribution, just as a manufacturer quotes goods F.O.R. his works at one price and "delivered" at another and higher rate. Restricted hour supply for all purposes and at 1d. has been given in one of the writer's districts since March, 1906, and has met with encouraging success. Ordinary manufacturing works cannot cut off at 4 p.m. in winter, but there are sufficient users to justify the special rate, which is only given when a clock-controlled switch is provided by the consumer.

The author then invited opinions as to the utility of showrooms. His own committee are, generally speaking, antagonistic to them, but his opinion is that, given a fairly large district to work in, a good showroom is a necessity to the success of the electricity undertaking. But it must, he pointed out, be kept up to date, and be in charge of a competent attendant. For smaller areas he thinks the best method of increasing the output at the works is to employ a canvaser of the very best type, who can watch new property being built, wait upon the builder and explain the good qualities of electricity for lighting purposes in ordinary dwellings. In Hanley, six years ago, the local contractors were encouraged to canvass by being given supply at 1d. per unit, all Corporation wiring is done by them, and they are lent any apparatus required for demonstration, while in special cases they are paid a commission.

Stoke-on-Trent has done a little in the direction of cooking appliances, and for some time has given this class of supply at 1d. per unit, but the trouble has been to obtain reliable and substantial stoves at a reasonable price. The £5 ovens, said Mr. Leese, are flimsy articles, while if £10 or more is paid, the hiring rate is much in excess of a gas stove. The ordinary domestic user will not pay more than 2s. or 2s. 6d. per quarter. The cost of operation is low; in small houses, a Sunday's dinner for three or four persons can be cooked for 2d. But there is one objection; in very few areas are the existing mains large enough to stand a row of houses taking on electrical ovens.

Lastly, Mr. Leese made some remarks as to the wide variations in the prices tendered to carefully drafted and clear specifications, and remarked the fact that there is nearly always a covering letter to the tender, which, while accepting the conditions laid down in the tender form, suggests modification of this, that, and the other, "which, if agreed to, sometimes would almost alter the whole construction of the article in question."

Discussion.

Councillor CROWTHER (Vice-Chairman, Sheffield Electricity Committee) agreed with the author as to the undesirability of handing over profits in relief of rates. The present tendency was to place restrictions upon municipal electrical undertakings which, if applied to a company, would spell ruin. There were many objections to handing over profits in relief of rates. In the first place, it made the engineer and the committee feel they must make a profit at all costs, and consequently they became very reluctant to scrap out-of-date plant. In his opinion the success of an engineer did not depend upon the profits he made, but upon getting the maximum number of consumers at a minimum cost. It would have been impossible for Mr. Fedden to have reduced the costs at Sheffield from 4d. per unit to 0·48d. per unit if he had felt that his first duty was to make a profit. Coming to the question of contractors, he asked why they should be so tender for the feelings of the contractors, and caused considerable laughter by saying that the average contractor was really only a draper who had taken up electricity as a side line to his business. He was, however, quite willing to admit the contractor to a fair share of the business if he could get it. On the question of showrooms, municipal electricity departments were too modest in this matter, frequently putting them behind their power stations, or in a small room in an attic or down in a cellar. Another matter was to see that the consumer had the amount of light he required, but not double what he required. It was only by giving their electrical departments a free hand that they could make electric light adaptable to the needs of all members of the community, including those earning 30s. and 35s. per week.

Mr. C. O. MILTON (Chief Electrical Engineer, Maidenhead) asked how cooking business would be dealt with by small undertakings, if a number of stoves were put in at the end of a long main of, say, 0·1 sq. in. section. For cooking, electricity would have to be sold at 1d. per unit, but with small undertakings he failed to see how this could be done, as the time of the load coincided largely with the lighting peak.

Mr. F. AYTON (Chief Electrical Engineer, Ipswich) said that Councillor Leese should not encourage workpeople and consumers to bring their complaints to him. With regard to sending round long lists of questions to other engineers for information, he suggested that all requiring such information should employ a consulting engineer, and pay a reasonable fee for it, if they could not get the advice they wanted from their own engineer.

Bailie WILLOCK (Chairman, Glasgow Electricity Committee) supported Mr. Ayton in his remarks upon trusting the engineer, and leaving him to deal with all complaints in the first instance. This had been his policy during the 17 years he had been Convener of the Glasgow Electricity Committee. He understood that Mr. Leese had said that supply at 1d. a unit for heating and cooking was given through the same meter as for lighting, and he would like to know how this was done, as it represented a great advance.

Mr. S. E. FEDDEN (Chief Electrical Engineer, Sheffield) strongly supported the views already expressed as to the undesirability of paying over profits in relief of rates, and in this connection drew attention to the shorter periods for the repayment of loans now being insisted upon by the Local Government Board. This resulted in their having to make huge gross profits if they were to make both ends meet at all. At Sheffield, for instance, he had made out a balance sheet as for a company, to show Mr. Ross Hooper, the Local Government Board inspector. He assumed that one quarter of the capital was in 4½ per cent. debentures, one quarter 5 per cent. preference shares, and the remainder ordinary shares, and after allowing for debenture interest and preference dividend, would have had enough profit to pay 9·4 per cent. on the ordinary shares, if he could have allocated in that manner the capital charges which the electricity department had to pay. He thought to charge 0·5d. per unit for large power supplies, as was the case at Stoke-on-Trent, was too high. With 45 per cent. or 50 per cent. load factor, the costs would be about 0·2d. per unit, and this would be sufficient to pay interest and sinking-fund charges. On the point of covering letters with tenders, he regarded these frequently as almost amounting to sharp practice, as they covered things up so much, and it would be a good thing if contractors would take the tip from him and Councillor Leese, and send in straight tenders without covering letters, which involved all sorts of other things.

Alderman G. PEARSON (Chairman, Bristol Electricity Committee) was also a supporter of not assisting the rates out of profits. At the same time, he did not think they need discuss the matter at very great length, because with the shorter periods allowed by the L.G.B. they were not likely to make extensive profits. Nevertheless, he objected to the restriction such as had been put upon the new Stoke county borough, that they could not, even if they desired, allocate any profits to rates. He desired these matters treated with common sense and freedom, as it might be necessary in emergency to assist the rates to some extent. They need not worry themselves much about covering letters with tenders, as they could easily ignore them. The chief difficulty was to get the work carried out to time. At Bristol they adopted the plan of not complaining if the work were completed within 12 months after the contract period had expired. He also advocated leaving all complaints to the engineer and his staff, a plan which almost always made it unnecessary to appeal to the committee. To interfere with the discipline of the works was the parent of nearly every mischievous thing that could arise between the workmen and a committee.

Alderman W. F. GOOD (Chairman, Maidenhead Electricity Committee), as a supporter of the principle of retaining the profits with the undertaking, suggested that, after meeting capital charges and depreciation, the surplus should be divided as to one third to reserve and renewals fund, one third towards reducing the price to the consumer, and one third to reducing the cost of public lighting.

Councillor W. B. SMITH (Glasgow) said that, as a member of a recent deputation of the Smoke Abatement League of Great Britain to Mr. John Burns, President of the Local Government Board, he had then urged Mr. Burns to prevent profits being devoted to the relief of rates. Mr. John Burns was strongly in sympathy with the suggestion, and quite appreciated that profits should be devoted to reducing the price of gas and electricity, both of which commodities would do more than anything else to reduce the smoke evil in Great Britain, and thought his colleagues were very much with him on that point.

Mr. MILES WALKER (British Westinghouse Co.) congratulated Mr. Leese on the interest he had taken in his undertaking.

Alderman SMITH (Vice-Chairman, Liverpool Electricity Committee) expressed the opinion that as the rates had to bear any losses upon the undertakings, they should also share any profits; and he caused considerable commotion by saying that street lighting was more cheaply carried out by gas.

Councillor LEESE replied briefly, reminding Mr. Ayton and others that they had quite misunderstood the Paper, if they thought he wished to usurp the functions of the engineer. The system adopted at Stoke for charging for supply for cooking apparatus was to take the average consumption of the premises in the previous year or two years, and to charge all above that at 1d. per unit.

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MODERN WIRING PRACTICE.

By MR. J. W. BEAUCHAMP.

(Chief Electrical Engineer, Tunbridge Wells.)

In the introductory part of his Paper, the author expressed his conviction that small consumers were remunerative; such business, he said, is of a special character, but on account of its possible magnitude and the comparatively high load factor of lighting supply to private houses, it deserves special treatment, more particularly as the growing demand for electric street lighting makes it necessary to lay cables in roads where only the smaller consumer can be obtained. Returns have shown him that the proportion of premises taking electricity supply varies from 5 to 25 per cent., whilst the percentage of houses rented at less than £50 per annum ranges from 40 to 70 per cent. of the total.

He next deplored the lack of uniformity in the quality of electrical installation work within any particular supply area. Small house and shop wiring usually falls to the lowest tender, and in many cases there is not the most elementary form of specification to ensure that the several offers are based on the same requirements. He recommended the drafting of simple and definite rules, to be made as light as possible, but to be stringently enforced.

Many of the existing rules, directed towards securing for the consumer a well-designed installation, with regard to capacity of conductors, sectionising, etc., cannot be enforced by the supply authority, and he therefore recommended that simple model "official" specifications should be issued, describing the requirements of good practice suitable for several different classes of wiring work.

He suggested that as the usual insulation resistance test depends chiefly upon dryness of the building and care used in connecting up fittings, a much lower insulation resistance than is usually called for would suffice, but should be supplemented by inspection of samples of hidden work in every case. He quoted figures to show the divergence in the limits of capacity of branch lighting circuits specified by various authorities, and said that the true limit should lie in the ability to make proper current carrying connections in the various "loop in" fittings used on branch lighting circuits; 10 amperes, he thought, should be a workable maximum. The limit of motor capacity which might be connected to one side of a 3-wire system was from 1½ to 9 kw. in one set of regulations, and, as he pointed out, these limits should depend upon the capacity of the system, yet in some cases most stringent regulations were issued by very large undertakings.

The regulation for maximum motor-starting currents would, he thought, be better stated in "limiting amperes" for any motor on a system or district according to capacity of cables or transformers—because having admitted, for example, a 10-h.p. motor at 1¼ times full load current (say 70 amperes), it is hardly reasonable to deny the users of smaller motors in the same district the privilege of taking up to the same value of starting current.

Provided that wiring is not dangerously overloaded, the question of pressure drop, he pointed out, concerns the consumer chiefly, and the increasing efficiency of lamps does not warrant the use of heavy wiring.

Amongst several "out of date" provisions he mentioned the following:—Motors to be insulated. No installation to have less than two branch circuits. No copper fuses to be used. S.P. switches to be used on each main. Meter shunt wire to be taken to lamp side of consumer's main switch. Slip conduit prohibited. Metal conduit to be avoided if possible. Others "conspicuously in advance of the period when they were written" were:—Bathroom lights to be out of reach of persons in water. No elbows to be used in conduit. Internal lighting fittings to be insulated. Meter main coil and all S.P. switches to be on live side of supply. Attention to the bath room rule is drawn in the Government Regulations of the South African Union, the recommendation being that all conduit and fittings should be out of reach of persons standing in or on the bath, or on a wet floor—and that porcelain switches should be used and key socket holders avoided. The position of the meter, main coil, should be tested for and insisted on in all cases. He also recommended that the following regulations in the more modern codes could be made general with advantage:—Electric irons to have some indicator showing when current is on. Capacity of cables for motors to be calculated on basis of short period over load ratings, and on basis of starting currents. In addition, he suggested that although most modern patterns of switches and fuses fulfil every requirement with regard to breaking circuit, they are greatly overrated so far as concerns their power of carrying full load current continuously, the makers apparently not making enough allowance for inaccurate machining and fitting of parts.

To replace the various earthing regulations, he pointed out that the essential requirement is merely that every part of a metallic sheathing or conduit system be permanently connected to earth by a conducting path of sufficiently low resistance to carry, without heating, the maximum current which the main fuses of the installation will pass. The minimum size of earth wire he proposed was No. 18 S.W.G., as he considered No. 14 unduly heavy and expensive for small installations. Tests made with lamp or bell for the continuity of a tube system give little indication of the current-carrying capacity of the many joints and connections.

Where the system of wiring makes it impossible to render all metal-work of motors, lamps, and other apparatus metallically continuous, the author recommended the running of a substantial and visible earthing wire or tape throughout the installation.

A number of other points were raised by Mr. Beauchamp, and we quote some of the opinions he expressed: The increasing stringency of Home Office Regulations has led to the production of various fittings which fall into two classes: one in which provision is made for earthing all metal-work, and the other in which insulating material shrouds all parts from which a shock might be obtained as a result of failure of internal insulation. When substantially made the latter class probably has the advantage.

It would seem worth while to consider earthing only portions of tube within usual reach in wet places, and keeping the remainder in isolated single lengths by the use of fittings and sockets which actually insulate instead of partially connecting as at present; this could be effected by lined sockets or by serving the outside of the tube with compounded tape or braiding. The use of "close" joint tube in any form of cement or plaster is undesirable but difficult to prevent on jobs where brazed or seamless material is not insisted on throughout. There appears to be a useful field for a conduit lapped with coarse tape or jute and compounded outside for such positions.

Various devices have been put upon the market to enable slip tubing to be made continuous without appreciable increase in cost. They are, however, always apt to be omitted where tube is fitted in awkward positions, whilst their weakest feature is that they do not render it necessary to remove the enamel from the tube and sockets. In some instances slip tubing has been put together with wet salammoniac in order to secure a rust joint—an injurious practice. There seems to be no reason, however, why a useful amalgam like jointing mixture should not be made, similar in composition to aluminium paint or the paste solders.

Where possible, the cartridge form or the modern development of the old Edison screw plug fuse, such as the "Zed" and "Diel" fuses, should be used, but the cheapness and convenience of the ordinary porcelain bridge fuse will prevent it from being easily superseded. The supply authority could fix printed cards by the service cut-out and the distribution boards, stating the usual fuse sizes rendered in terms of lamps and wire gauges.

The metallic filament lamp has led to a very general use of pressure-reducing transformers on A.C. distributions over 100 volts. This has not apparently made much difference to wiring practice, nor has it become general to use material of lower insulating quality on new work where pressures of 50 to 100 volts are intended. If makers should produce a high voltage lamp of small power and low price the transformers would presumably be abandoned in time, provided that the wiring were found suitable for the higher pressure. Where auto-transformers are used it is usual to insist on their being connected in such manner that the pressure to earth on the consumer's wiring is not greater than his working pressure. In any case, where low insulation work or earthed concentric wiring is put in, it should be made clear to the purchaser that he is possibly committed to the continual use of such transformers, or disappointment may arise in the future. Small transformers are responsible for a considerable number of faults on consumers' premises, particularly where their cores and frames are connected to earth. It is somewhat unfortunate that suppliers have not endeavoured to keep control over house transformers by a rental system. The pressure regulation of small transformers varies from 2½ to 4 per cent., and as they are seldom fully loaded, it follows that the average working pressure is raised somewhat at all times, and the lamps are considerably overrun.

The familiar bayonet pattern lamp holder is often contrasted with the foreign screw socket to the detriment of the former, but in this criticism the author does not concur.

Where it is possible to work on the surface of a building and to use concentric conductors with the outer or return sheath earthed, a saving in cost of 10 to 15 per cent. over slip joint conduit wiring can be secured by means of "Stannos" in the hands of men accustomed to its use. Its chief disadvantages appear to be:—The multiplication of mechanical joints or points where loose connections may occur. The difficulty of securing to plaster and composition walls and ceilings. Comparatively feeble resistance to accidental damage. Risk of loss of continuity and consequent sparking or pressure rise on the outer conductor in the event of loose contacts or breakage of sheathing. These difficulties are rather matters of detail, and many of them can possibly be overcome. Where it is required to use double "Stannos" wiring, the outer sheaths acting merely as a mechanical protection, no trouble arises from inductive drop with ordinary sizes and currents; experiment has shown that up to 25 amperes the drop at ordinary periodicities is quite inappreciable in a 55-yard run. The great value of this material lies in the fact that faults quickly develop into short circuits and put the bad section out of use whilst repairs are easily carried out; in

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addition, all the simplicity and advantages of a single pole system are secured.

Flexible wiring has been much discussed from time to time, but no effort made to define its utility or to establish any regulations which might make it safe for certain classes of work without rendering it too expensive; in consequence, a considerable amount of such wiring is actually in use in this country in a most improper manner, and only saved from failure by its high quality. Some attempts have been made to produce a strong and safe flexible wire, the result being usually rather clumsy and as costly as the cheaper forms of permanent wiring. There would appear, however, to be a field for such material in connection with heating circuits. A disadvantage peculiar to all fixed surface wiring systems lies in the difficulty which is met with when redecorating walls and ceilings, particularly when papering.

The author then gave the following estimates of the cost per light of wiring in small private houses, complete with metallic lamps and simple pendants.

Screwed seamless conduit (steel) and 600 meg class non-association cable: Conduit 5s. 9d., Cable 5s. 9d., Fittings 5s. 9d., Labour 5s. 3d., Total £1 2s. 6d.

Brazed slip conduit with clamp continuity fittings: Conduit 5s. 6d., Cable 5s. 9d., Fittings 5s. 9d., Labour 4s. 3d., Total £1 1s. 3d.

Brazed slip conduit and 600 meg class non-association cable: Conduit 4s., Cable 5s. 9d., Fittings 5s. 9d., Labour 4s., Total 19s. 6d.

Brass-cased paper tube: Tube 3s. 6d., Cable 5s. 9d., Fittings 5s. 9d., Labour 4s., Total 19s.

Close joint slip conduit (steel) and 600 meg class non-association cable: Conduit 2s. 9d., Cable 5s. 9d., Fittings 5s. 9d., Labour 4s., Total 18s. 3d.

Wood casing and 600 meg class non-association cable: Casing 1s. 3d., Cable 5s. 9d., Fittings 5s. 9d., Labour 4s. 9d., Total 17s. 6d.

"Stannos" wiring (concentric): Cable 6s. 3d., Fittings 5s. 9d., Labour 1s. 3d., Total 13s. 3d.

Twin rubber and lead-covered cable: Cable 6s. 3d., Fittings 5s. 9d., Labour 1s. 3d., Total 13s. 3d.

Rubber and cotton flexible and button insulators: Cable 5s. 9d., Fittings 5s. 9d., Labour 1s. 3d., Total 12s. 9d.

600 meg class non-association cable and cleat insulators: Cable and insulators 3s. 6d., Fittings 5s. 9d., Labour 1s. 3d., Total 10s. 6d.

The Paper concludes with a detailed review of the new edition of the Institution of Electrical Engineers Wiring Rules (see ELECTRICAL ENGINEERING, May 11th, page 247). The author particularly criticises Rule No. 49*a*, providing for conduit to be earthed and metallically continuous throughout, and stating that slip socket conduit does not comply, some form of screw or grip fitting being necessary, and such fitting to be put on in a manner to secure the conductivity of the joint being equal to that of the tubing. In his comment Mr. Beauchamp says: "This regulation is far reaching and apparently puts the great majority of conduit installations beyond the pale of the Institution Rules—a somewhat serious matter; in the writer's opinion it is both undesirable and impossible to bar good quality slip pocket conduit and fittings for general house and shop work; admittedly, unless they are metallically continuous, the earthing regulation constitutes more danger than safeguard, although experience demonstrates that the danger is extremely small.

DISCUSSION.

Mr. S. E. FEDDEN (Chief Electrical Engineer, Sheffield) said that even with gas as cheap as it was at Sheffield there was no difficulty in having electric light adopted in houses of a rental of £30 per annum, provided they had not already been piped for gas, and if they could only get the builders to wire when erecting the houses. He had hopes they would get the £20 houses also. Although not an advocate of jerry work, he thought that some of the ideals of the regulations would have to be dropped in the future if the small houses were to be got at. The wiring of small houses could be reduced to from 8s. to 12s. to 4s. or 5s. per point by using slip tubing up inside the plaster of the walls, and wiring under the floors by boring the joists. The work in the joists was absolutely safe if the wires were placed far enough apart, and they need not worry about amperes per square inch. For many years he had indulged in the extravagance of 70/40 vulcanised flexible, as when he first went to Sheffield there was much trouble with flexible wires. But having got back the confidence of the consumers, he was now rather inclined to drop this expensive flexible and to go back to the cheaper one permitted by the Institution Rules. He did not think the question of earthing needed considering except in wet places, when he preferred screwed conduit connected to a good earth. He had known cases, however, where the use of voltage reducing transformers had increased the consumption instead of reducing it, owing to the enormous magnetising current losses. He thought the price of "Stannos" wire too high; he was sure that the manufacturers could afford to reduce it by about one half. He gave the following particulars of an estimate for a definite job as showing how "Stannos" wire came out: Wood casing with 600 megohm cable, £35. "I.M.E.A." flexible was £35. "Simplex" steel-armoured flexible, £41s. 10s. "Stannos" concentric with double wound transformers and earthed outer, £42 10s.

Mr. F. M. LONG (Chief Electrical Engineer, Norwich) said that fourteen years ago they started the free wiring of small houses in Norwich, and it had been entirely satisfactory. The larger portion of their 5,000 consumers were now wired in this way. Many houses of £16 and £10 yearly rental were dealt with. Nearly all the troubles with wiring were electrolytic, and were not caused by the overloading, consequently they had to differentiate between work intended for damp places and that to be used in dry places. In ordinary private houses much cheaper material could be used, and the wires were attached to the joists between the floors. With new houses that were being built, they tried to fix tubes on the walls for the switch wires before the plastering was done, but he had not found the close joint tube satisfactory for this work, as trouble arose from the moisture in the plaster. It was more satisfactory to use solid tube. With work of this sort, earthing was not at all necessary. He had found pure rubber insulation, double jacketed, the most suitable for flexible; it was less trouble and cheaper than vulcanised.

Mr. W. A. VIGNOLES (Chief Electrical Engineer, Grimsby) pointed out that the question of wiring on easy terms was an important matter, and might be discussed in connection with cheaper wiring. It seemed to him very necessary for every town in the kingdom to have wiring powers, and notwithstanding the failure of the conference with the contractors, he hoped the Council were bearing the matter in mind, and that steps would be taken to promote a Bill in the future. He did not think there was such a thing as a good slip joint conduit system. Every one was utterly bad, and ought not to be used under any pretence whatever. As Mr. Long, he had also largely used wires threaded through the joists. Single lead-covered wires were run some distance apart, and holes drilled in the centre of the joists, and the wires threaded through, tubes being put in to protect the wires where they came down to the switches. This had proved quite satisfactory. He used paper-insulated lead-covered wire, and simply taped the ends. He earthed the lead or conduit to the lead-covering of the service cable. He thought it was necessary to earth even in private installations, because frequently the gas pipes were left in, and the whole of the gas supply was not cut off, and it was very difficult to ensure that the workmen had not allowed the conduits or the lead-covered wires to touch the gas pipes. It seemed to him that the cost of wiring could be considerably reduced by the use of a double-wound transformer, and 25-volt lamps, in which case there was absolutely no necessity to use fuses of any kind.

Mr. F. AYTON (Chief Electrical Engineer, Ipswich) said he still pinned his faith generally to wood casing. In dry places a cheaper quality rubber wire could be used, and in damp places casing could be made reasonably safe by using porcelain roller insulators and coating the casing with a waterproof paint. The weak point in wiring work was the flexible. A very important point was the rating of switches, and it was one which ought to be taken up either by the Association or the Engineering Standard Committee. They should be rated on the wattage basis and not in amperes. They also wanted some standardisation in switches and ceiling roses in regard to the position of the entry holes for the wiring through the block. Standardisation could also be carried to wall-plugs: difficulty in getting interchangeability, especially with china plugs, which were easily broken. When sending round irons on approval, in every case he sent a Pragnell adapter, which enabled the consumer to use the light whilst he was trying the iron.

Mr. A. J. CRIDGE (Electrical Co., Ltd.) urged the necessity of not reducing quality too much in the effort to cheapen wiring. He also said that the assistant entrusted with the testing of installations should have common sense, and should not have so great an idea of his own importance as to enforce regulations in cast-iron fashion.

Mr. W. A. WALKER (Chief Electrical Engineer, Kettering) said that he had drawn up a schedule of prices for wiring houses, upon which any contractor could canvass, and for screwed conduit the price per point was 22s., against 22s. 6d. in the paper. This included pendants and lamps. He paid per point for wood casing 19s., against 17s. 6d. in the paper, but he thought the latter figure was too low. Was the wood treated with shellac, or was it plain?

Owing to the shortness of time, Mr. Beauchamp will reply in the Proceedings.

(*Continued on page* 365.)

Telegraph Traffic.—The line between Bagdad and Bassorah was down on the 17th inst., but was restored to working order on the 18th inst. Communication between Tokio and Yokohama failed on June 19th, telegrams being sent by post from Kobé, but a quick restoration was effected on the 20th inst. with Tokio, and on the 21st inst. with Yokohama. The Bagdad-Bassorah line was down again on the 19th and 23rd inst., and the Rome-Constantinople line was down on the 23rd inst.

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RAILLESS TRACTION IN BRADFORD AND LEEDS

THE trolley omnibus systems at Bradford and Leeds, which form the first trial of railless traction in this country, were both opened on Tuesday of last week, and although they have only been in service for little more than one week, are giving great promise, and showing every sign that the system has come to stay. The vehicles combine features of both the motor-bus and the tramcar. Current is supplied from overhead wires, but rubber-tyred wheels are used. The wires, which, where the going and return routes are the same, are four in number, consist in both towns of No. 0000 S. W. G. hard-drawn copper, and are carried in general on 18-ft. bracket arms, the two inside being positive and the two outers negative, so that between the former there is double insulation, and between a positive and negative treble insulation, and, of course, single insulation between the negative and bracket arm. These wires are correctly spaced and insulated by one ball and two links in the Leeds system, but in the Bradford system a twin straight line hanger of phosphor bronze has been adopted. The advantage of these is that they have a greater scrap value than if malleable castings were used. The Leeds track is about 4¼ miles in length, and the positive wires are divided into half-mile sections, as in standard tramway practice, but the negative wires run from end to end of the route, and are bonded to the existing tramrails. The Bradford authorities are experimenting with just over a mile of track, and have a Chamberlain & Hookham 200-ampere meter at the terminus for keeping a careful record of the current taken. The



FIG. 1.—CAR PASSING LORRY, SHOWING LONG REACH OF TROLLEY AT BRADFORD.

trolley poles are geared at their bases so that they run in absolute unison. Their length is 17 ft., and a deviation of 15 ft. on either side of the centre of the road is obtained. When in this extreme position, shown in Figs. 1 and 2, there is a tendency for the poles to be pulled off the wires, and this is lessened by the action of two springs, so arranged to cause the force pulling the trolley straight to be less the wider the deflection. The vehicle is driven by two motors rated at 20 b.h.p. at 500 volts, one for each wheel, of the Siemens interpolar traction type with shunted fields. The controller, made by the same firm, provides means for cutting out either motor, and is of the series parallel magnetic blow-out type, giving five running positions on the main barrel, two with the motors in series and field, full, and 50 per cent. shunted, and three with the motors in parallel and field, full and shunted 25 and 50 per cent. respectively. The reversing barrel contains the points for cutting either of the two motors in or out, or both in. The steering is arranged so that the vehicle will turn round in a radius of 12 ft. measured on the inner rear wheel. Two mechanical brakes are provided, operated by a pedal and hand lever, one acting directly on drum brakes upon the rear wheels,

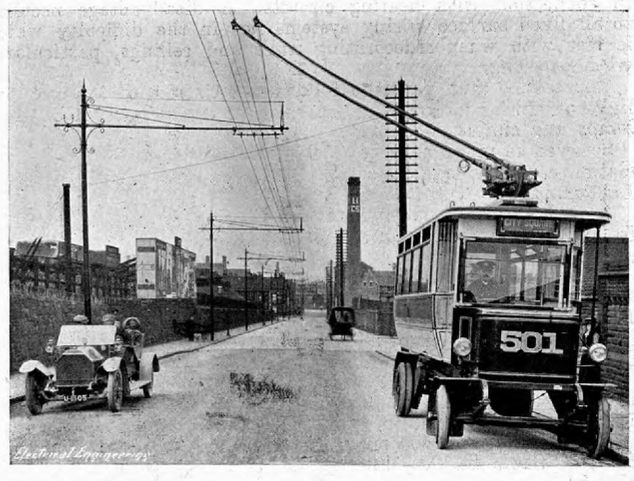


FIG. 2.—LEEDS RAILLESS CAR IN EXTREME POSITION.

and kept in the "on" position by a ratchet device on the hand lever, and the other acts on a countershaft. Each motor drives a countershaft through a double-reduction worm wheel, from which the drive is taken to one wheel by means of a sprocket and chain. Thus no differential gear is required. For running the cars in and out of the sheds at Leeds, a skate or contact arm, fixed under the car and arranged to fit the existing tramrails, takes the place of the overhead negative wire. At Bradford the overhead negative wire is run right into the sheds. All the handrails, &c., on the vehicles are insulated. The wheels are of the motor-omnibus pattern, with solid rubber tyres, the rear wheels being twin and the steering wheels single tyred. A trip along the whole route at Bradford showed how smoothly and quietly the cars ran. The roads are very good and undulate in places. They are partly sett

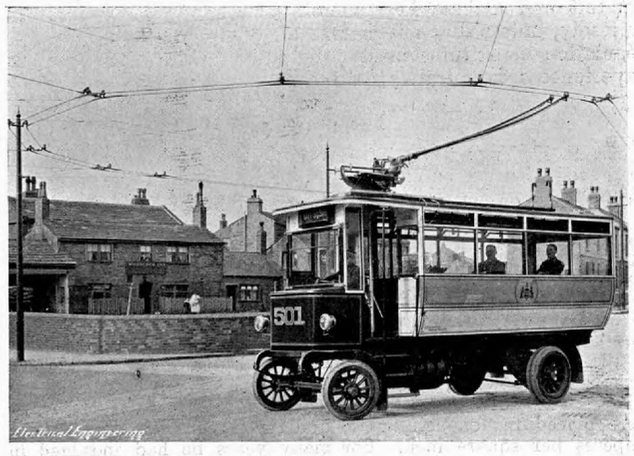


FIG. 3.—CAR ON TERMINAL LOOP AT LEEDS.

stones and partly macadam, so that the wear of the tyres should be satisfactory. The cars, which carry twenty-eight passengers, are very comfortable, being fitted with rattan spring seats arranged transversely, the interior fittings being of polished wainscot oak. The driver is well sheltered, the front platform being provided with adjustable side windows and hinged wind screen. In Leeds the termini are pro-

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vided with loops, so that the trolley poles need not be taken off the wires, and the cross-over points have had to be very carefully designed, to prevent a short-circuit taking place. At the City Square loop a negative wire is simply erected by the side of the existing tramway wires, but in Bradford the poles are pulled off. The speed of the vehicle is about ten miles per hour. At present only one car is at work in each case. Both of these were supplied by the Railless Electric Traction Co., Ltd. (56 Moorgate Street, E.C.). We understand

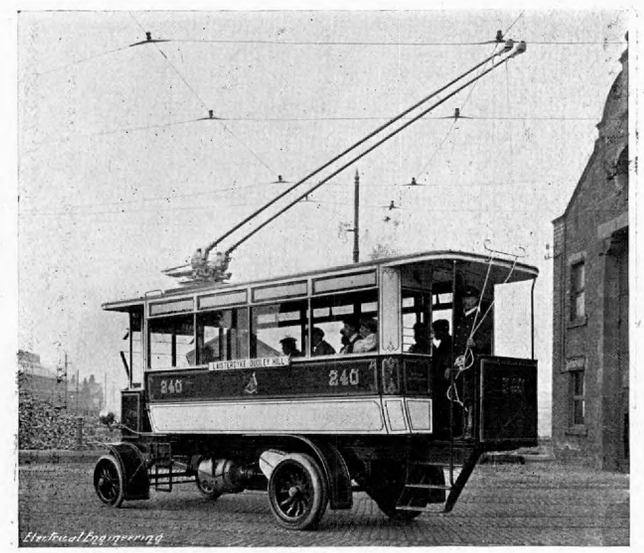
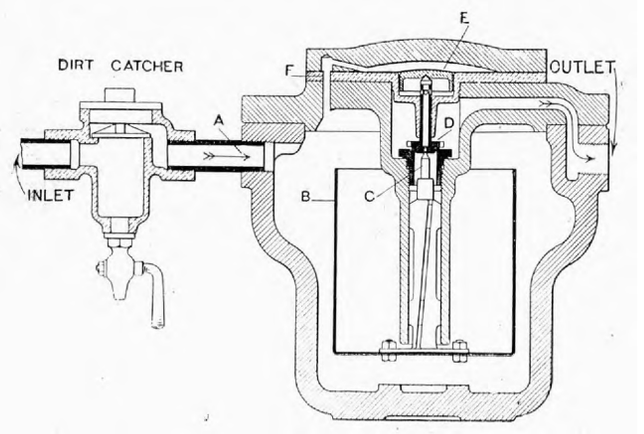


FIG. 4.—GENERAL VIEW OF BRADFORD CAR.

that the total number of cars on order is four. In conclusion, we must express our indebtedness to Mr. C. J. Spencer, General Manager of the Bradford City tramways, and Mr. J. B. Hamilton, General Manager of the Leeds City tramways, for putting at our disposal the photographs from which the accompanying illustrations are reproduced, and for the facilities afforded to our representative when visiting the installations.

THE RECORD STEAM TRAP

A NEW steam trap of the float pattern is being put on the market by Messrs. Gillespie & Beales (Amberley House, Norfolk Street, Strand). Its principal feature is that the bucket only contains a small relay valve, so that the main valve can be made of considerably larger size than in



SECTION SHOWING DETAILS OF RECORD STEAM TRAP.

most traps of this size as is actually opened and closed by the steam pressure. A section of the trap is given in the illustration.

The water enters at A and causes the float B to rise and close relay valve C. Above the main valve D is a diaphragm E the underside of which is open to the outlet by slight leakage past the valve spindle. The top side of the diaphragm is subjected to the same pressure as the steam pipe and trap, as a small hole at F admits steam from the inside of trap to top of diaphragm. It will be seen that the steam pressure acting on the top of diaphragm always tends to close the main valve D, which is held hard on its seat immediately steam or water under pressure is admitted to the trap. As more water accumulates the float B fills and sinks, causing relay valve C to open. Water which is under pressure is therefore admitted—through the hole in the spindle of the main valve—to the underside of diaphragm E putting it in equilibrium and free to deflect up or down. Immediately the diaphragm is in equilibrium, the pressure of water on the underside of the main valve D opens it and the water in the float is discharged. The float then rises and closes the relay valve C and, owing to the small leakage past the main valve spindle, the underside of the diaphragm is relieved of pressure, consequently the pressure on the top side immediately closes the main valve. It will thus be seen that the trap automatically adjusts itself to the pressure of the steam and in consequence, will work equally well at any pressure. An efficient dirt catcher is provided to prevent any possibility of grit getting between the valve and the seat.

ILLUMINATED TRAMCARS AT BRADFORD

WE illustrate here one of two illuminated cars which have taken part in the Coronation festivities at Bradford. The arrangement represents a crown upon a pedestal, the crown proper being in gold bronze suitably lined. The crown band is perforated and behind are fixed coloured celluloids and lamps representing jewels; on one side of the car is a ribbon with a ground work of royal blue and the words "Long Live The King" 1911, in bright gold, picked out with gold coloured lamps, also a shield in gold bearing the monogram "G.R.I." in white, red and blue lamps respectively. A ribbon on the opposite side of the car carries the words "God Save The Queen" 1911, and a gold shield with the monogram "M." in white. The whole of the devices on the car are picked out with suitably coloured lamps, there being in all 1,050 lamps used in the illumination of each car. The total height to the



ILLUMINATED TRAMCAR, BRADFORD CITY TRAMWAYS.

top of the Maltese Cross is 16 feet, the effect when the car is lighted being extremely brilliant. This device is one of the finest of its kind that has been attempted anywhere. The whole of the work of designing and preparing the cars was executed by the City Tramways Department.

Hartlepool Tramways Arbitration.—In the King's Bench Division on Wednesday last week, Mr. Justice Bray gave judgment on the legal point raised as to whether Messrs. Sellon & Ashby or the Hartlepool Tramway Co. were entitled to receive the purchase money for the Company's undertaking, which is being taken over by the Corporation. The facts were set out on p. 353 of our last issue. His Lordship held that the provisional order of the tramways, in view of the invalid transfer to the Hartlepool Co., still belonged to Messrs. Sellon & Ashby, and that the Corporation must pay the purchase money to them. All arrangements for giving the Corporation a good title must be made between the two gentlemen in question and the tramway company. Leave to appeal was given.

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I.M.E.A.—Continued

INTERNAL COMBUSTION ENGINES WORKING ON THE DIESEL PRINCIPLE.

BY HENLEY L. HOWARD.
(*Chief Electrical Engineer, Barking.*)

On Wednesday the meeting was at Portsmouth. After the official welcome by the Mayor (Alderman Scott Foster), two Papers on Internal Combustion Engines were discussed.

The first of these, by Mr. H. L. Howard (Barking), dealt with the Diesel engine, of which the author is an enthusiastic advocate, and we print it below in slightly condensed form :—

The problem the station engineer is always up against is how to deliver a unit of electricity to the station bus-bars at a minimum cost, and although very fine figures are being put forward for both steam and gas plants, yet in the author's opinion these can be greatly improved upon by the adoption of Diesel plant.

It should be remembered that the fuel cost accounts for a very large percentage of the works' costs, and also that it is the only item that is capable of being materially reduced.

The standard Diesel engine of to-day is a single-acting four-cycle engine—that is, every fourth stroke is a working stroke, the cycle of operations being as follows :—

1st down stroke is the air-suction stroke, which fills the cylinder with fresh air.

1st return stroke compresses the above air to about 500 lbs. per square inch, thereby raising its temperature to about 900° Fahr.

2nd down stroke is the working stroke, fuel oil being injected into the cylinder and mixing with the compressed air already therein. The compression heat having ignited the oil, it burns and expansion of the gases follows.

2nd return stroke is the exhaust stroke, the products of combustion being cleared out, ready for the air-suction stroke.

It will be clearly seen from the above that, unlike the gas engine, the Diesel engine is not an *explosion* engine, for at every working stroke the fuel burns steadily as long as it is injected into the cylinder—every globule of the oil being surrounded by the air which atomises it. The quantity of oil burned varies with the load, and is regulated by the fuel pumps, whose delivery is directly controlled by a sensitive governor, there being no "hit and miss" method, as with gas engines. Whatever quantity of oil is injected into the cylinder, it enters one or two degrees before the dead centre, when it automatically ignites and continues to burn during a portion of the stroke. The Diesel engine, again, unlike the gas engine, knows of no such thing as a "rich or poor" mixture, has no incandescent tube, electric spark, or other extraneous igniting device, and pre-ignitions and misfires are an impossibility.

The external appearance of a vertical three-cylinder set of the latest type is shown in Fig. 1, while Fig. 2 is a section of the standard slow-speed type of engine. [We are indebted to the Diesel Engine Co., Ltd., 179 Queen Victoria Street, E.C., for the loan of the original illustrations.]

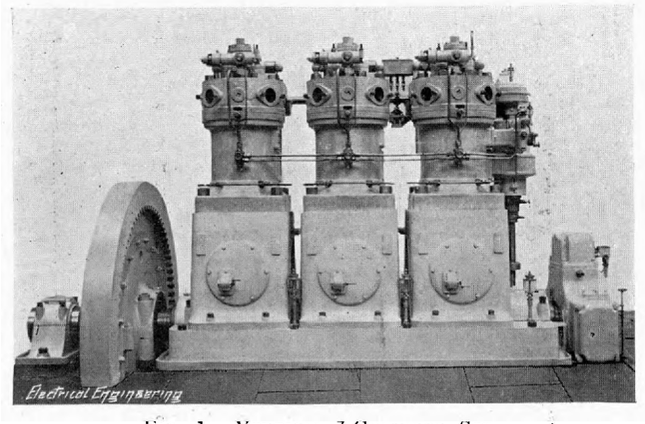


FIG. 1.—VERTICAL 3-CYLINDER SET.

The cylinder lining is of dense cast iron. This is set into the outer casing, the spacing between which and the lining forms a water jacket for the cylinder walls. This casing is cast in one, with the two legs of the standard A frame. This is heavily bolted to a stiff bed plate, carrying the main crank-shaft bearings. The cylinder is open at the lower end, the piston being of the trunk type. The different valves are arranged on the cylinder head, and are operated by cams and levers from the cam shaft.

The compressed air used for the injection of the fuel oil is stored in a steel air-bottle, at a pressure of about 800 lbs. per square inch, which is kept automatically charged with air by means of a two- or three-stage compressor, worked direct from the crank shaft. There are also two other air-bottles used for starting the engine.

A departure from the above standard engine is that put upon the market by the Nederlandisch Fabrik of Amsterdam. This engine is fitted with a cross-head and guide, and has a comparatively short piston. It is also provided with a distance piece, between the cylinder and the crank chamber. In the author's opinion, for high-power vertical engines, it is the line that will eventually be followed.

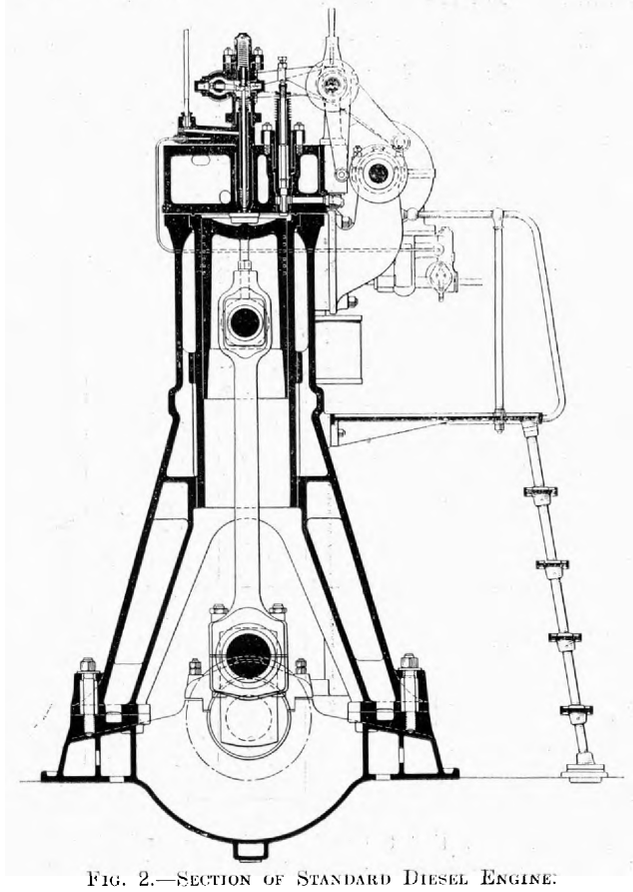


FIG. 2.—SECTION OF STANDARD DIESEL ENGINE.

One of the most interesting examples of high-power Diesel engines is the installation at Halle, where two 1,600 B.H.P. sets of the horizontal double-acting, four-stroke type, constructed upon the lines of the Nuremberg gas engine, have recently been started up.

The first question one is generally asked, when talking of this engine, is : "What is the possibility of the price of fuel oil fluctuating within wide limits?" and then : "What guarantee is there of a reliable and continuous supply?" The answer to both these questions is that, as petroleum is found in so many parts of the world, and as many new oil-fields are being opened up, the above factors cannot vary over very wide limits, and any such variation should compare favourably with the variations in coal. The oil fuel most generally used is the residue from crude petroleum, after the lighter spirits and oils have been distilled, and is commonly known as "petroleum residue." This oil runs about 240 gallons to the ton, and is generally either Texas or Roumanian oil. The author has recently fixed up a contract on behalf of his council, for a supply up to January 1st, 1913, at 37s. 6d. per ton, delivered into tanks at the Electricity Works, Barking.

Another factor in the fuel oil question is the possibility of using the by-products from the gasworks, viz., gas oil tar, and gas tar oil.

The former is the by-product from carburetted water gas plants, where gas oil is used to enrich the gas for illuminating purposes. It has a calorific value of about 16,500 B.Th.U. per lb., and is being extensively used on the Continent. The latter is the by-product from the distillation of gas tar. The author recently made a careful inspection of some plants using gas oil tar, including a large double-acting tandem four-cycle engine, and a twin-cylinder horizontal two-cycle engine, the sets working with a 10 per cent. addition of crude petroleum—and was perfectly satisfied as to the practicability of using such fuels; so much so, that a 600 B.H.P. engine is now being built to his specification by the Diesel Engine Co., Ltd., to run on either petroleum residue or gas oil tar, and will be in commission this autumn.

Some diagrams taken from the same engine running on different kinds of fuel are given in the Paper. In one the combustion was seen to be late, and to be attended by

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violent explosions. This diagram was taken when running entirely off creosote oil. Another diagram gives the ordinary Diesel diagram, and is a clear illustration how good combustion and smooth running can be obtained by the special arrangements made for mixing 5 per cent. of crude oil residue with the creosote oil.

In dealing with fuel costs it will be well, perhaps, to take first the actual guaranteed consumption of the 600 B.H.P. engine mentioned above, using petroleum residue having a calorific value of 18,000 B.Th.U., at 37s. 6d. per ton.

Table I.

Guaranteed Fuel Consumption and Cost.

Load.	Lbs. per kw.-hour.	Pence per kw.-hour.
12½% over	0·58	0·112
Full	0·58	0·122
3/4	0·61	0·122
1/2	0·69	0·132
1/4	1·01	0·202

Table II. gives some details of Diesel plants that have been in operation some years.

pack, and such items as packings, gauge glasses, cocks, valves, fittings, etc., do not occur, excepting in a minor degree. The cost of engine-room stores, therefore, is reduced to a minimum, being considerably less than with either steam or gas plant.

There appears to be a feeling amongst engineers that although the Diesel engine can compete with other forms of prime mover for small outputs, it is quite out of the question when large power stations are under consideration. That this is an entirely erroneous idea will be seen by the following comparison.

The Brighton works is taken as an example of a large steam-driven station, and one of equal output for both Diesel and gas plant respectively is compared with it. The output in each case being 10,800,000 units generated, 9,000,000 units sold, with a load factor of 21·8 per cent., and a maximum load on generators of 5,900 kw. The present capacity of the Brighton works is 10,200 kw.

The capital spent on the existing buildings and foundations is £109,300. Reducing this to £37,162 to make allowance for the fact that the existing buildings are large enough to house 30,000 kw. of steam plant, and adding the capital spent on boilers, turbo-alternators, switchgear, etc., the author arrives at £19 52 per kw. as the capital expenditure, and 0·424d. per unit generated for the capital charges (estimated at 8 per cent. of the capital). Adding to this the works costs (0·70d.) per

Table II.

Name of Undertaking.	Period covered.	Capacity of Diesel Plant K.W.-hour.	Max. Load.	Load Factor.	Average Cost of Fuel Per Ton.	Lbs. of Fuel per K.W.-Hour.	Units Generated.	Works Cost.					
								Fuel.	Lubricating Oil.	Engine Room Stores.	Repairs and Maintenance.	Wages.	Total.
	Months.			%									
Letchworth	5	135	90	27·2	43/6	0·655	95,169	0·153	0·027	0·015	—	0·160	0·355
Fareham	12	200	85	14·0	49/–	0·92	143,545	0·32	0·021	0·026	0·023	0·435	0·825
Daimler Motor Co.	12	436	495	46·0	53/4	0·624	887,200	0·1782	0·0188	0·0145	0·0233	0·0638	0·2986
Wakefield and District Light Railways	12	400	350	30·66	57/6	0·76	743,658	0·160	0·015		0·057	0·162	0·394
Leatherhead	12	160	—	13·5	—	—	—	0·226	0·025		0·038	0·289	0·578

Table I. shows that the engine maintains its high efficiency until well below half-load. The average load upon the engine is somewhere between half and three-quarters of the full load, and a comparison of fuel consumptions at such loads brings out still greater the advantages of the Diesel plant. The fuel consumption is independent of the time during which the engine is run, being the same for half as for twenty-four hours per day. There are no stand-by losses whatever.

The engine can be started with absolute certainty in a simple manner by means of compressed air, without the least danger, at any time within a minute of entering the engine room, even after a legthy period of rest. Again, the fuel costs are in no way dependent upon any other factor than that of the price of fuel, and the guaranteed consumption per kw.-hour; there being no question of the price to be obtained for by-products to be considered, as with Mond gas plants.

The amount of cooling water used is extremely small. It is circulated round the cylinders at the rate of about 4 gallons per B.H.P. hour, the outlet temperature not exceeding 120° Fah. The make up water should in no case exceed 2½ per cent. This is a most important consideration to those engineers who, like the author, have to take town water from the main. Compare this item with steam plant, especially cooling water for the condensers of turbine plants, or, with producer plant, for gas engines.

The Diesel engine is entirely automatic in its action, preparing its own fuel, stoking itself, and rejecting the waste gases. One man per shift (exclusive of switchboard labour) can easily do all that is necessary in a Diesel power station, up to 1,000 kw. capacity.

The expenditure under this heading is found to be very small. Taking an actual case of three power stations, having installed 1,500 B.H.P., a sum of £117 was expended between them during the last completed year, some of these engines having run practically continuously. This sum corresponds to 1s. 6d. per B.H.P. per annum, which the author considers a very liberal allowance indeed, and it is certainly much too high an average for large sets.

Records of several years' working of engines under various conditions show a consumption not exceeding 4 grammes of lubricating oil per B.T.U. generated, which at 1s. 8d. per gallon amounts to 0·019d. per unit. There is no auxiliary apparatus, such as boiler house plant, condensers, fed pumps, etc., or gas producers, scrubbers, etc. There are no glands to

unit sold, total costs, exclusive of management, comes out at 1·124d. per unit sold.

To obtain approximately the same capacity as the above with Diesel plant, it would be necessary to instal seven sets, each of 1,450 kw. capacity, making a total of 10,150 kw. The author estimates the capital cost per kw. installed at £14·38, and on the same basis as before 0·311d. per unit sold. The works costs he estimates would be 0·262d. per unit sold, giving a total of 0·573d., as against 1·124d. for the steam plant. The corresponding figures per unit generated are 0·477d. for Diesel, and 0·927d. for steam.

For a comparison with gas plant, the same number and size of sets have been taken as for the Diesel plant. The particulars, costs, and other details have been taken from the Paper of Messrs. Andrews and Porter, read before the Institution of Electrical Engineers in February, 1909 (see ELECTRICAL ENGINEERING, Vol. V., p. 169). The capital cost per kw. installed works out at £17·68, and the works costs per unit generated at 0·312d., as compared with 0·218d. for the Diesel plant, and the total cost, exclusive of management, at 0·604d. per unit generated, as compared with 0·477d. for the Diesel plant.

The author next deals with the question whether the Diesel engine could with advantage take the place of motor-driven sub-stations. It cannot, he says, be seriously suggested that a Diesel sub-station is undesirable or impracticable in a large city. There is in London a 100-b.h.p. set in the basement of one of the largest drapery establishments in Oxford Street, also a 1,100-b.h.p. sub-station in the city at Cannon Street, and a still larger one at Charing Cross. There is also another large one in course of erection at Lambeth.

Finally, from a table compiled for the author by the Maschinenfabrik Augsburg-Nürnberg Co. upon the conditions appertaining to South Wales, on the basis of capital charges of 4 per cent. interest, 7 per cent. depreciation, and 1 per cent. maintenance in all three cases, and a load-factor of from 90 to 100 per cent., he arrives at the following comparisons for small plants:—Cost per b.h.p.-hour: Diesel plant, 0·1635d.; steam plant, 0·173d.; gas plant, 0·178d. This is assuming one engine of 600 b.h.p., and one of 150-160 b.h.p. engine in all cases.

In conclusion the author thanks the President, the Diesel Engine Co., and the M.A.N., and many other station engineers for their kind assistance, both with data and drawings.

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INTERNAL COMBUSTION ENGINES FOR POWER STATIONS: GAS ENGINES AND PRODUCER PLANTS.

By R. M. Carr.
(*Chief Electrical Engineer, Leek.*)

In this Paper the author confined himself entirely to gas engines and producer plants, particularly with stations of comparatively small capacity. In small manufacturing towns, he pointed out, where there is a good demand for power, the average price obtained is so low that it is almost impossible for a small undertaking to cater for a heating and power load with steam plant. He admitted, however, that the advertised figures of some makers of gas engines, while they may possibly be true with the conditions under which the tests were taken, are seldom, if ever, realised under ordinary working conditions, and with the fluctuating load of the average central station. On the other hand, electrical engineers are inclined to magnify the troubles which exist with gas engines.

On the question of capital cost, he contended that, below a certain capacity, the gas-driven station costs less than steam, while, as the capacity increases, the figures are reversed in favour of steam, when everything is taken into consideration. For stations up to 500 kw. capacity he estimated that a steam station would cost £55·1 per kw. (including £19·1 for land, buildings, &c.), and a gas station £40 per kw. (including £12 for land, buildings, &c.). Between 500 and 1,000 kw. he gave the corresponding figures at £37·9 and £33·4 respectively, and from 1,000 to 2,000 kw., £29·5 and £30·5.

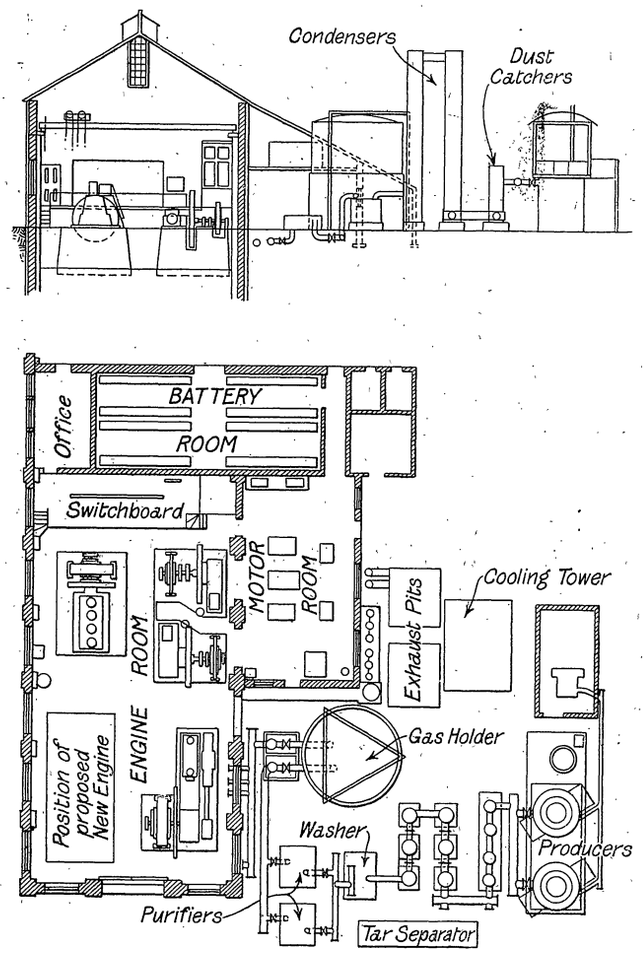


Fig. 1.—General Lay-out of Leek Station.

In the author's 420 kw. station at Leek, which is entirely gas driven, the capital expenditure was as follows:—

		£
Engines and dynamos		6,567
Producers and cooling and cleaning plant, including pipe-work		2,070
Switchboard and electrical auxiliaries ...		1,392
Accumulators		719
Travelling crane		189
		£10,937
Per kw. installed	£26	
Land, buildings and foundations		£5,413
Per kw. installed	£13	
Total cost per kw. installed	£39	

The gas plant is of the "Wilson" pressure type manufactured by the Horsehay Co., Ltd., and consists of two producers, each nominally of 300 b.h.p. capacity, but which are capable of 25 per cent. overload without forcing to the point of inefficiency. Water bottoms are provided for continuous running. The gas passes from the producers through an omnibus main into four cylindrical boxes where the greater part of the dust is deposited. The cooling operation is carried out by means of a series of concentric tubes, the gas passing between the outer and inner tubes. The cooled gas is then washed, the tar which is extracted flowing into a tar separator, and the gas passes through sawdust purifiers, leaving the last of the tar in the process. The purifiers are connected in parallel in order that one may be cleaned without shutting down. A small holder is provided, not as a reservoir, but merely as a mixer and governor. From the holder an 18-in. main is provided, and separate services connected to two horizontal, Otto cycle, single-cylinder gas engines, each of 100 b.h.p., one four-cylinder vertical engine of 200 b.h.p., and one Körting, two-cycle engine of 275 b.h.p. Each engine is coupled direct to a D.C. generator. The station is further equipped with a 400 ampere-hour battery, and the usual balancer, boosters, and other accessories.

Dealing next with running costs, the author pointed out that the fuel costs of a gas-driven plant are considerably below those of a steam plant, but repairs and maintenance of engines will be somewhat greater after a few years of running for gas engines than for steam. On the other hand, he maintained that the repairs to a well-designed producer plant should not be anything like so great as those of boilers. In the following table he compared the average figures of three gas-driven municipal undertakings, the averages of several other gas-driven undertakings, and the average of all the municipal undertakings of a capacity of under 1,000 kw. Where the figures given were per unit generated, 20 per cent. has been deducted from the number of units in order to allow for losses, &c., and to bring all to the basis of costs per unit sold.

Table I.—*Comparison between Gas and Steam Stations under 1,000 Kilowatts Capacity.*

	Averages of Municipal Gas Undertakings.	Averages of Other Gas Stations.	Averages of Steam Stations.
Capacity in k.w. ...	314	632	600
Units sold per annum	299,210	874,720	502,980
Costs per Unit Sold in Pence.			
Fuel	0·28	0·26	0·53
Oil, waste, water, and stores	0·06	0·04	0·06
Wages of workmen	0·26	0·16	0·30
Repairs and maintenance	0·19	0·22	0·28
Total works cost	0·79	0·68	1·17
Rent, rates, and taxes	0·10	not available	0·12
Management and establishment charges, insurance, etc.	0·41	not available	0·34
Total costs	1·30	—	1·63

The average price for fuel in the municipal stations quoted is 11s. per ton delivered, either coke or bituminous coal being used.

Regarding the general running of producer plants, a great number of the failures, the author thought, must be attributable to lack of knowledge and experience on the part of the attendants. For this, he said, manufacturers are somewhat to blame, as the rosy picture often presented of a suction plant, which takes care of itself, requiring only a few buckets of coal per hour, is not often realised. The secret of success in producer gas plants is systematic cleaning, particularly in bituminous plants. Suction plants, burning anthracite and coke, up to, say, 200 or 300 h.p., he continued, are now an acknowledged success where ordinary care is taken, and some thousands of horse-power are now in successful operation, but except in case of very small plants, they are not very desirable for central station work. Anthracite is expensive, except in districts in close proximity to the collieries where it is produced, and a suction plant is not very suitable for sudden variations in load. For a station of anything over 300 or 400 kw. capacity, a pressure plant with a small holder is preferable. On a fully loaded

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suction plant 1 lb. of anthracite would be required per B.H.P. hour, which at 30s. per ton would cost, for, say, a 300 h.p. engine, 4s. per hour for fuel, while a pressure plant burning bituminous coal would require 1½ lbs. per B.H.P. hour, which at 10s. per ton for the same size of plant would work out at 2s. per hour. Another advantage which the pressure plant has over the suction type is that it is much more elastic in operation. When installing suction producers a separate plant should be installed for each engine, but with a pressure plant the producers can be connected in parallel through an omnibus main.

The disposal of the effluent from the washer of a producer plant often presents a difficulty, especially in inland towns. The Sanitary Authority often objects to its going into the sewer in the state in which it leaves the washer, and the County Council naturally objects to the pollution of rivers and streams. When the water is turned into a sewer care should be taken that it is not hot, otherwise vapours may arise from it and pass the gratings in the streets. The author has recently met with opposition from the County Council to the effluent finding its way into a stream, but is getting over the difficulty by circulating the water by means of a pump and tanks, and treating it with lime. This throws down the sulphur compounds in the form of mud, and only a very small quantity of the treated liquor will be allowed to flow into the drain from time to time.

The author finds no difficulty in dealing with the tar in settling tanks, and in selling it at from 6s. to 11s. per ton, according to the percentage of water it contains. The sawdust scrubbers are cleaned every week, and the tarry sawdust is burned under the vertical boiler; with the addition of about one ton of coke breeze dust per week, it is sufficient to raise all the steam required for the blower engine and the producers. The only trouble the author has experienced from tar in the engines was in one engine, the design of which caused the gas to pass through the valves at a very high velocity; this velocity had the effect of dropping what tar remained in the gas, and after a few weeks these valves became clogged. This was got over by fixing a cast-iron box containing a series of grids of fine brass gauze near the gas inlet, and these grids are changed and cleaned every week.

To silence the exhaust, the author recommended exhaust boilers, where the plant is large enough to warrant this. These boilers are at the same time able to raise sufficient steam for all purposes required on the producer plant. He deprecated the silencing of the exhaust by means of water in the exhaust pipes, as the sulphuric acid formed by the mixing of the water with the sulphur in the gas causes rapid deterioration of the pipes. At Leek a system of exhaust pits is employed.

With most of the modern types of gas engine the author has found that a sufficiently good cyclic regularity can be obtained for alternating work, but close governing must be insisted upon, and this is a point the importance of which has not yet been fully realised by some manufacturers. He also criticised a tendency on the part of some manufacturers to overrate their engines slightly, an important thing to guard against, as a gas engine cannot be overloaded.

In conclusion the author drew up a statement of the capital and running costs of a gas driven station of 1,000 kw. capacity. The complete cost of this plant, based upon manufacturers' quotations, worked out at £30·6 per kw. installed, and the estimated works costs at 0·64d. per unit sold.

Our special correspondent wires us that a long discussion, chiefly devoted to Mr. Howard's Paper, disclosed considerable diversity of opinion. Mr. Charles Day, of Mirrlees, Bickerton & Day, Mr. Mulholland, of M. A. N. Co., and Mr. R. J. Kaula, of Messrs. Willans & Robinson, spoke for the makers. Mr. Day in particular said that the large consumption of lubricating oil noticeable in the early days no longer took place. Formerly some of the lubricating oil volatilised in the cylinders, and helped to lessen the apparent fuel costs. He admitted that engines exceeding 150 h.p. per cylinder introduced complications, increasing the cost of upkeep, a point which was subsequently taken up by engineers of large steam stations.

Mr. A. BLACKMAN (Chief Electrical Engineer, Sunderland Corporation), and Mr. S. E. FEDDEN (Chief Electrical Engineer, Sheffield), gave figures to show that their capital and works costs were enormously less than the figures given by Mr. Howard for Diesel engines in the Brighton example.

Mr. L. ANDREWS (Key Engineering Co.) complained bitterly that the quotation from his 1909 Paper was misleading, as Mr. Howard had included cost of ammonia recovery plant, but not credited revenue from sale of by-product. He gave curves to show that guaranteed consumptions for gas engines were lower than those for Diesel engines, even at half load.

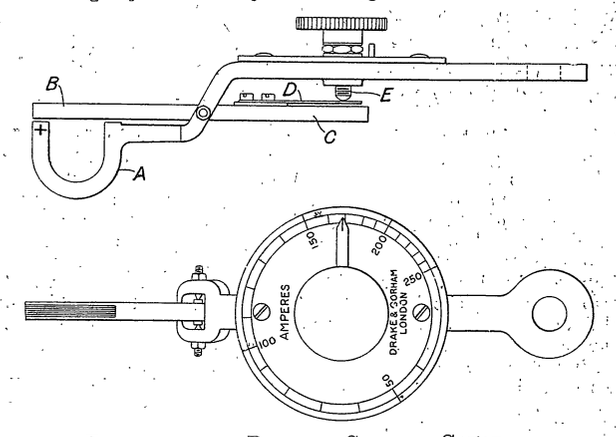
Mr. HORACE BOOT had been disappointed with the results at Chichester. Repairs and attendance, he said, must be very high if engines were to last more than three or four years, and he complained of cost of replacement of parts.

Mr. H. L. DIXON (Chief Engineer and Manager, Leatherhead and District Electric Supply Co.), on the other hand said he had had four or five years' success with Diesel engines. Although he employed cheap labour, repairs were only about £2 per year.

The discussion will be reported at length in our next issue.

THE FRISBY CURRENT GAUGE

A DEVICE for the determination of the current passing in any cable or conductor without making any connections, has been brought out by Messrs. Drake and Gorham, Ltd. (66 Victoria Street, S.W.). The appliance, which is to be known as Frisby's Patent Mechanical Current Gauge, is remarkably simple in principle, and is illustrated here. The instrument is placed with the U-shaped bend A surrounding the cable carrying the current to be investigated, and the armature B shut down, when, if the screw E is screwed back to the position where the pointer attached to it is at zero on the scale, it will adhere to the pole piece on account of the lines of force set up in the surrounding iron by the current in the cable. The apparatus is then held steady, and the screw gradually advanced till the tension on the flat spring D is sufficient to pull it off. The pointer will then read direct on the scale the current in amperes. The magnetic circuit is built up of laminations. The size of the cable and the nature of the insulation has practically no effect, and the readings are but slightly affected by armouring on the cable. The instrument should be of considerable use in distinguishing between current-carrying cables in trenches, and for estimating the current in feeders at a feeder pillar. For this purpose it may be clipped round the cables themselves where they are single, or even round the porcelain tube fuses. The size at present made will take cables, &c., up to 1⅛in. external diameter, and is graduated up to 250 amperes. Other sizes are in course of preparation, and a simpler form is made without graduations, in which a permanent magnet is used in conjunction with a compass needle to detect the direction, as well as the presence of, a current. In this case the spring is set so as just to balance the pull of the permanent U-shaped magnet on the armature.



ELEVATION AND PLAN OF CURRENT GAUGE.

Coronation Honours.—The Hon. C. A. Parsons, F.R.S., and Prof. J. A. Ewing, F.R.S., Director of Naval Education, have been created K.C.B. on the occasion of the Coronation.

Junior Institution of Engineers.—The summer meeting of this institution is fixed for July 29th to August 5th, and includes visits to Felixstowe, Ipswich, Norwich, and Cambridge.

Obituary.—We regret to record the death, owing to an accident last week, of Mr. P. S. Sheardown, Electrical Engineer to the Dublin United Tramways Co., who was well known in the electrical circles in Dublin.

Junction Box Explosion.—A junction box explosion occurred in Trafalgar Square on Monday evening, and a small portion of the pavement was damaged. The occurrence had no connection with the catching fire of some decorations near by at about the same time.

Laying a Foundation Stone Electrically.—After the Coronation electrical communication was employed for the King to lay the foundation stone of a Fishermen's and Sailors' Home in Newfoundland, by pressing a button at Buckingham Palace. The current impulse which set in action the mechanism for laying the stone travelled over special Post Office lines and the Anglo-American Co.'s cable, which lands at Heart's Content, Newfoundland.

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ELECTRICITY IN THE CORONATION ILLUMINATIONS

THE outstanding feature of the illuminations in London last Thursday and Friday nights was the enormous use made of electricity, far exceeding anything of the kind that has been attempted before, and it is chiefly due to the foresight and enterprise of a small group of electrical manufacturers and dealers, who prepared, in such large quantities, the special fittings, wiring material, and devices that were required. So great was the demand for current that over a week before the Coronation day the Westminster Electric Supply Corporation deemed that the capacity of their mains and feeders in the neighbourhood of Piccadilly would be fully taken up with the connections already applied for, and would not entertain further applications, and the same applied in the case of the St. James's and Pall Mall Electric Light Co. in the Pall Mall district. In the City, although the illuminations were on a grand scale, the position was more favourable, as in this case, of course, the special load was almost entirely in substitution for, and not in addition to, the ordinary private lighting load.

The brightest spot in the City was the space in front of the Bank of England, the Mansion House, and the Royal Exchange, which was illuminated almost entirely by lines and festoons of 8 c.p. lamps of various colours arranged in the specially made up forms of "strip" which have been so popular on the buildings, and outlining many handsome devices and mottoes. Probably the most ambitious scheme was the decoration of the Bank of England. Here there were three large gilded wreaths, two encircling the letters "G" and "M," and the third over the main portico enclosing the Royal cypher. At the ends of the building were two oval medallions mounted on scroll bases, with the Royal monogram in the centre. Each of these devices bore the imperial crown studded with 48 amber lights. There were 16 eight-pointed stars with 17 lights on each arranged along the coping of the roof, and the six central windows and the cornice of the main portico were outlined with ruby tipped lamps with white centres, the remainder of the festooning, outlining, and entwining being carried out with white-tipped lamps with ruby centres. The front columns were entwined with lamps fitted with white-petal floral reflectors, and ten large flambeaux projecting from the roof were illuminated with metallic filament lamps, the effect closely resembling the real flame. Altogether, there were about 5,000 lamps and four miles of cable fed by three special mains put in by the City of London Electric Lighting Co. These were divided into four main circuits, two one each side of the three-wire system, which supplied altogether 86 sub-circuits with an average of 46 lights on each, and the whole was controlled from a D.P. watertight distributing switchboard. This was the finest individual electrical display, and took only 150 kw. The work was carried out by Messrs. Piggott Bros., of Bishopsgate, who were also responsible for many other displays. The scheme for the Royal Exchange was divided, a certain amount of gas being used, but around the pillars and along the festooning electric lamps were prominent. The building occupied by the London and Liverpool and Globe Insurance Co., at the corner of Lombard Street and Cornhill, also had a fine display; large set-pieces depicting the national emblems on each side of the building and the dome were outlined with clear lamps. A view of this and the Royal Exchange from a short way down Poultry towards Cheapside was magnificent. The exterior of the Mansion House was very striking with electric torches as well as gas flambeaux on the roof and electric lamps were coiled round the Corinthian pillars in alternate colours of amber and purple. All the windows and cornices were outlined with electric lamps, and stretching right across the front of the building was a crystal device, "Long Live the King," with illuminated portraits of their Majesties on either side. Some very conspicuous clusters of red, white and blue flambeaux were to be seen on the Gresham Life Assurance Co. The London Joint Stock Bank was very much to the fore in Princes Street, the ground floor and the top cornice being lined with 120 frosted electric lamps spaced 12 in. apart. Four windows were also completely lined. The centre of the building was occupied by a large floral device measuring 6¼ ft. by 7 ft., with a green background and green lamps, the letter "G" being enclosed in the device, the total number of lights amounting to 115. Above this device a crown 3¾ ft. by 4½ ft. was erected, consisting of 57 frosted lamps with a gilded background, the jewels being picked out in their correct colours. Two smaller crowns 2 ft. square fixed on each side of the central device each contained 39 lights, the whole scheme consisting of 650 lights. Lombard Street was most picturesque; from end to end tall archways of amber lamps lining floral festoons hung across the street, while the walls on either side were festooned with lights, and many of the old signs of the Lombards were illuminated. The effect, which was very great, was added to by the narrowness of the street. The rival illuminants were to be seen fighting their battle over again on the City side of London Bridge, where the electrically illuminated Pearl Life Assurance Co. was one stream of light, and quite outshone its rival opposite in the Fishmongers' Hall. The former comprised two 6 ft. by 8 ft. crowns, each studded with 170 amber lights, and four letters with altogether 320 lamps. There were also eight double-light flambeaux. The whole building was lined out with about 3,000 ft. of Pixielite strip, supplied from 30 circuits and controlled from one switchboard containing four 100 ampere main switches with two double pole fuses per switch. This installation was executed by Messrs. S. Hammond and Co., 107 Cannon Street, and the power, about 40 kw., was taken from the City of London Co.'s mains.

London Bridge was artistically transformed in keeping with the other parts of the line of route by Messrs. Duncan, Watson and Co. At intervals of 20 yards on each side of the bridge 20 lattice columns were erected, with two Venetian masts between each two columns. Ruby lamps adorned the top of each mast, and a number of plain lamps lined the top of the columns. Festoons of 5 c.p. plain lamps about 12 in. apart hung between the columns and masts on twin strip, and below these were festoons of artificial wistaria. The current was supplied by the City of London Company at 220 volts A.C. from a peak load feeder, which is not in much demand during the summer. As the power was only available on one side of the bridge, a pair of 37/15 cables had to be taken under one of the arches to the other side. The current was distributed by a cable on each side of the bridge, supported by raw-hide suspenders hung from a steel wire which ran direct into a combined switch and fuse box at every second column, the two sides being balanced on the three-wire system. The arch at Temple Bar presented a sort of canopy lined with lights shining through lattice-work, and stretching on either side of the Griffin.

A very fine show was given by Messrs. Coutts' Bank in the Strand, where the firm's crest was very prominent in the centre of the building, its three crowns shining out like diamonds, and besides three glass medallions bearing initials, the doorway and the pillars were outlined with electric bulbs.

Beyond having to take away the Standard lamp columns from the centre of the road at the junction of Trafalgar Square and Whitehall, and replacing them with the "Beck" lamp, which was suspended across the road, the City of Westminster did very little illuminating. Of the shipping offices in the vicinity of Cockspur Street the display most prominent and pleasing to the eye was that of Oceanic House. There a model of the *Olympic*, the largest liner afloat, showed its port-hole and saloon window lights, with the footnote, "*Olympic*, 45,000 tons," in large gold letters. At the top of the building an enormous white star formed of many hundreds of white lamps shone out and had a luminous anchor on either side.

All the other shipping offices in this area were also aglow with various devices. A very picturesque display was that of Messrs. Hampton's, in Pall Mall East, where gilt lanterns of the seventeenth century with electric lamps shining through the talc material, hung from the first tier of seats, making a magnificent spectacle. Another feature was a large crown picked out at the top of the building in emerald, pearl and ruby lights, whilst incandescent lamps outlining the whole building gave a splendid finish to a really beautiful display. Visitors to Clubland were not disappointed after the brilliance of the City, for here, although perhaps on a smaller scale, a very high standard of artistic excellence was maintained. The Reform and Carlton Clubs were studded with lights, but for brilliance the new premises of the Automobile Club, which was completely outlined with frosted lamps, with a huge illuminated crown, was the most prominent, but for effect mention must be made of the new Oxford and Cambridge Club, which was outlined with lamps representing their colours. Another display to be noted was that given by Messrs. H. S. King, the Indian bankers, who exhibited two glowing mottoes, "Vivat Rex" and "Vivat Imperator." Although not on the line of route, we may here mention the Piccadilly Hotel, which was picturesquely outlined with about 3,000 ft. of Bro-ite strip. The main pillars were circled alternately with red, white and blue lamps, whilst a large crown on each side of the building and a number of flambeaux completed a scheme which was one of the many ably carried out by Messrs. Siemens Bros. Dynamo Works, Ltd. Especially noticeable also was the brilliant golden display of the Criterion Restaurant. Quite an original design was carried out by the Royal Academy, where, over the main entrance, was to be seen a crown of Chinese lanterns lit up with electric globes, and the inside of the archway was outlined with many rows of them. The line of route along Piccadilly from Hyde Park Corner to St. James' Street approached the City very closely for brilliance. The entire length was lined with 7,000 lamps, taking altogether about 2,000 amperes. These lamps hung in two rows between the masts on each side of the road. The top row, approximately straight, consisted of 16 c.p. lamps

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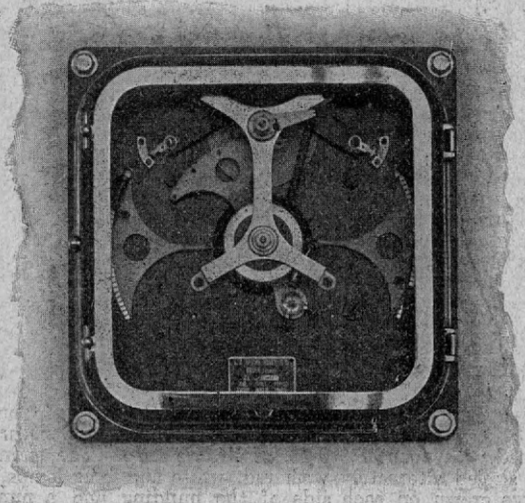
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enclosed in gold cloth balls of 7 in. diameter; the lower row, which formed the line for evergreen festoons, having 8 c.p. lamps. Each mast carried an evergreen garland and also a crown at the top, both of which were illuminated. The current was taken at about eleven different points from the Westminster Electric Supply Corporation, and fed direct into "Cantie" combined switches and fuses, of the cast-iron watertight pattern, fixed on to stout masts. The clubs and residences facing the Park along this route were all richly decorated and illuminated with equal effect, none standing out for special mention until Hyde Park Corner was reached. Here the windows and outlines of Apsley House and the adjoining residence of Lord Rothschild were picked out with electric lamps, the devices exhibited being a crown and the motto, "Long Live our King and Queen" on the former, and the Royal monogram and crown with electric torches on the latter. Of the buildings away from the line of route, Messrs. Wolland Bros., 95 Knightsbridge, was another for which Messrs. Siemens Bros. Dynamo Works was responsible. The installation comprised about 400 ft. of Bro-ite strip, which supplied the following devices: two large crystal medallions with Royal quarterings, four crystal stars, two transparencies of the King and Queen, all electrically illuminated. There were also twelve large gilt wreaths with central floral illuminations, and the complete line of lights had neat floral attachments. Beside these, there were 10 sets of shields with flags and tridents, and nine Colonial ovals. Selfridge's gave a patriotic display of shields bearing the arms of various monarchs of England. Above these were smaller shields bearing the arms of different Possessions of the Empire, which were draped with flags with a crown at the top, and surrounded with electric lights. A large gilt portcullis glowed between each of the columns. Numerous electric flambeaux about 6 ft. high extended round the building, and an enormous illuminated crown resting on a shield, with large initials studded with electric bulbs, towered above the building.

Accustomed as Portsmouth is to Naval displays, no finer sight has ever been witnessed than the illumination of the combined fleets at Spithead last Saturday night. The firing of a rocket gave the signal for switching on, when every unit all along the line simultaneously twinkled with light from hull to masthead, and in this case the reflection of the water produced that dancing effect so much admired by the advocates of gas. The flags at the top of the masts of the flagships glowed red, and the tripod masts of the Dreadnoughts showed up especially well. The "Eiffel-towers" of the American ship *Delaware* stood out with a weird effect. At the signal "All lights out," the most imposing spectacle of modern times, which will live long in the memory, especially of our foreign visitors, brought the Coronation festivities to a delightful and most fitting end.

In conclusion, it is interesting to note the advantages and disadvantages of electrical illumination compared with gas. The gas shimmering effects in crystal devices cannot be obtained by electricity, but on the whole the electrical designs were very much more effective, especially in exposed positions, where, in many cases, especially on Thursday night, half the gas-jets were blown out, and made a stronger appeal to the observer's nose than to his eyes. From an artistic point of view, moreover, electricity proved to be a more suitable medium for securing the individuality which was so noticeable in a number of instances. The gas effects appeared to be rather stiff and stereotyped.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ARC LAMPS.—A catalogue of arc lamps for photographic purposes has just been issued by the Globe Electric Co., Ltd. (11 Farringdon Avenue, E.C.). Special outfits are included for reproduction, projecting, and copying, with various accessories.

ALUMINIUM.—Some of the uses of aluminium in chemical industry are set forth in a leaflet from the British Aluminium Co., Ltd. (109 Queen Victoria Street, E.C.)

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

HOLOPHANE GLASSWARE.—A card from Simplex Conduits, Ltd., gives in a convenient form the latest prices of holophane standard "Stiletto" prism reflectors.

ELECTRIC WINDING PLANTS.—A book in German from the Allgemeine Elektricitäts-Gesellschaft contains particulars and illustrations of a large number of main shaft electric winding plants which the firm have installed. A pamphlet accompanying this describes their latest form of depth indicator and safety device.

Turin International Congress for the Applications of Electricity.—The following have been appointed as delegates to represent the Institution of Electrical Engineers at the Congress which is to be held in Turin in September, 1911:—Mr. S. Z. de Ferranti, Colonel R. E. Crompton, Mr. W. Duddell, Dr. R. T. Glazebrook. Mr. R. Kaye Gray, Mr. R. Hammond, Major W. A. J. O'Meara, Mr. A. Siemens, and Dr. S. P. Thompson.

ARON ELECTRICITY METER

THE annual meeting was held at Winchester House on Thursday last week, Mr. H. Hirst, Chairman of the Company, presiding. After the notice convening the meeting had been read, the Chairman said:—

"I take it that you have read the report and balance sheet as presented to you (ELECTRICAL ENGINEERING, June 15th, p. 338). I hope you have looked at the figures with the same amount of pleasure that they have given to your directors. They show the healthy development and progress of our business. Comparing this year's report with last year's, I single out the following items for comment. First, the most interesting item of gross profit on trading, amounting to over £44,000. This is nearly £9,000 in advance of last year. The amount received from dividends on investments is reduced, owing to the fact that the expansion of our business drained our liquid reserves to the utmost previously to our debenture issue. We had to realise these reserves during the year, and, I regret to say, at a loss. No blame can be attached to your directors for this loss, as we kept these reserves in trust securities, and you are all familiar with the fact that all trust securities in this country have receded in their value to an unpleasant standard. I refer to it not only on account of the items on the debit side of the profit and loss account, namely, £87 6s. 5d. and £85, but more on account of the fact that we have had on a previous occasion to write trust securities down by an amount of between £700 and £800. On the debit side of the profit and loss account I wish to point out that we have depreciated this year more by about £1,600 than last year, and the additional expenses are due to the recent debenture issue, which necessitated calling in the old debentures, and paying the premium on them. The management charges are of course increased, but not out of proportion to the increased business. As regards the figures on the balance sheet, on the credit side we have increased stock and outstanding account; but your directors are satisfied that the increase is normal in proportion to the increase of business. The large amount of cash at our disposal is, of course, the residue of the recent debenture issue. On the debit side of the balance sheet I would like to refer to the increased nominal capital. We have not issued any additional capital; we have only asked for the power to do so. This was a necessary provision to meet the possible—I may say probable—desire of the new debenture holders in due course to avail themselves of their option of converting their debentures into ordinary shares. I am happy that we are at last in a position to pay a dividend to the ordinary shareholders, and I personally thank them for the patience they have shown. I think the outlook is such that they may enjoy continued participation in our prosperity. We shall continue to be conservative in our policy, and I hope you approve of our recommendation to put £5,000 to reserve account and use £7,000 of this year's profits in writing off a portion of the costs of the debenture issue. I personally hope, and I think I am justified in doing so, that the profits we are now making may continue, and that the business we have established may prosper further to enable the directors to distribute in the future satisfactory dividends to both classes of shareholders. As regards the business itself, there is very little now to say. The meter business is carried on on the same lines as before, and our increased output has strengthened our power to compete in the world's market; our organisation, thanks to the supervision and hard work of Professor Aron, is being more and more perfected every year, and the loyalty and interest in the business of our staff is an asset of which we can be proud. Concerning the taximeter business, we are pleased with the ever-increasing number of instruments that are being placed on the streets. It may be pleasant news to the shareholders to learn that we have hitherto used the total revenue from this branch of our business towards writing down the expenses and cost of the instrumnets we hire out, and none of the revenue has so far been used in arriving at the figure which we record as our trading profit. By this conservative policy, we hope in years to come to create a valuable annual contribution towards the dividends we hope to pay. I now have much pleasure in moving that the report and accounts for the year be received and adopted."

In reply to a question, the Chairman said that a subsidiary company had been formed to work the taximeter business of the Aron Co., as it was felt that the meters and taximeters formed distinct departments. The profits went to the Aron Co.

The report and accounts were then adopted.

The Chairman then proposed that a further dividend of 5 per cent. for the half year, making 6 per cent. for the year, be paid upon the preference shares, and a dividend of 6 per cent. on the ordinary shares for the period to March 31st, 1911. Mr. Roger Wallace, K.C., seconded, paying a tribute to the work of Prof. Aron, and the proposal was carried.

Col. R. E. Crompton and Mr. Barclay Heward were re-elected directors, on the motion of the Chairman, seconded by Mr. Harry Kahn.

The auditors having been re-elected, the Chairman announced that the dividend warrants would be sent out on the 24th inst.

Votes of thanks to the Chairman and Prof. Aron closed the proceedings.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published June 22, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

12,926/10. **Series Transformer Switchgear.** G. BERRY. A modification is described of the Berry series transformer system for saving light load losses (see ELECTRICAL ENGINEERING, Vol. III., page 197), designed to prevent the switch mechanism after acting automatically to short-circuit the supplementary transformer upon failure of the main transformer during low load, from being afterwards automatically moved into a position to open the short-circuit upon the relay re-assuming the position corresponding to low load. For this purpose, one winding of the main operating solenoid is arranged to be closed by a relay through a circuit that will be rendered non-effective upon failure of the main transformer, by being arranged to be closed across the secondary of the main transformer between the ends thereof, and the fuses in the conductors connecting such ends to the secondary mains. The other winding is connected across the low-tension circuit, and the fuses for the primary and secondary of the main transformer are weaker than those of the spare transformer. One figure.

13,224/10. **Motor Starters.** THE ADAMS MANUFACTURING CO. (*The Cutler Hammer Co.*) Improved means are afforded by this invention for retaining the contact arm of a solenoid starter in the "on" position after the operating solenoid has ceased to be energised, by the provision of a separate retaining magnet engaging directly with the contact arm. Three figures.

13,694/10. **Transformers.** THE BRITISH THOMSON-HOUSTON CO. (*General Electric Co. of America*). An improved method of winding transformers so that a maximum degree of ventilation is obtained between the windings, applicable to windings symmetrically arranged round the core. The inner layers of the winding are arranged with less radius of curvature than the outer ones, providing air ducts between the layers. Two figures.

27,174/10. **Suspension Insulators.** SOCIÉTÉ VEDONELLI, PRIESTLEY & CIE. A chain for the suspension of high-tension insulators, in which each porcelain insulator has a core perforated by two holes at right angles to each other and has downwardly sloping wings. The insulators are connected by rings of iron wires, so that the wings of one insulator react between those of the next below, giving protection against rain and minimising leakage. Five figures.

29,726/10. **Converters.** CROMPTON & CO., LTD., and H. BURGE. Alternating current is converted into continuous for the supply of variable speed motors by a motor-generator set consisting of a rotary converter driving a continuous-current generator wound for the same voltage, and connected in series with it and provided with a reversing field regulator, so that current can be delivered at any voltage from zero to twice that at the brushes of the converter. One figure.

132/11. **Lamp Filaments.** G. LÜDECKE and IMPERIAL WORKS (BRIMSDOWN), LTD. A method of decarbonising, consolidating, and sintering metal filaments carried upon a support in an open-tube furnace, supplied with a reducing atmosphere introduced into the furnace at such pressure as to completely drive out the air. The gases are mixed in such proportion as to effect decarbonisation, but not to permit of combustion either within the furnace or at the open end. The mixture may contain 90 per cent. of nitrogen or inert gas, and the reducing agent may be hydrogen freed from water and oxygen, or ammonia may be used in relatively small proportions. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: GILBERT ARC LAMP CO. and DOWDELL [Electrodes for] 21,157/10; SCHMIDT, 29,506/10; MOUL (*Korting*) 741/11.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: LARMUTH [Cable-making machinery] 21,101/11.

Dynamos, Motors, and Transformers: HEATHER [Safety methods of hoisting and lowering with induction motors] 11,336/10; HITCHCOCK and MUTTER [Self-acting motors] 13,984/10; AKT.-GES. BROWN, BOVERI, ET CIE. [A.C. commutator machinery] 14,391/10.

Electric Ignition: SIMMS [Distributors] 1,893/10; SBOROWITZ [Igniting devices] 10,978/10.

Electrometallurgy: BLASBERG [Electroplating apparatus] 19,236/10; PAULING [Electric furnace for treating gases] 3,251/11.

Incandescent Lamps: COWPER-COLES [Lamp bulbs, globes, &c.] 13,282/10; HALLIWELL and JEREMIAH [Means for locking lamps in their holders] 14,429/10; CITY OF LONDON ELECTRIC LIGHTING CO. and PEARD [Supporting, raising, and lowering apparatus] 19,795/10; WESTINGHOUSE METALLFADEN GLUHLAMPENFABRIK GES. [Metallic filament lamps] 22,852/10; MAYES [Lamp cap] 24,216/10; NEPLE [Inclinable lamp supports] 24,818/10; SMITH and KAATZ [Regulator for] 29,700/10.

Meters: SCHOTT and GEN [Electrolytic meters] 10,792/11.

Switchgear, Fuses, and Fittings: ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Motor-starting devices] 13,335/10; RANKIN [Electric controlling apparatus] 13,453/10; McGEOCH and W. McGEOCH & Co. [Switches]; PRICE [Prevention of sparking in controlling circuits] 14,380/10; BRITISH THOMSON-HOUSTON CO. (*General Electric Co.*) [Voltage regulation] 21,041/10; DR. PAUL MEYER AKT.-GES. and KUHNEL [Mercury contact electric switches] 28,657/10; LOHAY [Apparatus for electrical control at a distance] 29,378/10.

Telephony and Telegraphy: NEUHOLD [Automatic telephone systems] 22,959/10; AITKEN and BRITISH INSULATED & HELSBY CABLES, LTD. [Telephone switchboards] 25,502/10† SIEMENS and HALSKE AKT.-GES. [Automatic telephone circuits] 27,026/10.

Traction: SHAW and GREEN [Detachable power handle for controllers] 16,017/10; SEFTON-JONES (*Oesterreichische Daimler-Motoren Ges.*) [Conductor supports] 3,747/11.

Miscellaneous: HARRIS [Electric detonators for blasting] 10,717/10; ESSER and HODGKINSON [Electric lighting for cars, cycles, etc.] 19,532/10; WILLIAMSON [Electric alarms] 22,642/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Instruments: HARTMANN and BRAUN AKT.-GES. [Hot wire] 10,056/11.

Telephone, &c.: GIRARDEAU [Receiving and transmitting apparatus] 11,999/11; SOC. DES ÉTABLISSEMENTS GAUMONT [Phonic relays] 12,576/11.

Batteries: CHEMISCHE FABRIK GRIESHEIM-ELEKTRON [Regeneration of] 12,040/11.

Electric Ignition: KETTERING, 11,292/11.

Miscellaneous: SOC. DES ÉTABLISSEMENTS GAUMONT [Energy relays] 15,744/10; KREGLEWSKI [Regulating device for transforming diffusers] 3,146/11; AKTIESELSKABET HOVLANDS RADIO-TELEGRAPH [Electric condensers] 12,976/11; FRIEDREICH [Supporting devices for electric illuminating bodies] 13,026/11.

Restoration of Lapsed Patents

530/07. **Copper Refining.** L. JUMAN. This patent, which expired due to the non-payment of renewal fees, has been restored. The specification, which was abstracted in ELECTRICAL ENGINEERING, February 2nd, 1911, covers a chemical process for obtaining a copper precipitate from a copper salt solution.

Application for Extension of Term

809/98. **Telephone Exchange Automatic Calling Devices.** W. P. THOMPSON (*Strowger Automatic Telephone Exchange*). The Automatic Electric Co. will shortly apply for an extension of the term of this patent.

Opposition to Grant of Patent

30,602/09. **Separators for Primary Batteries, &c.** P. MARINO. Opposition has been entered to the grant of this patent, which deals with the construction of separators for primary batteries and secondary cells, by a process of treating the fibrous material for use as separators.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

15,838 of July 3rd, 1897. **Printing Telegraph Systems.** H. A. ROWLAND. This patent relates to improvements in telegraphy, and constitutes a method of transmitting messages by modifying the impulses of an alternating current so that the number and sequence of the impulses will represent a signal, which is then transmitted over a line and used in any desired form.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: J. BROCKIE, 5,555/06.

Distribution Systems, &c.: BRITISH THOMSON-HOUSTON CO. and E. B. WEDMORE [Electric distribution] 4,878/05; A. G. BLOXAM (*J. Goffin*) [Electric insulation] 5,049/05.

Dynamos, &c.: C. A. PARSONS [Dynamo electric machines] 5,907/02; H. PIEPER [Dynamo electric machines] 4,504/05.

Electrometallurgy, &c.: S. COWPER-COLES [Electro-deposition] 4,668/05.

Incandescent Lamps: J. McFARLANE and H. WATSON, 4,700/05.

Switchgear, &c.: R. C. CLINKER [Regulating electric currents] 5,831/02.

Telephony, &c.: M. KOTYRA [Telegraphs] 5,183/03; J. WILKINSON and J. D. LYNCH [Ships' telegraphs] 5,698/06.

Traction: F. E. WARD [Electric railways] 5,323/02.

Miscellaneous: L. W. YAGGY [Coin-freed apparatus] 4,990/99; J. & C. HOLT and J. W. POWELL [Lifts and cranes] 5,819/02; C. E. GROUSELLE and V. E. MANOUVRIER [Electric time alarms] 12,629/03; CROMPTON & Co. and C. CROMPTON [Electric fans] 4,727/05; W. C. HILL [Electric bells] 5,304/06; F. W. HOWORTH (*J. W. Holman*) [Electro-magnets] 5,371/06.

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THE TELEPHONE TRANSFER

IN the House of Commons last week, in moving a formal money resolution upon which to found a Bill authorising the transfer of the National Telephone Company's undertaking to the State, Mr. H. Samuel, the Postmaster-General, gave a short history of the events which led up to the purchase agreement of 1905. In mentioning that the Company's undertaking is to be purchased upon what is generally known as "Tramway Terms," *i.e.*, without any sum for goodwill, he called attention to the special cases of Portsmouth and Brighton. In these two places, in respect of which municipal licences were granted, which will expire in 1926, the Company's licence was extended to expire at the same date. Consequently, the Company can claim goodwill payment in respect of the licences at Portsmouth and Brighton.

Continuing, the Postmaster-General stated that provision is being made for very large developments in the use of the telephone subsequent to the transfer to the State. At the present time the Treasury is authorised to spend £2,000,000, but he now asked for an additional £4,000,000, over and above the sum that will be required as the purchase price of the Company's undertaking. The Post Office had been watching very closely the development of the telephone system established in the United States, where all the chief officials of the Post Office telephone department had recently been visiting. A system of travelling scholarships had recently been established, which would enable Post Office engineers to go to the United States for considerable periods in order to make a minute study of the telephone there. Sweden also had been recently visited, and experiments were about to be carried out with automatic and semi-automatic exchanges. With regard to the telephone rates, no general revision would take place until the price which would have to be paid to the National Company was settled. It was hoped to arrange a tariff which would enable the system to show a moderate profit.

As to the staff, it had been decided to take over the whole staff, no matter what their length of service might be; their pay in many cases would be greater than that they were now receiving, and in no case would it be less, "unless their rate of pay had been abnormally raised by the Company in the last two years, in view of, or in connection with, the transfer."

He was opposed on several grounds to the suggestions that had been made that a telephone authority should be created on the lines of the Port of London Authority. One important reason was that such an authority could not be fully representative without being too large to be workable. It would be necessary for the small users to be represented as well as for the large, and again, it was not impracticable to work the telephone system as distinct from the telegraph system.

After a brief discussion, the resolution was agreed to, and the Bill is to be circulated with a memorandum dealing with the terms on which the staff will be dealt with on transfer.

Judgment by Court of Appeal

The Master of the Rolls and Lords Justices Farwell and Kennedy gave judgment yesterday in the appeal of the Postmaster-General against the decision of the Railway and Canal Commissioners, which appeared in our issue of June 1st, p. 307.

The Master of the Rolls, in allowing this appeal, thought that the notices with regard to plant, land, and buildings were good, and with respect to the word unsuitable, he thought, with all respect to Justice Lawrence, that he had put too narrow a construction on the case, and he agreed with Sir James Woodhouse that both parts of the notices were sufficiently indicated in general terms in the form of agreement, considering the early date on which they had to be given. He thought that with regard to the second part of the notice, the word quality did not stand alone, but that a quantitative meaning was also plainly understood in the text of the agreement. Lords Justices Farwell and Kennedy, who read separate judgments, concurred in the main with the above. The appeal was accordingly allowed.

LOCAL NOTES

Barrow-in-Furness.—We regret that the note in our last issue referring to the accounts of the electricity department at Barrow-in-Furness was not accurate. The gross profit for the year was £8,028, and after meeting interest and sinking fund, there was a net profit of £705 18s. The number of units sold increased from 1,130,092 to 1,249,163. The works costs were reduced from 0·912d. to 0·099d., and the total costs from 1·249d. to 1·231d. per unit.

Bexhill: *Electricity Accounts.*—There was a net profit of £561 upon the electricity undertaking last year, compared with £859 in the previous 12 months.

Chester.—A report has been prepared by Mr. J. E. Britton (Borough Electrical Engineer), recommending the utilisation of the old Dee water-mills for generation of current. Another expert is also to be consulted.

Clacton-on-Sea: *Electricity Accounts.*—There was a loss of £362 upon the working of the electricity undertaking last year.

Dawlish.—Electric supply from a small new generating station was inaugurated last week. At present the plant consists of one 40-h.p. engine and dynamo and a battery.

Dudley: *Electricity Accounts.*—After meeting capital charges and £500, the first instalment of the costs of the arbitration in reference to the price of tramway current, there was a loss last year upon the electricity department of £1,206.

Elland.—*Supply to Greetland.*—The Electricity Committee have refused the terms of the Greetland for the supply of electricity, but are willing to give a bulk supply at the boundary if a minimum payment is guaranteed.

Finchley: *Electricity Accounts.*—There was a net profit of £1,588 on the electricity department last year compared with £378 in the previous 12 months.

Halifax: *Price of Gas and Electricity.*—Some time ago a sub-committee was appointed to consider the possibility of a mutual arrangement as to prices of gas and electricity, but at the last meeting of the Corporation, it was announced that no decision was arrived at. The Chairman of the Electricity Committee expressed the opinion that there was not the slightest chance of the two Committees ever agreeing to any principle.

London: *L.C.C. Tramways.*—Traffic has been commenced on the new line from Battersea Park Road over Battersea Bridge to Beaufort Street, Chelsea.

Luton: *Electricity Accounts.*—The accounts of the electric lighting department for the past year show a net profit of £3,127 after meeting capital charges. The number of units sold was 2,360,009 and the total maximum supply demanded 1,310 kw.

Oldham: *Electricity Accounts.*—A net profit of £1,300 has been made against £2,203 for the previous year. There had been an increase in the lighting revenue but the units sold for traction had decreased. The gross profit was £20,143, of which £7,940 was absorbed by capital charges.

Shoreditch.—The Lighting Committee have recommended that the agreement with the Great Northern and City Railway for the auxiliary supply of electricity to the Council be extended for a further two years.

South Shields: *Electricity Accounts.*—Mr. J. H. Cawthra, Borough Electrical Engineer, in his report for the past year's working of the electricity undertakings, states that there is a profit of £1,414 15s. after meeting capital charges, compared with an adverse balance of £106 in the previous twelve months. The revenue from power supply increased by 70 per cent. during the year. The works costs were 0·57d. per unit against 063d., and the total costs, including capital charges, were 1·66d. against 1·85d. per unit in the previous year

Sunderland: *Electricity Accounts.*—The position in Sunderland is considerably improved this year owing to the recovery of the shipbuilding trades, &c., and reductions in the generating cost. A profit of £1,189 has been made against last year's deficit of £1,126.

Torquay: *Paignton Tramway.*—It is expected that the new tramway to Paignton will be opened in a fortnight.

OSRAM-LAMPS

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TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Aldershot.—The Council are inviting tenders for a 135-kw. Diesel engine and dynamo. Particulars from Borough Electrical Engineer, and tenders by July 4th.

Australia.—Tenders are invited by August 16th by the Deputy Postmaster-General, Brisbane, for 9,910 yards of paper-insulated, lead-covered cable, 3,960 yards of paper-insulated, lead-covered cable taped with brass ribbon, 3,520 yards of silk and cotton-insulated, lead-covered telephone switch-board cable; 320 miles of covered wire, etc. Copies of specifications at 72 Victoria Street, Wesminster, S.W., or 73 Basinghall Street, London, E.C.

Battersea.—Tenders are required for 440 street lanterns for metal filament lamps. Particulars from Borough Engineer, Lombard Road.

Belfast.—A circulating water pump and motor driven air pump are required by the Electricity Committee. (See advertisement on another page.)

Bispham.—A Local Government Board inquiry was held last week into an application for a loan of £9,180 for electric lighting. Mr. W. J. Speight has prepared a scheme for the Council.

Canada.—There is an opening for electrical machinery in connection with the water power scheme at the North Saskatchewan River, near Prince Albert. The name and address of the engineers to the work is on file at 73 Basinghall Street, London, E.C.

Cardiff.—The Electricity Committee require cables, economisers, induced draught plant. Particulars from Mr. Ellis, City Electrical Engineer, and tenders by July 14th.

Carlisle.—Application is to be made to the Local Government Board for a loan of £3,000 for the purchase of a chapel to be converted into an accumulator sub-station.

Eccles.—Tenders are required by July 17th for an electrically driven centrifugal pump. Particulars from Borough Electrical Engineer, Patricroft, fee one guinea.

Halifax.—A loan of £2,000 is to be taken up for new services.

Hammersmith.—Cable extensions to Messrs. Clark's lead mills are to be put in hand at an estimated cost of £868.

Leyton.—Tenders are required by July 6th for the construction of a condenser pit, foundations, cooling towers, &c., for the electricity works. Particulars from Town Clerk.

Mansfield.—The Council have under consideration the question of extending the supply of electricity to the urban district of Mansfield Woodhouse.

Salford.—Tenders are required for a 35 kw. belt-driven continuous-current generator, by July 3rd. Particulars from Borough Electrical Engineer, Frederick Street.

Swinford.—The Council invite tenders by July 10th for suction gas engine plant and dynamos, storage battery and accessories, switchboard, overhead lines, and street lamps. Particulars from Consulting Engineer, Mr. L. J. Lawless, 27 Castlewood Avenue, Rathmines, Dublin.

Torquay.—Application has been made for a loan of £5,000 for additional plant.

Worcester.—A Local Government Board inquiry was held last week into an application for a loan of £3,375 towards the cost of substituting polyphase plant for part of the single-phase plant in view of the increasing power load.

WIRING

Ayr.—Additions to Academy buildings at an estimated cost of £12,000

Belfast.—New buildings for Queen's University. W. H. Stephens & Sons, 13 Donegal Square.

Cardiff.—National Museum. Architects, Smith & Bremer, 2 Gray's Inn Square, W.C.

Chelmsford.—Tenders are invited for electric lighting of St. Mary's Church. Particulars from Chancellor & Son, Duke Street, Chelmsford.

Dundee.—New Training College, Park Place. T. Martin Cappon, 32 Bank Street.

Dunfermline.—Additions to the Townhill School.

East Cowes.—School buildings. County Education Office, Newport, I.W.

Edinburgh.—Alterations at Royal Infirmary, Lauriston. W. Thorburn, Works Department.

Haslingden.—The Board of Guardians have decided to apply for borrowing powers for £1,480 for the installation of electric lighting in their buildings at Pikelaw. New Council School.

Hemel Hempstead.—Public elementary school for 250 scholars. W. R. Locke, Town Hall.

Heston and Isleworth.—Tenders are invited by July 5th for the electric lighting of certain schools. J. G. Carey, Surveyor, Council House, Hounslow.

Hull.—New hospital for the Guardians.

Wigan.—Elementary School at Billinge.

TENDERS RECEIVED AND ACCEPTED

Carlisle.—The tender of the Premier Accumulator Co. (£1,755) for a battery, booster and switchgear and £77 per annum maintenance for ten years has been accepted.

London: *Hammersmith.*—The tender of the Alphons Custodis Chimney Construction Co., Ltd., for a chimney stack at the electricity works at £392 15s. has been accepted.

The following tenders were received for the supply and erection of high-pressure steam and feed-water pipes, exhaust steam feed-water heater and circulating pipes, steam valves and feed-water heaters:—E. Danks, £1,192; Foster Bros., £1,405; J. Spencer, £1,458; Babcock & Wilcox, £1,560; Aiton & Co., £1,568; Stewarts & Lloyds, £1,625; Edward Le Bas & Co., £1,635; Stewarts & Lloyds, £1,685; J. Wilson & Co., £1,699 10s.; Ashwell & Nesbitt, £1,980; Wembley Heating Co., £2,160. The tender of Messrs. Aiton has been accepted at £1,568.

Mansfield.—The tender of Messrs. Bertram Thomas for switch-gear has been accepted at £166.

South Shields.—We are informed by Mr. J. H. Cawthra, the Borough Engineer, that the figure given under the heading of South Shields on page 337 of our issue for June 15th, is not quite accurate.

Worcester.—Subject to the Local Government Board sanction, the Electricity Committee recommend the acceptance of a tender of the Electric Construction Co. for a 200-kw. motor generator at £640, and that of the Phœnix Dynamo Co., for a 125-kw. alternator at £250.

Messrs. Siemens Bros. Dynamo Works, Ltd., in addition to those already published, have obtained the following orders for illuminations:—P. & O. Steam Navigation Co., Northumberland Avenue, W.C.; Fitch & Son, Bishopsgate Street, E.C.; Russian Bank, 61/62 Gracechurch Street; Royal Institution of Great Britain, 21 Albemarle Street; Thames Iron Works; Royal Yacht Club. As usual, all the fixing and erecting was sublet to electrical contractors.

MISCELLANEOUS BUSINESS NOTES

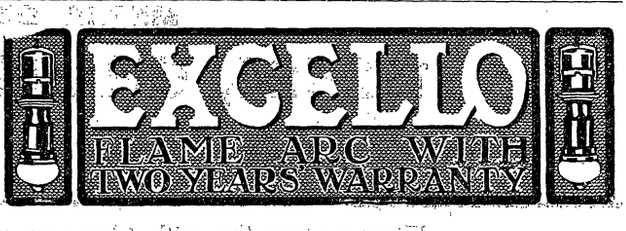
Price of Copper.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic copper bars c.i.f. port of arrival, quoted on Tuesday night, was £58 15s. to £59 5s. per ton (last week same).

Bankruptcies.—The public examination took place last week of W. H. Illingworth, Electrical Engineer, of Pellon Lane, Halifax. No arrangement was come to and the matter was left in the hands of the official receiver.

Dissolution of Partnership.—S. A. Sillem, F. A. Donnison and W. Sillem, carrying on business at 17 Morwell Street, Tottenham Court Road, as the Phœnix Electric Heating Co., have dissolved partnership. Debts by S. T. Cox, who will carry on the business.

Coronation Arrangements.—Messrs. Siemens Brothers Dynamo Works, Ltd., inform us that their energetic move in keeping their Supplies Department at 39 Upper Thames Street, E.C., open all night on Wednesday last was much appreciated by contractors, who kept the staff busy right through the small hours. We may safely say that more than one of the large shows would have been incomplete if there had not been some electrical supply firm to turn to in the dead of night.

Sociedad Anonima "La Electricidad."—A new company has just been formed under the above title in Sabadell, Spain, for the purpose of taking over the business of "Frêne Agazzi y Cia," and manufacturing all classes of electrical material, gas engines, pumps, mill-machinery, water-turbines, &c. The



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capital is 1,000,000 pesetas: Don Emilio Frêne becomes managing director of the new company.

The Linolite Company.—The annual outing of the works and office staffs was held on Saturday last. Mr. Ackermann (engineer and manager), Mr. R. L. Matthews (assistant manager), and Mrs. Ackermann being present. The party journeyed to Chertsey-on-Thames, and luncheon and tea were served at St. Anne's Hill by permission of Sir Albert Rollit, who kindly conducted the party round his grounds, and over his residence. The party drove back *via* Staines, Hounslow, and Hammersmith.

APPOINTMENTS AND PERSONAL NOTES

Mr. E. Taylor, Fourth Engineer in charge of the Hammersmith Electricity Works, has resigned upon receiving an appointment under the Board of Trade. A successor is to be advertised for at a salary of £130 rising to £150 per annum.

The Council of the National Electrical Manufacturers Association have elected Mr. F. H. Nalder to the post of Chairman, as, in consequence of Mr. W. H. Butler having for a time severed his connection with the Electrical Manufacturing Industry, he has resigned the Chairmanship of the Council, which resignation the Council accepted with much regret.

An experienced electrical engineer with a knowledge of English and German is required for estimating work for large contracts. See an advertisement.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Thames Ironworks Co.—The report for 1910 states that the company's electrical department has been kept busy throughout the year in the manufacture of the "Thames Snap" switch which has been adopted by the Admiralty, and with other Admiralty orders for electrical fittings. An electrical installation for the Metropolitan Water Board at their Walton pumping station has also been completed. The work on the electrical installation of H.M.S. *Thunderer* is much advanced.

R. Waygood & Co.—At the recent annual general meeting, the chairman stated that the past year had been an exceptionally busy one, and it would have been possible to pay a higher dividend than the 6 per cent. proposed in the report. But the Board thought it better to conserve the profits rather than divide up to the hilt. The contracts recently completed or received include six lifts for H.M. the King of Siam, the Bank of England, Crystal Palace, British Museum, Harrod's Stores, Holborn Restaurant, and William Whiteley & Co.

Marconi's Wireless Telegraph Co. (New York).—The report of this company for the year to January 31st states that, after providing for the usual 10 per cent. depreciation on stations and experimental work, the result shows that the company is more than self-supporting, in spite of fierce and undue competition. A reference is made in the report to the judgment of Mr. Justice Parker in the Chancery Division here, which decided that the British Radio-Telegraph & Telephone Co. had infringed the Marconi Patent No. 7,777, and the opinion is expressed that if a similar judgment to the above was obtained in America, the position of the company would be greatly strengthened. An identical patent is held in America, and the American Marconi Co. are taking steps to sustain it.

Hobart Electric Tramway Co.—A dividend of 6 per cent., free of tax, is recommended.

Provincial Tramway Co.—Interim dividend of 8d., less income tax, on the ordinary shares for the June half-year.

J. G. White & Co.—The accounts for the year to Feb. 28th show a net profit of £91,466, against £64,802 in the previous year. The sum of £15,000 is transferred for the formation of a dividend equalisation reserve, and a dividend of 12 per cent. is declared on both ordinary and preference shares, compared with 10 per cent. for the previous year. This is the maximum dividend to which the preferred shares are entitled. An extra dividend of 10s. per share is recommended on the ordinary shares.

Canadian General Electric Co.—A quarterly dividend of 1¾ per cent. is declared on the ordinary shares for the three months to June 30th.

Victoria Falls & Transvaal Power Co.—At the annual meeting on Tuesday last week, the report and accounts given in our last issue were adopted. The Marquis of Winchester, who presided, stated that the new station at Vereeniging will have a total capacity of 30,000 h.p., and he hinted at the possibility of further extensions owing to the increasing use of electricity in the mines, in spite of the large amount of current now used there. The Rosherville station is now almost completed. The Chairman stated that the company now supply electric power for dealing with nearly 63 per cent. of the total output of the Rand mines.

Marconi International Marine Communication.—The report records a profit of £10,765 for the year, after meeting debenture interest. A dividend of 5 per cent., with £5,118 carried forward, is recommended. Mr. G. C. Isaacs has been appointed managing director in place of Mr. G. Marconi.

National Electric Supply.—A dividend of 3s. per share, payable July 1st, is announced.

Bombay Electric Supply and Tramways.—A 17·5 per cent. increase in receipts, and a 6·09 per cent. increase in expenses, is reported. £64,164 profit remains after meeting debenture charges. Of this £32,748 is absorbed by arrears of dividend on 6 per cent. cumulative preference shares, £15,000 is to be placed to depreciation, and £6,000 to sinking fund, leaving, including last year's balance, £11,748 to be carried forward. £50,000 second debentures have been created to provide for the new Kussara power station, &c.

Rio de Janeiro Tramway, Light and Power Co.—A dividend of 1¼ per cent. on the issued capital, payable August 1st, is declared.

London Electric Railways.—An issue will be made next week by Messrs. Speyer Bros. of about £2,000,000 Metropolitan District & London Electric Railways, Joint Powerhouse Rent Charge 4 per cent. stock at par.

NEW COMPANIES

CANADIAN P. J. MITCHELL CO., LTD., Caxton House, Westminster. Capital, £21,000. Exporters and importers of electrical and general engineering machinery, tools, and plant. Directors, Colonel A. Durand, P. H. Brown, and P. J. Mitchell.

TITAN TRACKWORK.—Capital, £5,000. Tramway and railway track manufacturers and layers. Registered by Jordan & Sons, 116-117 Chancery Lane.

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We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Fortschritte der Elektrotechnik." No. 3, 1910. 993 pp. 9½in. by 6¼ in. (Berlin: Julius Springer.) 10s. 6d. net; by post 11s.

"The Propagation of Electric Currents in Telephone and Telegraph Conductors." By Prof. J. A. Fleming, F.R.S. 316 pp. 8¼ in. by 5¾ in. 80 figures. (London: Constable and Co.) 8s. 6d. net; abroad, 9s. 2d.

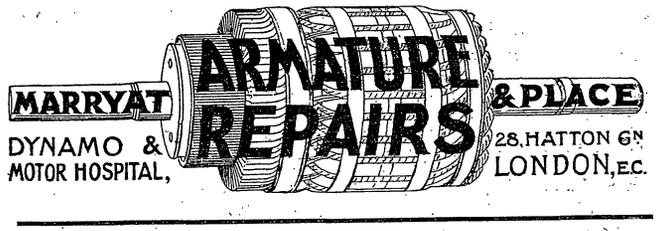
"Whittaker's Electrical Engineer's Pocket-Book." Edited by K. Edgcumbe. Third edition. 597 pp. 6½ in. by 4 in. 181 figures. (London: Whittaker and Co.) 5s. net; abroad, 5s. 4d.

"Principles of Electrical Engineering." By H. Pender. 340 pp. 9½ in. by 6¼ in. 125 figures. (New York: McGraw-Hill Book Co.) 17s. net; abroad, 17s. 9d.

"The Compulsory Working of Letters Patent." by F. W. Beney. 15 pp. 8½ in. by 5½ in. (London: Wm. Clowes and Sons.) 3d.; by post, 3½d.

"Practical Dynamo and Motor Management." 48 pp. 6½ in. by 4¼ in. 21 figures. (London: S. Rentell and Co.) 6d. net; by post, 7d.

"Electricity in Locomotion." By A. G. Whyte. 143 pp. 6½ in. by 4¾ in. 18 figures. (Cambridge: University Press.) 1s. net; by post, 1s. 2d.



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Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

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Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

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United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

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British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.
M.A.N. Co., Caxton House, Westminster, S.W.

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Joseph Tomey & Sons, Ltd., Catherine St., Aston, Birmingham.

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Bastian Electric Heating Syndicate, Ltd., Palmerston House, Old Broad St., E.C.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87-89, Cleveland Street, W.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
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India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.

INSULATING MATERIAL.
Weidmann (H.), Rapperswil, Switzerland.

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Blume (Chas. H.), The White Building, Sheffield.
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British-Thomson Houston Co . Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
Adnil Electric Co., Artillery Lane, London, E.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Electromoters, Ltd., Louisa St., Openshaw, Manchester.
General Electric Co., Ltd., 67, Queen Victoria St. E.C.
Ingleby & Co., Elland Road, Leeds.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
Willans & Robinson, Ltd., Rugby.

STEAM CONSUMPTION RECORDERS.
Lea Recorder Co., 28, Deansgate, Manchester.

STEAM ENGINES AND TURBINES.
Belliss & Morcom, Ltd., Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
Vickers, Sons & Maxim, Ltd., Sheffield.
Willans & Robinson, Ltd., Rugby

SWITCHGEAR.
Adams Manufacturing Co., Ltd., 106, New Bond St., W.
Berry, Skinner & Co., 78, Upper Thames St., E.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Brown, Boveri & Co., Ltd., Caxton House, Westminster.
Electrical Apparatus Co., Ltd., Milford Works, Queen's Rd., Battersea, S.W.
Ellison (George), Warstone Lane, Birmingham.
Ferranti Ltd., Hollinwood, Lancs.
Reyrolle & Co., Ltd. Hebburn-on-Tyne.
Union Electric Co., Ltd., Park St., Southwark, S.E.

TECHNICAL BOOKS AND JOURNALS.
Blackie & Son, Ltd., 50, Old Bailey, E.C.
Cassell & Co., Ltd., La Belle Sauvage, E.C.
Constable (Archibald) & Co., Ltd., 10 Orange St., Haymarket, W.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W.
Electric Journal, 422, Mansion House Chambers, E.C.
Electrical Engineering Abstracts, 57-58, Chancery Lane, London, W.C.
Griffin (Charles) & Co., Ltd., 12, Exeter Street, Strand, W.C.
Indian Industries and Power, 204, Temple Chambers, E.C.
International Institute of Technical Bibliography, 57 & 58, Chancery Lane, E.C.
Lewis's Scientific Circulating Library, 136, Gower Street, W.C.
Longmans, Green & Co., 39, Paternoster Row, E.C.
National Telephone Journal. Telephone House, Victoria Embankment, E.C.
Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C
Western Electric Co., Ltd., North Woolwich, E.

TESTING LABORATORIES.
Electrical Standardizing & Testing Institution (Faraday House), 62-70, Southampton Row, W.C.

VACUUM CLEANERS.
Duncan Watson & Co., 62, Berners St., W.

VULCANISED FIBRE.
Mosses & Mitchell, 122-124, Golden Lane, E.C.

WATCHES.
Leecla Watch Co., 215, Old Street, Ashton-under-Lyne.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

Our monthly supplement on Electrical Engineering in Mines is included in this issue. It opens with an article on Prof. Redmayne's report on the Hulton colliery disaster, and contains some notes on electric power in the Kent colliery works.

Particulars are now available concerning the position of the National Telephone Co.'s staff on being taken over by the Post Office at the end of this year, and the pensions which they will be entitled to when they ultimately retire from the Post Office service.—The arbitration proceedings with regard to the transfer of the business have been resumed, and the matter now under discussion is what portions of the plant the Postmaster-General is entitled to exclude for the purchase. (Page 379.)

A conference on the education and training of engineers was held by the Institution of Civil Engineers last week. (Page 380.)

A complete list of firms who have signified their intention of exhibiting at the Electrical Exhibition at Olympia in September is given. (Page 381.)

The Annual Dinner of the Electrical Contractors' Association was held last Monday. (Page 381.)

We conclude our report of the meeting of the Incorporated Municipal Electrical Association. On Wednesday last week the discussion at Portsmouth was chiefly devoted to Diesel engines. Mr. C. Day emphasised the low fuel costs and the improvement in lubricating oil consumption, and recommended that sizes corresponding to 150 h.p. per cylinder should not be exceeded. Mr. Andrews pointed to serious errors in Mr. Howard's estimate of gas engine costs, and also said that over half load better fuel costs could be guaranteed for the gas engine than for the Diesel engine. Mr. Boot emphasised the importance of skilled attendance. Mr. Mulholland referred to the work that had been done by the M.A.N. Co., and Mr. Kaula mentioned a small and comparatively high-speed engine which Willans & Robinson are developing. Mr. Blackman attacked the figures given for steam station costs in Mr. Howard's Paper, and quoted the Sunderland costs to show that steam turbines were preferable to Diesel engines for large stations. Mr. Dixon gave an account of his success with Diesel engines at Leatherhead, and Mr. Fedden joined Mr. Blackman in condemning Mr. Howard's estimates, and expressed the opinion that Diesel engines were most suitable for intermittent use and light loads.

On Thursday at Brighton a discussion on the purchase of fuel was opened by Mr. Shawfield, and he and several other speakers expressed their opinions as to the utility of chemical tests and boiler tests, and other matters connected with the purchase of coal. In many cases interesting details were gone into, and the whole discussion was of a most practical nature.

Mr. A. H. Seabrook then opened a discussion upon shop front lighting, and Mr. Haydn Harrison followed upon the question of street lighting. Both dealt with

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the methods of gas companies, but whereas Mr. Seabrook was uncompromising in his attitude towards the gas companies, Mr. Harrison favoured co-operation as a means of keeping up prices. Mr. Seabrook and also Mr. Cramb claimed that a proper business organisation was the means of keeping up the prices of electric lighting, even in competition with gas, the latter putting it as high as £1 per lamp per annum more for shop front lighting. Mr. Watson gave particulars of the change from arc lamps to metal filament lamps for street lighting in Bury, and Councillor Crowther and Mr. Cramb urged the Council of the Association to make serious efforts to obtain wiring powers for all municipalities, as without them it was impossible to meet gas competition for shop front lighting.

AT the Annual Dinner on Thursday, some sensation was caused by Mr. Ferranti expressing his view that as municipal trading in electricity supply was an accomplished fact, local authorities should be afforded precisely the same power to extend their business as any private enterprise.

ON Friday, Mr. G. Wilkinson was elected President of the Association for the coming year, and it was decided that the Convention should be held in Harrogate. Messrs. Shawfield (Wolverhampton) and Chattock (Birmingham) were chosen as Senior and Junior Vice-Presidents respectively. A long discussion (from which the Press were excluded) took place upon municipal wiring powers. (Pages 383–388.)

PROFITS are reported on the Electricity Departments at Belfast, Bradford, and Hull, but the year's working at Kendal has resulted in a deficit. Increased profits have been made on the tramway undertakings at Glasgow, Manchester, and Plymouth. The bulk supply scheme for Wood Green has been rejected. (Page 389.)

LOCAL GOVERNMENT BOARD inquiries have been held at Gloucester (£14,000) and Hornsey (£9,600), and loans have been allowed at Broxburn (£2,000), Dublin (£50,000), Eccles (£3,294). Tenders are required for switchgear at Govan, and coal-handling plant at Poplar. (Page 390.)

THE NATIONAL TELEPHONE Co. have declared a dividend of 6 per cent. on the deferred shares for the June half-year, and the General Electric Co. 5 per cent. on the ordinary shares for the past year. (Page 390.)

AMONG the specifications published by the Patent Office on Thursday last was one by W. R. Shaw and G. H. Green for an improved detachable controller handle.—An electric lamp cap was described by F. C. Mayes, and E. H. Smith and E. A. Kaatz have introduced a device for regulating the brilliancy of lamps. —Another by H. Sefton-Jones relates to railless traction.—Application has been made for the restoration of the two following patents, one by S. M. Young dealing with the operation of electric signals, and the other by Saltpetersäure Industrie Gesellschaft G.M.B.H. referring to arc furnaces. One of Sir Oliver Lodge and A. Muirhead's patents on wireless telegraphy has expired after the full term of fourteen years. (Page 391.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, JULY 6TH.

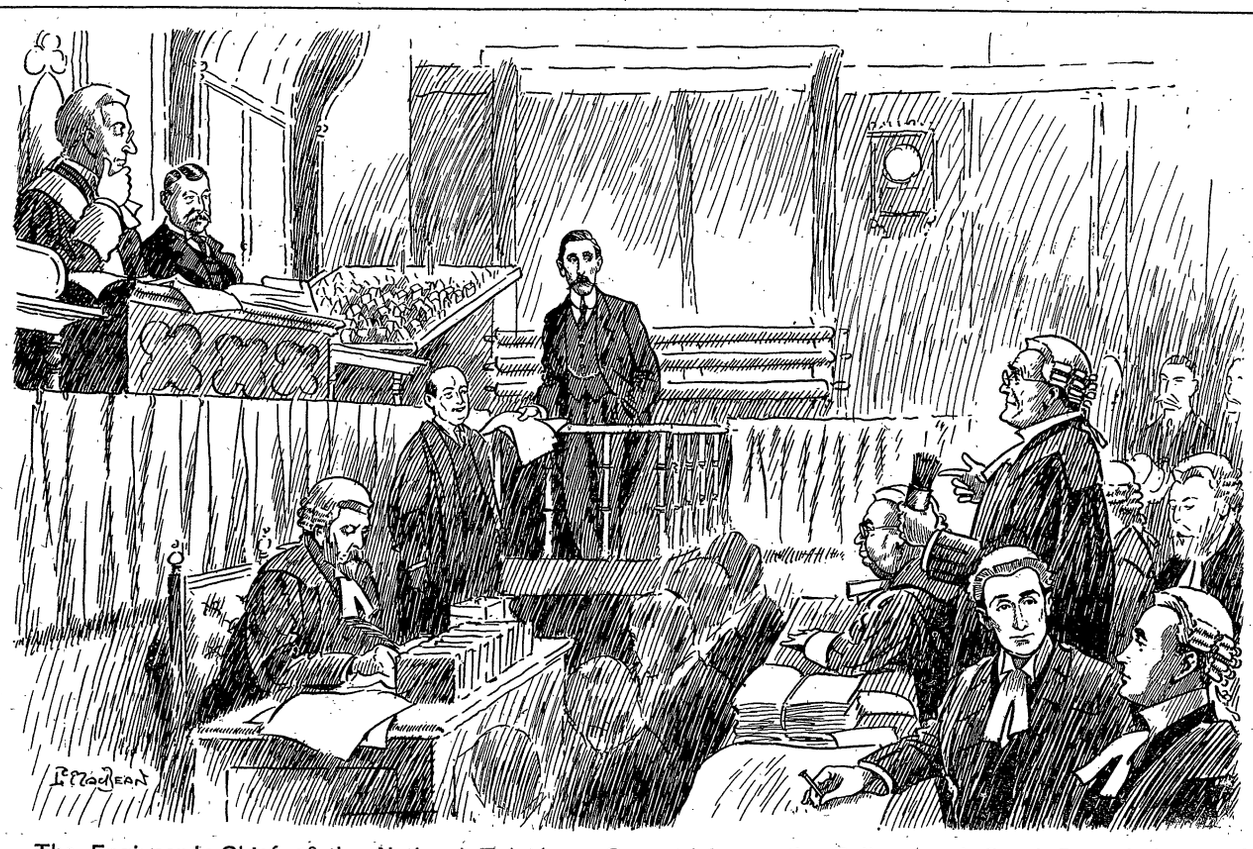
National Electrical Manufacturers' Association.

2.30 p.m. Council meeting at Offices of Association.

Institution of Electrical Engineers.

9 p.m. Conversazione at Natural History Museum, South Kensington.

Obituary.—We regret to state that Mr. John Gilley, who was with the Foster Engineering Co., Wimbledon, from the commencement, and was their first outside representative, died from consumption on June 14th.



The Engineer-in-Chief of the National Telephone Co. explains to the Railway and Canal Commissioners the difficulty which would be involved in selling some of the wires in an underground cable to the Postmaster General and removing the remainder.

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THE TELEPHONE TRANSFER
Position of the Staff

ALL members of the staff of the National Telephone Co. should purchase from Wyman & Sons, Ltd. (Fetter Lane, E.C.) copies of the Telephone Transfer Bill and of the "Memorandum" issued by the Government in connection with Part II. of the Bill. The cost of these is 1½d. and ½d. respectively. These Papers set forth the position of the transferred staff with regard to their re-engagement by the Post Office, pensions, &c.

All members of the staff who have been with the company since January 1st, 1909, with the possible exception of some of those earning £700 a year or more, will be taken into the service of the Post Office, and "except in the case of any persons whose salary may have been abnormally increased during these two years," the initial pay will not be less, and in many cases will be greater than what they are now earning. Those with less than two years' service will also be taken over subject to a satisfactory certificate being forthcoming.

The great majority of those who have contributed to the company's pension fund will also come in the pensionable class, and the younger members who had not yet reached the age to join the pension fund of the company will also come on, and their two years' previous service will rank. The sufferers, so far as we can see, will be those in the Solicitors' Department of the company, who will not come in the pensionable class (and possibly also the Contract Managers). They will have their contributions to the company's pension fund returned to them, and will also be given a slight increase in initial salary. The amount of pension which will be receivable in every case is explained in the Bill.

The Bill also makes provision for the sum of money that will be required for the transfer.

The Arbitration Proceedings.

The second stage of the arbitration proceedings in connection with the telephone transfer was commenced on Monday, and is likely to continue for several days. It will be remembered that the Post Office, in purchasing the National Telephone Company's plant at the end of this year, has the right to object to take over such plant in competitive areas (*i.e.*, London, Cardiff, Newcastle, Hull, Portsmouth, Brighton, &c.) which is unsuitable for the actual requirements of the telephonic service of the Postmaster-General at that date. Under the conditions of the agreement, the Postmaster-General was to send the Company particulars of the plant which he deemed unsuitable, and if the Company considered that any of this was wrongly so described, it was open to them to appeal to the Railway and Canal Commissioners. This they did, and decision was first given on two points: first, as to whether plant or lines which might duplicate the Post Office plant was to be regarded *ipso facto* as unsuitable, and secondly, whether or not the Post Office notices of the plant which they wished to reject were invalid, owing to the want of proper definition. The Railway and Canal Commissioners decided in favour of the National Telephone Company, but this was reversed on appeal, so that the position now is that the notices were valid, and that plant which is redundant may be deemed unsuitable.

The second stage of the proceedings now is to argue before the Commissioners whether or not the plant objected to by the Post Office is unsuitable, owing either to its construction, or to its being redundant. The London plant was taken first, and Mr. Frank Gill, Engineer-in-Chief to the National Telephone Company, was put in the witness-box, and was examined by Sir Alfred Cripps, K.C., on behalf of the company. He said that 68 per cent. of the total mileage of the company's wire in London is underground. The London telephone area covers 640 square miles, and includes ninety-five exchanges, of which sixty-two are owned by the National Telephone Company, and thirty-three by the Post Office. On December 31st last, the company had 70,700 exchange lines, and 122,680 exchange stations in London, as against 47,896 lines and 71,323 stations owned by the Post Office, so that the company owns roughly two-thirds of the London system. He pointed out that the company's system was more highly developed in that there were the larger number of exchange stations per line.

Notices of objection to take over twenty-three of the Telephone Company's exchanges have been put in by the Post Office, these exchanges including the Avenue, Bank, and Westminster. The Post Office also objected to take over all lines connecting any exchange subscriber's office or call-office or other exchange, with any of these exchanges, and it was pointed out that spare lines and private subscribers' lines leading to these exchanges were not covered by the notice, and would, therefore, be presumably taken over. The question whether lines which passed through the exchanges, and are connected to the test-board, but not to the switchboard, are to be included, is one which will have to be argued.

Mr. Gill instanced the removal of the Hillhead Exchange, at Glasgow, as a case in which it had not been necessary to take out any of the cables, as practically every wire had been diverted or made temporarily spare, and he was of opinion that a considerable portion of the lines leading to the Avenue exchange ought to be retained and transferred to the new exchange, which the Post Office is building in Creechurch Lane, to take the place of the Avenue exchange. He also said that when the Post Office moved its trunk exchange from St. Martins-le-Grand to Carter Lane, there could not have been this wholesale scrapping of wires such as they contemplate in this case. He further said that he did not know a single case in which cables leading to the condemned exchanges did not contain other wires than the subscribers' and junction wires to those exchanges, and the same applied to pole lines. According to the definition of "telegraphic line" in the agreement, this includes not only the conductors themselves, but also the poles and supports. As an example, a case was mentioned near New Eltham station, in which a pole carries two pairs of exchange wires, connecting the "condemned" Bank exchange with the Sidcup exchange, and also carries twenty other junction wires, and forty-two exchange lines, eight spares, and a fifty-pair cable, all of which will be wanted to carry on the service, but will, of course, have to be removed if the pole were removed, while, in addition, the wires to the condemned exchange should still be wanted for connecting the Sidcup exchange to the Central exchange, which is the one which will absorb the Bank exchange. Another instance was given in which a cable carrying wires to some of the condemned exchanges, was used to connect up two cables owned by the Post Office, and leased to the company, so that if the company's cable were removed, these two latter lengths of cable would be left disconnected. Again, in the subway leading to the Gerrard exchange, which is not one of the condemned ones, there are thirty-three 600-pair cables, and 496 circuits objected to, which are distributed over thirteen of these cables.

On Tuesday the examination of Mr. Gill was concluded, and during part of the time, as Sir Alfred Cripps had been called away, Mr. Forbes Lankester, K.C., took his place. The evidence was partly devoted to the time required to change over from an old exchange to a new one, and it was elicited that in the case of the Paddington, Dalston, Manchester City, and Aberdeen Exchanges, it took about thirty weeks in each case from the time the installing of the plant was commenced in the new exchange. Mr. Gill pointed out, however, that there would be far greater difficulties when it was a question of changing over twenty-three exchanges simultaneously, as would have to be the case in London at the end of this year if the "condemned" exchanges are not taken over by the Post Office. The question of what was meant by the Post Office definition of metallic circuits was also gone into. The Post Office object to take over any but metallic circuits, and apparently it was not quite clear under the terms of the notice whether the objection might not be taken to extend to any lines which were used with an earth return. This would, of course, condemn a large number of lines used as speaking circuits which are used with an earth return for signalling purposes, but during the examination of Mr. Gill on this point, the Attorney-General, Sir Rufus Isaacs, K.C., interposed the remark that the Post Office would not object to any metallic speaking circuits.

Mr. Gill was still under cross-examination when we went to press yesterday. The Court will not sit to-day (Thursday), and it is not improbable that a compromise on certain points will be announced on Friday.

Among the experts who have been retained on the two sides, and who may or may not give evidence in addition to the permanent officials of the National Telephone Company and the Post Office, are:—For the National Telephone Company, Sir Alexander Kennedy, Mr. S. Z. de Ferranti, Mr. J. Swinburne, and Dr. H. F. Parshall; for the Post Office, Professor Silvanus P. Thompson, Mr. Dugald Jackson, Mr. Robert Hammond, and Mr. A. H. Preece. Sir John Gavey, K.C.B., was also retained for the Post Office, but is at present suffering from an attack of pneumonia.

International Electrotechnical Commission.—In conformity with the wishes of the Brussels Conference of August, 1910, the delegates of the British, French, and German Electrotechnical Committees met at Cologne in May last. Those present were:—Prof. Eric Gerard (President of the Belgian Committee), M. E. Brunswick (Delegate of the French Committee), Dr. E. Budde (President of the German Committee), Dr. Silvanus Thompson (Delegate of the British Committee), and Mr. C. le Maistre, General Secretary of the Commission. A suggestion was outlined by Dr. Budde dealing with the international unification of symbols. The German-speaking nations, as represented by the Elektrotechnischer Verein of Berlin, would, he said, be prepared to abandon the use of "W" for resistance and adopt "R," if the English-speaking nations, on the other hand, would adopt "I" instead of "C" for current. They were ready to exclude "J" as synonym for "I," as "J" was already employed to represent other quantities. Dr. Thompson, on behalf of the British Committee, concurred in this suggestion, and as the American Institute already employs "I," and the National Electric Light Association of America is being approached in the matter, it is anticipated that at Turin the symbols "I," "E," "R" will be universally adopted. The work of the various committees on the German list of terms put forward at Brussels was considered, and a list of some 50 industrial terms and definitions was agreed to in French and English. The delegates will meet again at Turin early in September.

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CONFERENCE ON THE EDUCATION OF ENGINEERS

A CONFERENCE was held, somewhat on the lines of the engineering conferences on previous occasions, by the Institution of Civil Engineers on Wednesday and Thursday of last week, dealing with the education and training of engineers. The subject for the purposes of discussion were divided into three sections dealing respectively with general education, scientific training and practical training, but as explained below, joint meetings were held by more than one section. At the formal opening, Mr. Alex. Siemens, President of the Institution, made some introductory remarks dwelling upon the representative nature of the conference, and was followed by Sir William White, who mentioned the work of the Institution's Committee on training of engineers, and Sir J. Wolfe-Barry, who expressed the strong hope that the advantages of good general education and culture should not be lost sight of.

Sections I. and II. met jointly on Wednesday morning, and after opening remarks by Mr. A. G. Lyster, a discussion on "The extent to which mathematical and scientific subjects should share with other subjects of literate education the attention of schoolboys who intend to enter later the engineering profession," was introduced by Dr. J. Gow (Headmaster of Westminster School) and Prof. Silvanus Thompson (Finsbury Technical College). Dr. Gow defended the retention of classics in the very necessary literary studies forming part of the general education, emphasised the desirability of due development of the critical faculty and delight in reading, and sounded a warning against too early specialisation. Prof. Thompson dwelt on the lack of system and organisation of education in this country and the futile nature of such examinations as the London Matriculation. Science teaching in schools was in danger of becoming "fossilised," but there had been, largely due to the efforts of Prof. Perry, considerable improvement in late years in the methods of teaching mathematics. He was inclined to regret, however, the departure from the curriculum of our dear old friend Euclid. The selection of subjects to be taught was of less importance than the manner in which they were presented. The speakers in the discussion, which was continued by Sir J. Wolfe Barry, were in agreement with the main principles expressed, and Dr. Rouse, in particular, condemned the methods of conducting examinations in this country, which, he said, produced "hotbeds of cram." The question of specialised entrance examinations for university or college courses of study in engineering science, with a view to the curricula to be followed, and also of the inclusion in the latter of courses in modern languages, was then introduced by Prof. Schwartz (Manchester Municipal School of Technology). He took the view that entrance examination should have for its object testing the fitness of the candidate to pursue the contemplated course of specialised study, and should not be specialised in themselves; he was in favour of a due inclusion of modern languages, especially German, a point which was particularly emphasised in the discussion by Mr. W. H. Patchell. Dr. W. C. Unwin and Prof. E. W. Marchant (Liverpool University) held that some degree of specialisation was advisable, and the latter said that the great defect in the modern school system was the attempt to teach too many subjects.

Section III. also met on Wednesday, under the chairmanship of Mr. R. Elliott-Cooper. The first discussion, on "The requirements of practiced training and of scientific study, and the apportionment of time to them," was introduced by communications from Mr. A. F. Yarrow and Mr. W. H. Allen. The Chairman, in his introductory remarks, dwelt on the fact that real practical training could only be obtained under conditions which necessarily could not be found in educational establishments. The old custom of pupilage was just as important as in former days, the only difference being that the young engineer of to-day was better equipped to take advantage of it. Mr. Yarrow dealt with the "sandwich" system of training, and advocated an arrangement whereby the student spent the six summer months in the shops, living in lodgings, and in the six winter months took up studies at colleges while living at home. There should be in works where such apprentices were taken a member of the staff, whose special business was to look after them. Mr. Allen, in his remarks, favoured college training preceding workshop experience. The discussion largely turned on special conditions of railway and civil engineering. Mr. A. H. Preece summed up the whole situation by saying that the school training was to teach the student how to absorb knowledge; the college training to teach him how to appreciate knowledge; and the workshop training to teach him to apply his knowledge. Without the college training the student was unfit to be let loose in a workshop. Prof. Dalby said that the colleges would welcome Mr. Yarrow's proposed system, but the difficulty was with the employers.

Communications on practical training in workshops or on works of construction, with special reference to training in the the engineer's office by Messrs. W. B. Worthington and H. F. Donaldson, were then discussed. The latter, for the training of electrical engineers, recommended, besides three years' theoretical study, four years' practical training, consisting of two years in ordinary mechanical workshops, one year in electrical workshops, and one year of office experience.

Thursday morning commenced with a joint meeting of Sections II. and III., with Dr. W. C. Unwin in the chair. A discussion on the relation of engineering employers and colleges from the point of view of the practical training of college students was initiated by Prof. Petavel (Manchester University) and Mr. J. W. Horne. The former favoured a year in works between school and college, and said that although the engineering employer should not anticipate that a university graduate would be of much assistance to him during the first few months, he should require him to reach a satisfactory standard of efficiency before the end of the first year, and expect him to deserve some reasonable remuneration during his second yea. Mr. Horne favoured a college course preceding workshop experience, and regretted that there was not more co-operation between colleges and employers. He outlined a system of committees for the purpose. Prof. Kapp (Birmingham University) defended the sandwich system, but said that, as a rule, the slices were too thin. Mr. J. F. C. Snell, on the other hand, thought that the theoretical training should be completed first without a break. Prof. Silvanus P. Thompson, however, preferred to have students who had had one year in the shops, so that with the practical work in their minds they could better understand the college lectures.

Sections II. and III. then met separately. In Section II. Prof. S. M. Dixon (Birmingham University) and Prof. C. F. Jenkin (Oxford University) opened a discussion on the value of a university degree in Engineering Science in relation to professional competence Prof. Dixon defended the value of a university training to engineers, and regarded the degree as the natural conclusion of it and evidence of its completion; and Prof. Jenkin looked upon the degree as of greater value than the examination result, as being evidence of having gone through a course containing much that would not be included in the examination at all. In the discussion Prof. J. A. Fleming railled bitterly at the evils of examinations, and Mr. A. P. Trotter also spoke of their harmful effects, but Mr. Dugald Clerk, as an employer, had had good experience of men with degrees, but thought that, especially as regards Oxford men, they were usually much too conceited at first and apt to think they knew better than their employers. Prof. S. P. Thompson saw no value in degrees as degrees. The subject of the position and uses of engineering laboratories in relation to education at college was then introduced by Prof. W. E. Dalby (Central Technical College), Prof. J. Goodman (Leeds University), and Prof. B. Hopkinson (Cambridge University), and discussed by one or two speakers. The value of doing things at the laboratory as well as hearing them in the lecture-room was generally agreed upon, for, as Prof. Dalby said, a student often remembered what he did and forgot what he heard. Equipment should be simple, and a variety of small engines, &c., were of greater value than one large one, and facilitated the student being in charge himself of the machine under test.

In Section III. Prof. A. Barr (Glasgow University) and Prof. H. Louis introduced "The relation of practical training to college study: whether, or to what extent, before, sandwiched, or after its conclusion." Prof. Barr thought that it was well that different systems should be used in different districts, as the most suitable system for a particular case depends largely upon the nature of the student in question. Prof. Louis recommended that directly on leaving school the student should pass a matriculation examination, go to a works for three to six months, then come to college for his three years' course, returning to the same or to a different works for some three months during each long vacation, and then finally serve a two or three years' apprenticeship. Some speakers in the discussion thought that the sandwich system broke the thread of both parts of the work, and Prof. Turner favoured a certain amount of practical knowledge before attending lectures. Sir Alex. Binnie wished for the widest training possible, and thought that most college courses were too specialised.

The next subject was workshop training as a preliminary to practical training in other branches of engineering. Mr. J. A. Brodie recommended three years in works as a preliminary to college education, Mr. J. M. Moncrieff referred to the value of mixing with the workmen and seeing the practical conditions as well as the actual manual work, and Prof. J. J. Welch was in favour of the year in the workshops before the college course. Several speakers in the discussion preferred the works' experience after the college course, and Mr. Read was of opinion that the college training should be supplemented by about three months in an engineer's office before going into works.

Electrical Fatality.—The inquest on J. Peat, a wireman in the employ of the British Westinghouse Co., who lost his life owing to electric shock on June 20th, was concluded last Thursday. Deceased had been working on an electric crane, and the driver had switched the current on again under the impression that he had finished and gone away. A verdict of accidental death was returned.

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ELECTRICAL ENGINEERING

IN

MINES

THE HULTON COLLIERY DISASTER

WE referred briefly in ELECTRICAL ENGINEERING IN MINES of June 1st to the findings in Prof. R. A. S. Redmayne's report as Chief Inspector of Mines on the explosion which occurred at the No. 3 Bank Pit of the Hulton Colliery on December 21st, 1910. The report does not attribute the disaster in any way to electricity, but contains a good deal of interesting comment, information and investigation on the electrical equipment of the mines in question.

Electric power was used extensively in the group of mines for haulage on the endless rope system, and electrically driven coal cutters of the fan type were in use at the Nos. 1 and 2 faces of the North Plodder pit. All cutting was carried out during the night shift, and the breaking down and filling away of the coal so cut was done during the morning shift, the mechanical conveyor, also electrically driven, being worked during the latter period. A large electrical power plant, capable of generating 2,500 h.p., serves all the mine groups comprising the colliery, the power being generated and transmitted at 2,500 volts three-phase. Exhaust steam from the winding engine is used to supply the turbines. At each pit the current is transformed down to medium pressure for use in the workings. Electricity was in use in the Yard seam level at the shaft sidings in the neighbourhood of the downcast shaft, and in two of the five main districts, viz., the Bottom Yard (two electrically driven pumps), and the North Plodder (haulage, coal cutters, and coal conveyor). There was also a motor in course of erection in the South Plodder section, but it had not been set to work at the time of the explosion, and the cable to it had never been made live.

The accompanying figure shows the positions of the motors in the neighbourhood of the explosion. Motors A, B, G, H, and I appear to have been running at the time of the explosion. Motors A, B, and C were placed in intake airways, and they were all relatively close to the downcast shaft bottom. Motors D, E, and F were at or near the coal face, and motors H and I were in return airways, both being fixed in a place at a distance of, approximately, 400 yards from the shaft bottom. Motor G was fixed at a point in the return 600 yards from the shaft bottom, but the motor house was ventilated by a fresh air split.

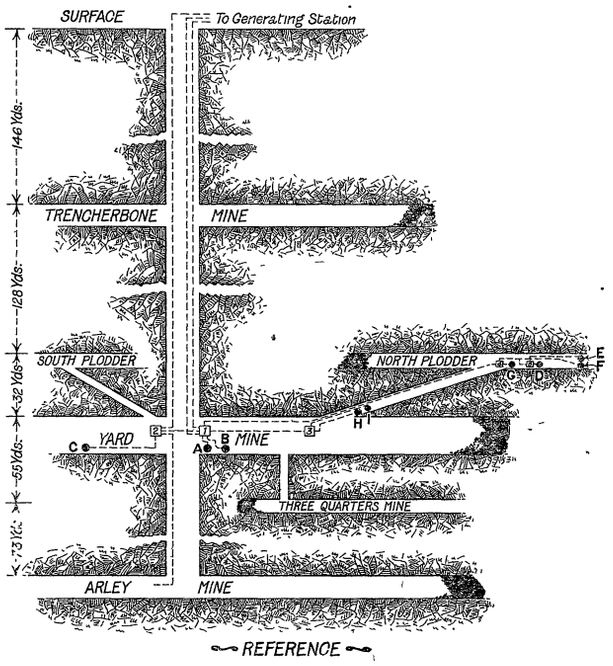
In addition to the above, there were 60 or 70 lamps at and near the shaft bottom, 16 lamps near motor C, and four lamps near motor G.

All the cables in roadways were armoured, and many of them lead-sheathed and armoured. There were, however, lengths of unarmoured mains between switches and motors in every case. In the downcast shaft was one set of bare cables supported on insulators, otherwise the shaft cables were insulated, lead-covered and armoured.

Prof. Redmayne reports that the electrical staff appears to have been sufficient and efficient. It consisted of a thoroughly competent electrical engineer, who had control of the entire electrical arrangements at the colliery under the general manager, and in each mine there was an underground electrician, so that in the case of the No. 3 and No. 4 pits there were three such persons. It was the duty of the electrician to examine daily the electrical plant, and to report defects to the electrical engineer, and generally to keep the electrical plant in proper order. In addition to this, the firemen examined the electrical plant and reported thereon, but it was admitted that this examination was external only, and that they could not be expected to detect an internal defect.

A good deal was said, both at the inquest and inquiry, as to the heading in the North Plodder having been the point of origin of the explosion, and the igniting cause sparking of the conveyor switch which was stationed there, but after a careful examination of the evidence, it is finally concluded that no real external sparking was caused by this switch, although possibly a glimmer of internal sparking, probably under the oil, may have been seen through an aperture covered with copper gauze. The subject is finally dismissed with the remark that whether the switch sparked on the morning of the explosion or not, the chief inspector is satisfied that No. 1 heading, where the switch was placed, was not the point of origin of the explosion. The conclusion arrived at is that the explosion originated at the point where the persons were engaged in working at a fall at the furthest in-bye point of the intake airway of the No. 2 face of the North Plodder. In all probability a second fall took place immediately before the explosion, accompanied by the liberation of a quantity of gas, and this gas was ignited by a safety lamp becoming overheated, falling through the gas, or by its being damaged by the fall of stone.

This leads up to the subject of safety lamps generally, and the report continues: It would seem as if the time had come when something safer may be used. The electric lamp, in that it provides a light which is absolutely shut off from the atmosphere, would seem to present possibilities in this respect, but the matter is one which requires further and very careful consideration. I merely adumbrate the possibility of the replacement, or partial displacement, of the gauze lamp in fiery mines by the electric lamp (for it would still be necessary to provide the deputies, firemen, and shot lighters with either a gauze lamp, or some other means of detecting the presence of gas), as a subject worthy of the most serious consideration of mining engineers and others connected with the working of gassy collieries. There are already in use 2,155 miners' electric portable hand lamps; and at Murton Colliery, in the County of Durham, miners' electric hand lamps have been in use since the year 1897, when 500 were introduced; these have since been increased to 1,840. The disadvantages that have militated against their extensive use have been: Their greater weight; trouble in respect of the batteries; greater first cost and greater working costs. The detection of the presence of gas by them is impossible. The advantages in respect of these lamps are—The risk of ignition of an explosive mixture can be eliminated; the lamps give a better light than that afforded by "safety" lamps, and hence allow of a better examination of the roof and sides.



SECTION SHOWING POSITIONS OF MOTORS IN NEIGHBOURHOOD OF EXPLOSION.

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Dealing in general with the electrical equipment of the mine, Prof. Redmayne writes as follows :—"The electrical plant was, generally speaking, mechanically and electrically strong, properly erected, and well maintained. There were some deficiencies, however, which might have been remedied, and although I have come to the conclusion that any sparking which may have occurred at the conveyor switchbox had no bearing on the explosion, nevertheless, I think it unwise to use electricity at the coal face in a gassy mine, such as this undoubtedly was, and I am satisfied that under the Electrical Special Rules just proposed by the Secretary of State, its use under such conditions would be prevented. I am perfectly satisfied that the explosion did not originate in the No. 1 North Plodder, and that the use of electricity in the mine had no bearing on the disaster. It is a noteworthy feature in respect of the electrical plant that armoured cables were in use throughout the mine, and that these satisfactorily resisted the effects of the explosive blast, heat, and heavy falls of ground, and were in every case found afterwards to be mechanically and electrically perfect—a more convincing argument in favour of the use of armoured cables it would be hard to find. So far as I observed, and so far as Mr. Nelson observed, no breach of the Electricity Special Rules can be alleged against the management. The improvements which might be made in the plant are confined to points of detail, as follows, namely :—(1) The removal of open-type switchgear from the pit. (2) The protection from abrasion of all insulation (except that on flexible cables) by an earthed metallic outer covering. (3) The provision of a better design of plug and socket connection for use with flexible cables. The most frequent causes of accident in underground conditions are :—(1) Live parts left uncovered by insulating material, and insulating material left unprotected from the risk of mechanical damage; and (2) the absence of a sound connection to earth for metallic outer coverings. The first point had received due consideration except at the down cast shaft bottom, and at several places where short lengths of unprotected cable were used for connecting to switches and fuses. The second point had received consideration, so far as I observed, everywhere in the pit. It is generally agreed that pressure should be cut off from electrical apparatus as a precautionary measure upon the first appearance of firedamp. That duty is, indeed, imposed by the Electricity Special Rules, but apparatus can, and should, be designed so that if gas should unexpectedly appear, unknown to the workmen, there is still no risk of its ignition. This is not, however, equivalent to saying that such apparatus may be installed or used where gas is likely to occur, for there is always the risk due to want of vigilance. The conclusion which I suggest may be drawn from the evidence submitted at the inquiry as regards the electrical plant, is the importance of its proper supervision. A daily report as to the condition of the electrical apparatus was made at the mine, but it is not sufficient merely to say that the condition of apparatus was found to be 'good.' If the apparatus is intended to be completely enclosed, then it would be better for the report to say that it was completely enclosed in fact at the time of the inspection; that is to say, that all joints were found to be sound, and that the mechanism, both electrical and mechanical, was found to be in good order. If a switch is oil-immersed, the person making the inspection should satisfy himself as to the level of the oil. Other points suggest themselves, *e.g.*, the continuity of cable armouring. Such an inspection and report should clearly be made by a competent man. I was greatly impressed in the course of the inquiry by the importance of the proper apparatus, its safety may still be dependent upon constant *maintenance* of electrical plant. However well designed the apparatus, its safety may still be dependent upon constant supervision and efficient maintenance."

Opposition to Electricity in Mines.—At a meeting last month of the Derbyshire Miners' Association, an alarmist attitude was taken up with regard to electricity in mines, and it was urged that the electricity must "come out of the mine where there is no room for it."

Testing of Mining Motors.—At the German Siemens-Schuckert Works, a special chamber is provided where all motors intended for mining work can be tested in a gaseous atmosphere. The chamber is closed by a paper wall on one side, and all switches and gas-control apparatus are placed in an observation house some distance away.

Electrical Mining Accidents.—An inquest was held at the end of May on a man named J. McPherson, who was found dead beside a motor in the Lumley third pit. Deceased had complained of shocks when touching the motor. Examination showed that some strands of one connecting lead had projected and touched the motor-case, and it is presumed that the earth connection had become loosened by vibration. A man was also killed recently at Sherburn Hill by a shock from a main cable, the insulation of which had been damaged by a tub coming off the rails. Considerable sparking was reported at the inquest between the cable and the rails. A fatal case of accidental contact with a cable that had become live is reported to have occurred recently at Auchengeich Colliery, Kilsyth.

ELECTRIC POWER IN THE KENT COLLIERIES

THERE is considerable activity in the coalfield of the Kent Coal Concessions and Allied Companies, and although the coal-raising stage has not yet been reached, electric power is already used to some extent in the sinking operations at the five collieries already actually commenced. At the Snowdown Colliery about nine miles from Dover, generating plant has been put down consisting of a Westinghouse 50-kw. 220 volt dynamo, direct driven by a Browett Lindley high speed steam engine. This supplies the lighting both underground and on the surface, and is also to be used for workshop driving.

At the Tilmanstone Colliery, five and a half miles west of Deal, there has been trouble with water bearing strata at a depth of over 1,000 ft. immediately above the coal measures, and to deal with this electric sinking pumps are being put in. These consist of two vertical shaft high lift centrifugal pumps, each capable of raising 1,200 gallons per minute against a head of 660 ft. They will be suspended by a rope 2 in. diam. handled by a 40 ton single drum winch. These pumps are in addition to a considerable amount of steam pumping plant. For this and other future purposes a generating plant is being installed consisting of two Westinghouse turbo-alternators for an output of 1,200-kw. of 3,000 volts, three-phase, 50 cycles. The condensing plant is of the Westinghouse Le Blanc type. Steam will be supplied by two Babcock and Wilcox water tube boilers, each with 4,020 sq. ft. heating surface and fitted with integral superheaters and Green economisers.

For the power load that will ultimately arise, a power company known as the East Kent Power Co. has been formed, and is promoting an unopposed Bill in Parliament. The collieries mentioned above and other sinking and boring works were visited by members of the Institution of Mining Engineers during their annual meeting at the end of May.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during June.

June 1st.—Monthly supplement on Electrical Engineering in Mines, opening with a report of a Paper by Mr. H. J. S. Heather on the driving of winding engines by induction motors, discussed at a recent meeting of the Institution of Electrical Engineers. Notes are given of the principal patents relating to electrical mining work published during May, and attention is drawn to some of the exhibits at the recent mining exhibition in Manchester. A publication on modern mining switchgear is reviewed, and a short article deals with a new system of electric winding. Notes are also given on some recent accidents. An illustrated article gives particulars of some new mining switches, and a report is included of a meeting of one of the Scottish branches of the Association of Mining Electrical Engineers.

June 8th.—Discussion at the Institution of Electrical Engineers on the heating of cables with current. Tests of a 5,000-kw. turbo-alternator.

June 15th.—Discussion on cable laying and jointing. Description of a generating station for power supply.

June 22nd.—Illustrated descriptions of a large generating station with turbo-generator and an electrically driven railway works. Notes on the report of the Electrical Inspector of Factories and Workshops.

June 29th.—Papers and discussions on Diesel engines and on gas engines for generating stations. Description of a simple current gauge.

Luminous Shaft Signalling.—In the course of a paper read last month before the Manchester Geological and Mining Society, Mr. J. C. Eadie described a new system of electrically illuminated shaft signals.

Compensation Claim Refused.—At Alfreton, last month, a case was heard where a miner named J. Fearn, of Wellington, claimed compensation in view of injury by electric shock from a defective coal-cutter. The evidence was to some extent contradictory, but finally the view was favoured that the accident would not have occurred had not a heavier fuse than allowed been placed in the fuse carrier, and the application was dismissed.

Electrical Mining Patents of June.—Among the patents published during the past month of interest to mining engineers was one (No. 25,991 of 1910) by J. C. Rutter relating to hand-lamps intended for use in mines, and is arranged so that it can be used with perfect safety. The accumulator and the switch are enclosed and locked within the body of the lamp. The locking device comprises a ratchet carried by one part of the lamp adapted to be engaged by a spring-pressed rod or pawl carried by another part of the lamp, so that screwing the lamp parts together effectively locks them against separation until the pawl or rod is withdrawn from the ratchet by means of a magnet or a particular form of key.

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THE ELECTRICAL EXHIBITION AT OLYMPIA

WE give below a preliminary list of firms who have signified their intention to exhibit. Intending exhibitors are reminded of the rule that exhibitors the nature of whose displays necessitates their showing goods of other manufacturers, must agree not to advertise such makers' names either upon the article shown or upon their stands, unless such goods are manufactured by a fellow-exhibiting firm or are specified on the space contract. Any contravention of this rule will render the offending exhibitor liable for any damage that the Committee or the Management may incur.

Abbey Electric Co.; Adams Manufacturing Co.; Aerators; G. H. Alexander; Allen & Simmonds; Armorduct Manufacturing Co.; Aster Engineering Co.; Auto Recorder Co.

J. Barker & Co.; Bastian Electric Heating Syndicate; Bastian Meter Co.; Bat Meter Co.; Bell Heslop; Benjamin Electric; E. Bennis & Co.; Berry Construction Co.; Berry, Skinner & Co.; Bonnella & Son; W. E. Boosey & Co.; Braun & Co.; The Bristol Co.; British Aluminium Co.; British Electric Transformer Co.; British Metal Engraving Co.; British Prometheus Co.; British Thomson-Houston Co.; British Vacuum Cleaner Co.; E. Brook; Brook, Hirst & Co.; Bruce, Peebles & Co.; Brunner, Mond & Co.; Brush Electrical Engineering Co.; J. Buckton & Co.; Bullers; C. W. Burton, Griffiths & Co.

Callender's Cable & Construction Co.; Louis Cassier & Co.; J. L. Cateaux & Co.; Chamberlain & Hookham; Chas. Churchill & Co.; Concordia Electric Wire Co.; Consolidated Pneumatic Tool Co.; Corona Lamp Works Co.; Coventry Chain Co.; Credenda Conduit Co.; Crypto Electrical Co.

Dorman & Smith; Dowsing Radiant Heat Co.; Drake & Gorham; Dussek Bitumen Co.; J. Dugdill & Co.

Eastman & Son; Eastman & Warne; Ebonestos Manufacturing Co.; Edison and Swan United Electric Light Co.; Efandem Co.; Electrical Apparatus Co.; *Electrical Engineering; Electrical Engineer;* Electrical Ordnance & Accessories Co.; *Electrical Press; Electrical Review; Electrical Times; Electrician; Electricity;* Electromotors; Elliott Bros.; A. Emanuel & Sons; *Engineer;* Engineering Instruments; Escarè & Denelle; Everett, Edgcumbe & Co.; Evershed & Vignoles; Eyre Smelting Co.

Falk, Stadelmann & Co.; Famous Diamond Steel Co.; Ferranti; Foster Engineering Co.

Galsworthy; Gambrell Bros.; W. Giepel & Co.; General Electric Co.; Gent & Co.; Globe Electric Co.; G. W. Goodchild & Partner.

A. C. Hands; *Hardware Trade Journal;* Hart Manufacturing Co.; O. C. Hawkes; W. T. Henley's Telegraph Works Co.; L. Hervé; Hill, Siffken & Co.; Hoffmann Manufacturing Co.; Holmquist Electric Co.; Holophane; J. Hopkinson & Co.; R. Hornsby & Sons.

Imperial Electric Co.; Imperial Lamp Works (Brimsdown); Imperial Lighting Co.; *Iron & Coal Trades Review; Ironmonger's Chronicle & Hardwareman;* Isenthall & Co.

W. & R. Jacobs; Jandus Arc Lamp & Electric Co.; Johnson & Phillips.

Laing, Wharton & Co.; Lancashire Dynamo & Motor Co.; Lanston Monotype Corporation; Lea Recorder Co.; Le Carbone; Leskole Co.; Linolite Co.; R. A. Lister & Co.; Litholite; London Decorative Metal Works; Longstreth's; W. Lucy & Co.; A. P. Lundberg & Sons.

Major & Co.; Marconi's Wireless Telegraph Co.; Marryat & Place; Mawdsley; Medway's Safety Lift Co.; Metalite; Morgan Crucible Co.; Muirhead & Co.

Nalder Bros. & Co.; Nalder Bros. & Thompson; National Telewriter Co.; Nelson Bros. (Bradford); W. I. Nicholson & Clipper Co.

Oliver Arc Lamp; Ozonair.

R. Pape; Parmiter, Hope & Sugden; C. A. Parsons & Co.; R. W. Paul; J. W. & C. J. Phillips; Phillips Commutator Grinder Co.; Phœnix Dynamo Manufacturing Co.; Pinchin, Johnson & Co.; Pirelli; Pooley & Austin; Pope's Electric Lamp Co.; Post Office London Telephone Service; Post Office Telegraphs; Premier Electric Heaters; J. Proctor; Purcell & Nobbs.

Rapid Magnetting Machine Co.; Reavell & Co.; Hans Renold; A. Reyrolle & Co.; J. Rhodes & Sons; Ronald Manufacturing Co.; O. Rühl.

Samuel Bros.; Schaffer & Budenberg; Ship Carbons; Siemens Bros. & Co.; Silver Replating Powder Co.; Simmonds Bros.; Simplex Conduits; H. C. Slingsby; J. C. Smith; Spagnoletti; Sterling Telephone & Electric Co.; Stern-Sonneborn Oil Co.; St. James & Pall Mall Electric Light Co.; J. B. Stone & Co.; Sunbeam Lamp Co.; Sunderland Forge & Engineering Co.; Sun Electrical Co.; Synchronome Co.

W. C. Tackley & Co.; Tella Camera Co.; Bertram Thomas; J. H. Tucker & Co.

Unbreakable Pulley & Mill Gearing Co.; Union Cable Co.; Union Electric Co.

Vedovelli, Priestley & Co.; Venner and Co.; Vickers.

Wallach Bros.; Walker, Horrocks & Co.; Wandsworth Electrical Manufacturing Co.; Duncan Watson & Co.; R. Waygood & Co.; L. Weil & Reinhardt; Western Electric Co.; Westinghouse Brake Co.; Westinghouse Cooper Hewitt Co.; Westminster Engineering Co.; Allen West & Co.; Whipp & Bourne; H. Wiggin & Co.; W. H. Willcox & Co.; Alex. Wright & Co.; Wright & Wood.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ALUMINIUM.—Two new leaflets from the British Aluminium Co., Ltd., show respectively, by striking illustrations, examples of the extensive use that is being made of aluminium for interior fittings in the new carriages on the District Railway, and for switchboard connections.

SILVERTOWN CABLES, PLANT, AND APPARATUS.—We have received from the India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., 100–106, Cannon Street, E.C., a collection of price lists, &c., conveniently bound in a cover. These are too numerous to deal with separately in detail, and cover the following branches of the firm's manufactures:—Guttapercha, indiarubber, silk and cotton-covered wires, jointing tools and materials; primary batteries of the Leclanché and other types, including the Bleeck-Love battery, electric bells, pushes, &c.; telegraph instruments, testing sets, resistance boxes, &c.; water level indicators, railway signalling apparatus, &c.; the Rymer-Jones patent mica-tinfoil condensers and universal shunts; insulators, fittings and tools for telegraph and telephone lines; dynamos and motors, and electric light cables and wires.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

AIR HEATERS.—A handsome illustrated pamphlet from the Underfeed Stoker Co. (Coventry House, South Place, E.C.) describes the "Usco" air heater for placing in boiler flues to heat the air supplied to the furnace. The heater is built up of sections in a manner to give very large heating surface in a compact piece of apparatus.

ELECTRICAL DRIVE IN TEXTILE MILLS.—We have received from the British Westinghouse Electric and Manufacturing Co. (Trafford Park, Manchester) an advance proof of an interesting little booklet which they are bringing out on loom motors, pointing out the advantage of individual motor drive and the improvement both in the quantity and quality of the work turned out, rendered available by the steadiness and flexibility of electric drive, in addition to the reduced cost of power, where conditions are favourable. A series of photographs gives an idea of the large amount of work of this nature already accomplished by the company.

SINGLE-PHASE MOTORS.—A letter from E. Brook, Ltd (Huddersfield), deals with this firm's slip-ring type single-phase induction motors from 3 to 50 h.p., with ball bearings.

ANNUAL DINNER OF THE ELECTRICAL CONTRACTORS' ASSOCIATION

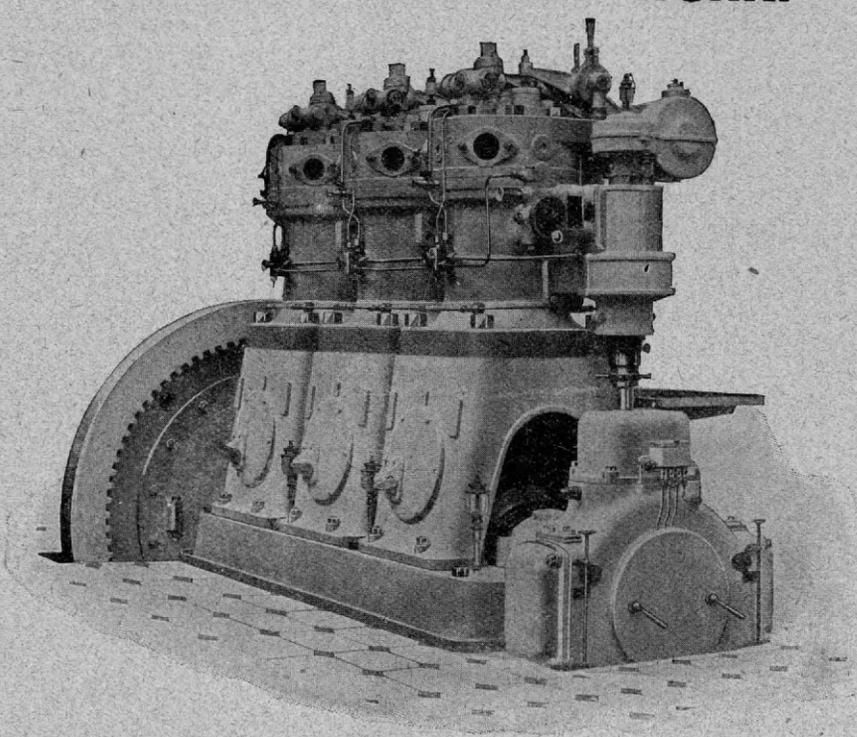
THE Electrical Contractors' Association held their annual dinner, with Mr. G. Harland Bowden, President, in the chair, on Monday last at Frascati's Restaurant, when over 100 members and guests enjoyed a pleasant evening. After the loyal toasts had been duly honoured, the toast of the Houses of Parliament was proposed in a witty speech by Mr. R. Tweedy Smith. Mr. H. Terrell, K.C., M.P., who was to have replied, was unfortunately unable to be present. The toast of the Electrical Contractors' Association was proposed by Mr. H. H. Berry, who referred to the special fund which had been got together largely through the instrumentality of their President, and would, he hoped, enable them to maintain their rights and oppose such Bills which were not what they thought they should be. In his reply, Mr. Harland Bowden mentioned that the membership of the Association had increased by 20 per cent. during the year. In reference to the vexed question of municipal trading, he regretted that more had not come of the recent Conference, but although their real interests were identical, unfortunately the policies of the municipal engineers and themselves were opposed. It was necessary to educate the public in the matter, and he thought that they would ultimately agree with the contractors' point of view. The toast of the Institution of Electrical Engineers, the National Electrical Manufacturers' Association, and Kindred Associations was then proposed by Mr. W. R. Rawlings, who expressed their thanks to the Institution of Electrical Engineers for the use of their rooms and their work in connection with the wiring rules. Among other associations he mentioned with appreciation the work of the Cable-makers' Association and the National Electrical Manufacturers' Association. The toast was replied to by Messrs. L. B. Atkinson and F. B. O. Hawes, and finally the President was proposed in well-chosen words by Mr. E. C. Wallis. Between the speeches an excellent musical and humorous programme was performed, in which Miss Mary Lund, Mr. J. Prout, Mr. C. F. Wood, Mr. C. W. Wrexford, and Mr. R. Triggs took part.

Power from Coke Oven Gas.—Considerable developments in the utilisation of waste heat for power purposes are reported to be about to be undertaken in the Barnsley district. At the Stanhope Silkstone Colliery a 2,000-kw. generating station is to be put down, run entirely on coke oven gas, and supplying power to assist the system of the Yorkshire Electric Power Co.

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THE ENGINE FOR CENTRAL STATION WORK.



Latest Type Diesel Engine specially designed for Lighting and Power Sets.

LOW MAINTENANCE COSTS

AT LEATHERHEAD:—The cost for repairs on two engines of 120 B.H.P. each has not exceeded £2 per annum for five years.

Full particulars on application.

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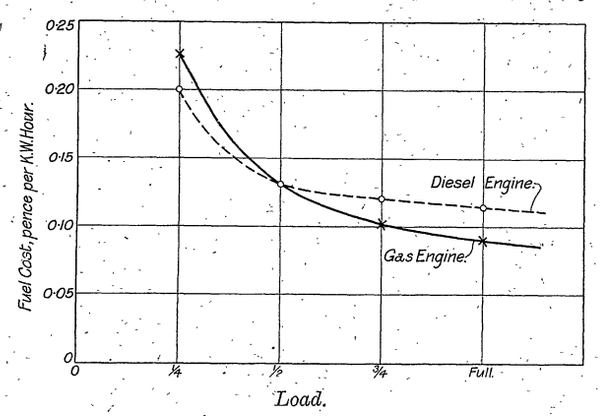
SIXTEENTH ANNUAL CONVENTION OF THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION

IN our last issue we reported the first two days' proceedings, concluding with two Papers on "Internal Combustion Engines," and a brief telegraphed report of the discussion on them at Portsmouth. We now publish a fuller report of the discussion.

DISCUSSION ON INTERNAL COMBUSTION ENGINES.

Mr. CHARLES DAY (Mirrless, Bickerton, and Day), who opened the discussion, said that his own experience in the manufacture of Diesel engines extended over nine years, and his company's experience in the same direction extended over fourteen years. Engines built by them fourteen years ago were still running in his company's works. The average of figures given to him during the past few months by station engineers of the saving in fuel effected by the adoption of Diesel engines was over 40 per cent. In some of the early Diesel engines the consumption of lubricating oil was rather heavy, and particularly so in the high speed type. He remembered a case in which with the new type of engine they expected the fuel consumption to be rather higher than with the slow speed ordinary type, but were surprised to find that it had dropped from about 0·42 to a little over 0·3 lbs. per b.h.p.; the explanation was that they consumed lubricating oil to cover the difference. This difficulty had, however, been entirely eliminated, and the lubricating oil consumption was now about the same as with very good steam plant. Whilst with steam or gas plants the average actual result over a year or two differed very considerably from the guarantee or the best figures, with the Diesel engines, owing to the absence of outside accessories, and owing to the fact that there was nothing to adjust and control outside, the real results had been very much better than were obtained with other plants giving equal guarantees. With steam, the larger the unit, the better the result; but the case was entirely reversed when they dealt with internal combustion engines, and every investigation that he had made showed that the gross cost of working with internal combustion engines went up as the size went up. When they exceeded 150 h.p. per cylinder, they introduced complications, such as water-cooled pistons and other things, resulting in a distinct increase in the cost of oil, and, in addition to that, the capital expenditure per h.p. tended to increase rather than to diminish as the size increased. About eighteen months ago, Sir Marcus Samuel wrote him saying that the outlook was that the visible supplies of oil were very considerably in excess of the visible likely demand. Sir Marcus had repeated this statement in public lately, and he thought there was not the slightest fear of any scarcity for many years to come.

Mr. LEONARD ANDREWS (Key Engineering Co.) did not think anyone would accept Mr. Howard's steam engine figures, and pointed out that the gas engine figures had been wrongly quoted from the paper by Mr. Porter and himself. Mr. Howard had assumed a total output of about half the output taken in the Institution paper (11,000,000 units per annum instead of 21,000,000 units), but had assumed a coal consumption considerably more than half, viz., 14,000 tons. Mr. Andrews, however, was quite



sure that any gas engine maker would be prepared to guarantee to generate the output specified with about 11,000 tons of coal. Then Mr. Howard had included the cost of the ammonia recovery plant and accessories, and there were other ammonia recovery items lower down in his estimates, and the costs included extras for the ammonia recovery plant in the way of oil, repairs, &c., and finally an item for handling the ammonia. But Mr. Howard had quite forgotten to credit the costs with the sale of the by-product. Allowing for these two items, the gas engine costs would be brought down to about £1,000 less than Diesel engine costs. Turning to the guaranteed results, Mr. Andrews exhibited the curves below, based on Diesel engine and gas engine makers' guarantees, the former being the dotted line, and the latter the full line. The gas figures were based upon the cost of coal at 12s., and oil was taken at 40s. per ton. At half load it would be seen that the costs per unit exactly coincided, and that above half load up to full load the figures for the Diesel engines were about 20 per cent. higher than the gas figures. At quarter load the Diesel figures were about 10 per cent. lower than the gas figures. With regard to the question of the supply of oil, he was afraid that the cost of oil would follow the natural law of supply and demand. In a recent tour in the Colonies, he came across a number of Diesel engines working satisfactorily, and, in one case, a cotton factory, where there was 200 h.p. running, there was no one about the engine-room, and he was there a quarter of an hour before the attendant came in. He entirely agreed that there was a very great future in front of the Diesel oil engine, but did not by any means look upon it as the competitor of the gas engine. Referring to Mr. Day's remarks, he said he could not agree that the cost of internal combustion engines went up as the size went up. The capital cost certainly went down, the efficiency increased, and all costs went down. A large German station, which had started with engines of 500 or 600 h.p., had extended with 1,300 h.p. and 3,000 h.p. units, and was finally putting in a 4,000 h.p. set.

Mr. G. SEATON (Willans and Robinson) said that a few years ago gas engine men only worried about little places like Leek and Hebden Bridge, and so forth, but now the man who was selling big gas engines was fancying his chance at places like Manchester, where Mr. Pearce had been making enquiries about large gas engines, and had been holding out the carrot to the donkey. The difficulty was to get any really accurate information about the working of big gas engines, but in March of this year, a paper was read before the Manchester Association of Engineers, by Mr. A. L. Chorlton, of Messrs. Mather and Platt. He rang up Mr. Carr, to ask him to come, but he said he could not—he was busy at home. He had heard other men that used big gas engines say the same thing. It seemed that a big gas engine was the equivalent to a six-foot wife for keeping a man at home. Two evenings were devoted to the discussion; all the speakers were prominent gas engine makers, they went for each other bald-headed, and he had no idea until then that there was so much trouble with big gas engines. Mr. Day was absolutely correct when he said that the bigger the internal combustion engines the bigger the troubles. He was not so much concerned about the costs; it was the trouble that choked people off. He had been through the steam turbine business in the early days, and knew what it was, and the troubles with big gas engines were much worse than those with steam engines.

Mr. H. L. P. BOOT said that some years ago, he put down Diesel engines in a small town not far from Portsmouth, and depended entirely upon them without any battery, relying more or less on the excellent figures which the Diesel engine would give when running very lightly loaded. He wanted to sound a warning note to those engineers who were thinking of rushing headlong and madly into Diesel oil engines, because he was convinced that in the future Diesel oil engines were likely to be installed in places where they would be unsuitable. He had found that the wages for skilled attendance which was necessary, and the repairs which were also necessary if the engines were to be kept in an efficient state, were serious items. Of course, it was possible to talk of an engine running for three or four years without any repair bill, but at the end of that time it would probably be necessary to scrap the engine altogether. If such an engine was well maintained it would probably have run for many years longer. In the first year of the installation to which he referred, the fuel costs came out at 0·291d. per unit, wages 0·543d., and repairs 0·210d., but these figures would be very much reduced as the output rose. As to oil supply, although there would always be plenty of oil, the difficulty was to get it landed in this country at a reasonable rate. When he was in Mexico last year, he was told that the whole of the National Railways of Mexico had changed over their locomotives for the use of oil fuel, but on account of the difficulty of getting the oil they were actually changing their locomotives back to fire-boxes for burning coal. For small powers, undoubtedly the Diesel engine was better than any other form, as far as economy went, but he warned them to get particulars from the makers of all spare parts and repair parts that were likely to be necessary. He also warned them to have at least twelve months' guarantee of maintenance. He advised the testing of the calorific value of the oil, and gave other advice from his experience with Diesel engines. In conclusion, he said that if any members cared to inspect the Chichester station, he would be only too pleased to make arrangements for them to do so.

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Mr. G. WILKINSON (Harrogate) related in considerable detail the costly experience obtained with three or four of the early types of German Diesel engines put down in 1902. The repairs had been very formidable, the consumption of lubricating oil had been nearly half the consumption of fuel oil, and the latter had at one time cost £4 7s. 6d. per ton, delivered at the works. He could never understand how it was that these engines took such an enormous amount of lubricating oil, until he found out that it was going into the cylinder, and helping to work the engines. He was very pleased to find, on visiting Messrs. Mirrless, Bickerton, and Day's works during the Manchester Convention, that they had a very simple and thoroughly practical device for getting over that very expensive trouble. It was his opinion that for large sizes, the single acting cylinder type of Diesel engine, put back to back, would have to be developed. At present this type was only used for marine purposes, and had to be run at rather a slow speed.

Mr. J. MULHOLLAND (M.A.N. Co.) said that of the 1,600 b.h.p. Diesel engines, at the electricity works, Halle, mentioned by Mr. Howard, only one engine was at present working, whilst the foundations for two further engines had been built. Mr. Howard had stated quite correctly that at the present time the single-acting four-cycle engine was the standard engine, but in future, especially for engines of 1,000 b.h.p., upwards, the double-acting four-cycle, or the two-cycle engine would take its place. It would be possible to build a safe and cheap single-acting two-cycle engine up to about 2,000 b.h.p., whilst the limit for a really reliably working single-acting four-cycle engine ought to be reached at 1,000 b.h.p. For land purposes, the engine would be built preferably of the horizontal type. On the question of oil supply, he quoted some statistics, which showed, he contended, that an artificial raising of the price of crude oil would be impossible. The M.A.N. Co. had installed, in more than twenty small rural electricity works, Diesel engines which supplied a number of villages and farms with power and electric light. It had been the experience of the M.A.N., which built Diesel engines, steam engines, steam turbines, and gas engines, and could, therefore, form an impartial judgment, that the repairs of a substantially-built slow-speed Diesel engine were not larger than those of a first-class steam engine. Diesel engines which, with an output of above 200 b.h.p., exceeded a speed of 200 r.p.m., cost more for maintenance and lubrication, and should be used only in special cases where there was lack of space. He concluded his remarks by giving a long list of large stores and restaurants in which M.A.N. Diesel engines were used.

Mr. R. J. KAULA (Willans and Robinson) endorsed the opinion that the single-acting four-cylinder engine was the standard engine for land practice. There seemed to be a demand, however, for a small, low-price engine of the two-cycle type which must be economical in fuel consumption whilst running at the highest speeds, and his firm had designed an engine on these lines. The engine was at present running at Norwich, and it was only 50 k.w., but it was hoped that the results would be sufficiently satisfactory and that they would be able to extend the sizes considerably.

Mr. A. S. BLACKMAN (Sunderland) found fault with the statement in Mr. Howard's paper that the Diesel engine was not subject to violent stress because of the slow nature of the combustion of the gas, and pointed to the indicator diagrams of the engine and instances of breakage of crank shafts. A more damning admission could not have been made than that by Mr. Day, who had said that the mechanical difficulties would enormously increase with the larger sizes. Mr. Day had also said that the lubrication difficulties were not greater than were met with in steam practice, but he did not see how that could be the case, because the higher temperatures in the cylinder of Diesel engines meant lubricating difficulties, and, with steam turbines there was no internal lubrication at all. He refused to accept Brighton as a typical case for comparing costs. At Sunderland, which was by no means a modern station, the actual works costs for the last half year, with a smaller output than that taken by Mr. Howard, were 0·2104d. per unit, as against 0·583d. given by Mr. Howard for Brighton, and the capital figures taken were also far higher than were represented by modern practice. Mr. Andrews had said that he could beat Diesel figures by £1,000 a year with gas engines, and he (Mr. Blackman) claimed to be able to beat Diesel figures with modern steam plant by at least £4,600 a year. They had also to bear in mind that the Diesel had a very small overload capacity indeed as compared with the overload capacity of a turbine plant.

Mr. H. DIXON (Leatherhead Electricity Supply Company) said that perhaps a few remarks from a satisfied user of Diesel engines would be of interest. He had had five years' experience with two 120 k.w. sets, at Leatherhead, and was just putting in a third. His experience was just the opposite to Mr. Boot's. The engines ran very satisfactorily, with cheap labour, and the repairs had only cost £2 a year for the last five years. In a modern Diesel engine, the wearing parts were arranged to be easily renewable. The fuel costs for the very small station at Leatherhead for the whole year worked out at 0.22d. per unit, whereas formerly they were like a large number of other steam stations of the same size, in the neighbourhood of one penny. The makers had guaranteed him 0·64 lbs. of fuel per unit generated; he was running the engines at quarter full load, and, taken for the whole of the year, the consumption was 0·7 lbs., which was exceedingly good when the poor load factor was taken into account. The price of oil had gone down steadily from 77s. to 48s. 6d. per ton (the latter on a two years' contract), whilst he had been using these engines. Where the Diesel engines scored more heavily, was in connection with the large number of stations which were struggling to produce cheap units from poor coal and inefficient steam engines. It would pay them to give their steam plant away and put in Diesel engines.

Mr. W. G. PICKVANCE (Wrexham) said that, reading between the lines, it was possible to form the impression that Mr. Carr would be happier with steam plant of average efficiency and reliability than his present gas plant, although with engines of the slow horizontal type, similar to the Nuremberg engines, he would have been more exuberant in his praises of gas plant.

Mr. S. E. FEDDEN (Sheffield) spoke in the same strain as Mr. Blackman, and said that the figures of capital expenditure and works costs for steam plant given in the paper were absolutely wrong. At the Neepsend station, at Sheffield, the capital expenditure had been only £13 per kw., and the coal costs, on the whole Sheffield undertaking (which included 4,000 kw. of obsolete engines), only 0·17d. per unit last year. He had come to the conclusion that the internal combustion engine must have an intermittent use, and it must be very much under-loaded. Mr. Dixon's success, he was convinced, was due to his underloading the engine. Figures such as those in the paper would mislead very many councillors and young engineers.

Mr. I. V. ROBINSON (Richardsons, Westgarth, and Co.) said that his firm had now taken up the manufacture of the Diesel engine. His firm had built, for marine purposes, a 1,000 h.p. four-cylinder double-acting engine, similar to those manufactured on the Continent by Messrs. Carels Frères, and after they had got this engine working, they would probably turn their attention to Diesels for land purposes. He thought that the Diesel engine was an excellent one for stations of 500 to 1,000 kws. capacity. For larger power stations, when they could give gas engines, say, an average of 80 per cent. of their full load throughout 130 hours per week, these should be used, with a spare engine as well, and a steam turbine to deal with the peak load. Manufacturers of the Diesel engine were prepared to go up to 6,000 h.p. four-cylinder engines, and he had seen cylinders of that size (1,500 k.w.) working very satisfactorily. He disagreed with the suggestion that repairs to a gas engine were heavy, and gave instances, both in this country and the Far East, to prove his point.

Mr. J. E. EDGCOME (Kingston-on-Thames) asked Mr. Carr whether, in getting out the extension of the Leek station, which was proposed, he intended to use gas engines, steam engines, or Diesel engines. [We understand that a Diesel engine is contemplated for the next extension.—ED., *E.E.*]

The authors reserved their reply for the *Proceedings*.

PURCHASE OF FUEL.

A discussion on this subject was opened by Mr. C. E. C. Shawfield (Wolverhampton) when the members met again in Brighton on Thursday.

Mr. SHAWFIELD first pointed out that it was very necessary to take into account the position of the stations and the cost of carriage, *e.g.*, a cheap fuel of, say, 10,000 B. Th. U. calorific value might be the best in some cases, whereas it did not pay a station far from the coalfields to purchase any fuel of a lower value than, perhaps, 13,500 to 14,000 B. Th. U. Another important matter to be taken into account was the type of boiler-house plant and the method of firing. Hand-fired boilers usually necessitated purchase of a higher class fuel. The boiler doors had to be opened so much for cleaning purposes in the case of an inferior class of fuel, that the strains thrown upon the boiler were very considerable, and, moreover, in hand cleaning the boiler there was always a good deal of good fuel brought out along with the clinker, and, consequently, the less the amount of incombustible material to start with, the less the loss which was occasioned from this source. The question of the percentage of incombustible contents in any fuel had a very important bearing upon its commercial value. Ash and clinker appeared to have a more deleterious effect than moisture. The reason was probably that the fire-clay or shale had to be raised to the furnace temperature, and, in the case of internally fired boilers, at all events, these were frequently removed at very nearly furnace temperature every time the boiler was cleaned. On the other hand, the heat expended in evaporating the moisture was partly given back to the heating surface of the boilers by the steam. This had a very considerable bearing when considering the relative value of washed and unwashed fuels. He had some interesting particulars of an experiment which he had made upon a certain class of fuel before and after it was washed. The fuel in question was a very fine and dirty pit bank sludge, which had practically been of no commercial value, for the calorific value per pound of dried fuel was 9,500 B. Th. U., the moisture contents 5 per cent., and the ash contents about 28 per cent. When tested in a calorimeter it gave about 9,900 units

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per pound, but that could not be taken quite as the criterion of its commercial value, because in the calorimeter the ash contents are raised to the temperature of combustion, but subsequently give back their heat to the water in the testing apparatus. The price of this fuel was about 4s. 5d. per ton; by the calorimeter test this worked out at 397,000 B. Th. U. per penny, but, if allowance were made for the heat lost in the ash and clinker, it was brought down to about 290,000 B. Th. U. per penny. The same fuel, when washed, gave an average B. Th. U. per pound of dried washed fuel of 11,700. The cost delivered was 5s. 6d. per ton, the moisture contents 13 per cent., but the ash was reduced to about 11 per cent. That would give an apparent heat value per penny exactly the same as by the calorimeter test for unwashed, namely, 397,000 B. Th. U. per penny, but if they took into account the heat required to raise the clinker and ash to furnace temperature and also, in this case, the heat required to raise the excess of moisture, they got a figure of 350,000 B. Th. U. per penny, as against 290,000. Mr. Shawfield next described the process of washing such fuel, as employed by one of the collieries in the South Staffordshire District. The principal difficulty in using the fuel, however, was that, as it had come entirely by boat from the colliery, there was very little opportunity for it to dry, and it frequently arrived with as much as 25 per cent. of moisture, but that might be improved by allowing, say, twenty-four hours or forty-eight hours of storage in a perforated bunker.

Mr. Shawfield next spoke on the relative advantage of purchasing direct from the collieries or through agents. He had found it better in every way to contract directly with the colliery, and the Wolverhampton contracts had been placed with the same colliery for practically the same class of fuel for the last eight or nine years. On the other hand, he believed that in the North of England it was the practice to contract almost exclusively with agents. Agents had command of perhaps a larger range of collieries, but they could not be so certain of getting a regular quantity of fuel. For several years it had been the practice at Wolverhampton to obtain their supplies annually; but for the last five or six years the practice had been followed of purchasing say, 20,000 to 50,000 tons, according to the state of the market and the requirements of the station. That method might be said to be to a certain extent speculative, but it often enabled them to cover their requirements for a period of, say, three years, and it was a great advantage to know that they were covered for several years ahead. He thought, also, that collieries usually preferred that a definite quantity should be contracted for rather than a period of time.

Purchase on the basis of net calorific value was the ideal method, but he was afraid there were many difficulties in the way at present. When dealing with agents and not with collieries direct, these difficulties seemed insuperable, but it was, perhaps, feasible when they were dealing directly with one or perhaps more collieries, and colliery owners would have to be educated up to it. He thought a contract might very easily be entered into in which the payments were based entirely upon the net commercial value of the coal as it left the colliery. He believed Mr. J. H. Rider had entered into contracts on something like that basis, with quite satisfactory results, at the Greenwich Power House. In that case the contract was for the coal as delivered at Greenwich, and not as it left the colliery. He thought it was of the utmost importance that every station should possess an adequate coal-testing department, and that regular tests should be made of the fuel actually fired into the boilers. At Wolverhampton there had been one in operation for eight or nine years; the first cost of the apparatus had been about £10 or £12, and the annual expenditure in time and material for taking daily tests of the fuel delivered was about £20 to £25. Without exaggeration, he estimated that the net result was an annual saving in fuel costs in the first two years of something like £500 per year. The colliery was practically content to take the word of the Corporation as regards the calorific value of any consignment of fuel that was sent, and, as a matter of fact, they not infrequently sent along a trial boat to know whether it was worth while placing it on the market. He thought that a further development of fuel-testing might be the establishment of a testing laboratory, jointly controlled by the producer and the consumer, that every consignment of fuel, as it left the colliery, should be tested for calorific value, moisture, and ash percentage, and that the payment for the fuel should be based entirely on these tests. He hoped to have such an arrangement in operation in a few months.

He had found it necessary to have the following wage clause in his coal contracts: "The prices quoted in this contract are to be based upon the present standard rate of wages, as agreed upon between the colliery owner and the Miners' Federation in the federated area in England. This standard is hereby declared to be 50 per cent. above the minimum. For every 2½ per cent. in the minimum variation above or below the present standard, it is agreed that there shall be a corresponding increase or decrease upon the contract price of the fuel, such increase to be calculated as 2d. per ton upon fuel Class I. and Class II., and 3d. per ton upon fuel Class III. for each 2½ per cent. alteration in the rate of wages." A clause of that kind facilitated contracts being made for long periods or large quantities, because the colliery owners were covered to a large extent from loss in the event of there being any considerable rise in their labour costs.

The Eight Hours Act, passed about two years ago, had affected not the price of fuel, but the quality. Immediately after the Act came into operation in the South Staffordshire district, he had noticed an increase of from 5 per cent. to 7 per cent. in the amount of incombustible contents in all fuel delivered; apparently the miners had not the time to be so careful in sorting out the inferior class of fuel when shovelling in the trucks below ground. He had had serious trouble with the colliery people for some two or three months before he could get this matter rectified.

Another question which affected the price of fuel was the condition of trade, and it appeared probable that there would tend to be an increase in price during the next year or two. The price of low quality slack had appeared for some years past to rise and fall in cycles of four years. There had been just over three years of comparatively low prices, and there might be a continuous slow increase for the next period of three or four years.

Mr. R. A. CHATTOCK (Birmingham) differed from Mr. Shawfield as to the influence of the ash percentage as being more important than the influence of the moisture in the fuel, for whilst a lot of the heat was carried away with the ash in the furnace gases, a large amount was returned to the boiler through the incandescent ash in the form of radiation. He had tried both washed and unwashed fuel in his station, and preferred the latter. He had found it difficult to get washed fuels dry, and had even had to pass 20 to 25 per cent. of moisture. There was a lot of moisture passing over with the furnace gases, which condensed on the economiser tubes, and tended to corrode them very badly. His experience showed that, when purchasing a very large quantity of fuel, it was better to deal with agents. He could not get any better prices from the collieries direct, and in most cases the best collieries would not quote direct, and when he had been able to obtain a quotation from a colliery, it was generally higher than that from agents. This might, of course, only happen in large towns. Moreover, in buying from agents, they had a bigger range of collieries to deal with. As to purchasing coal on the basis of calorific value, he had found that two coals of identical calorific value, and practially identical percentages of ash, gave very different results on the same boiler. One coal might be more suitable for a certain type of mechanical stoker than the other. In Birmingham they had instituted a very careful testing department. They had their own chemist and staff of men continuously testing; every boat-load of coal was tested, and every week they tested two clases of coal for performance in the boilers. In that way they saw that they were kept up to the original records on which the coal was purchased. They also tested one boat-load of new coal every week, and in that way they were able to obtain information about new coals for helping them in deciding on the contract when it came up annually. He now had complete information of about 130 different classes of coal in the Birmingham neighbourhood (it was not much use going outside the coal district round Birmingham, on account of the railway rates), and they had been able to reduce the average cost from 8s. to an average of 6s. 10d. per ton; the percentage of ash from 21 to 14; and the cost of coal per unit from 0·18d. to 0·14d.—a decrease of 22 per cent. in about three years. They also checked the efficiency of the boiler-house, and had been able to obtain a thermal efficiency of about 65 per cent. over each 24 hours, and 75 to 80 per cent. on the full load test on the boiler over a fixed period. The 65 per cent. was a very near approach to that when they considered that it included all banked boilers and cleaning at night time. The cost of his testing department was approximately £400 per annum, and that included the wages of the chemist and assistants in carrying out the boiler tests. The boilers were tested every day. The cost of this testing only represented 7 per cent. of the cost of the coal burned, which was very small compared with the reduction of 22 per cent. that had been obtained in four years in the cost of the coal per unit generated. He did not think that a testing laboratory could be jointly owned by the colliery and the consumer, unless the consumer was content to obtain the whole of his coal from one colliery, in which case there would not be sufficient competition to ensure getting the best price.

Mr. F. A. NEWINGTON (Edinburgh) said that at Edinburgh they went very carefully into the question of moisture in fuel. They took samples from every truck-load of coal delivered through the twelve months, had it dried, and the amount of moisture determined. The coal contractors thought that he was baking the coal too much, and taking more than the surface moisture, and they objected. From what they said, it was clear that this testing would increase the price of the coal considerably for the next contracts, and, therefore, for the following year, he asked for two prices, one with the moisture, as delivered, and another with not more than 9 per cent., as specified. The result was that the price of the dried coal was about 6d. per ton more than for the coal as delivered, and it was not thought worth while to pay this. He thought that it was very much the same question as buying by calorific value. He believed that the coal owners knew just as much about coal as electrical engineers—probably rather more; and if they tied them down to laboratory tests of calorific value, they would probably artificially increase the price. If everybody bought at calorific value it might work out better, but he was afraid that this would never come to pass. In Scotland they did not get into touch with the collieries at all, and purchased entirely

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through agents. One point which had not been mentioned yet was that if they were dealing with one colliery, and there was a strike, they were in rather a hopeless position. He doubted the reliability of the testing apparatus purchased by Mr. Shawfield for only £10 to £12. He had not very much faith in calorimeter tests, because the amount of coal tested was so extremely small that there were very grave doubts whether they got a representative sample. Boiler tests were much more reliable, and very large users of coal—he had not tried it himself—might find it well worth while to have a specially constructed boiler in which to make all their tests.

Bailie-Willock (Convener, Glasgow Electricity Committee) said that many districts in England were about thirty years behind Scotland in their methods of handling coal. Scotch coal was used so generally, both in Scotland and England, that sometimes the price rose so high that it was impossible to buy locally. At Glasgow they burned about 80,000 tons of "single nuts" per annum. Recently, however, Mr. Lackie and his assistant engineer had come to the conclusion that they could buy a coal called "pearls"; it was washed, and held a greater percentage of water than the singles, but it answered their purpose equally well, and cost about 6d. a ton less. He happened to be both a coalmaster and an agent, and, from his experience in this dual capacity, he thought the purchaser was likely to get the best coal, at the cheapest price, from the agent, and was not in such a risky position in the matter of strikes, as the agent had several strings to his bow. There was a motion before the Glasgow City Council recently that no agents need apply. There were several non-coalmasters on the Council, and three coalmasters, but happily the majority was in favour of leaving it open.

Mr. F. Ayton (Ipswich) favoured purchasing through coal merchants. He had ascertained the opinion of one of the large coal merchants on the London Coal Exchange as to purchasing on calorific value, and he had pointed out to him that the handling of the coal is quite beyond the control of the agents, as they have to buy at the pit's mouth, and, further, the inevitable variations in the various seams of coal are also beyond their control. Merchants, therefore, added a considerable margin to the price to cover themselves for this risk, and the advantage given to the consumer having a guarantee is, more often than not, nullified by this. The coal-owners who had been asked their opinion on this method of purchasing had replied that they "had no opinion to offer on the matter." They evidently did not care, as long as they could sell their coal as it was raised at the pit. He thought they must leave it for the present to the larger undertakings to go forward with this educational policy. In London there were two large undertakings, both dealing with about 150,000 tons per annum, who purchased on the heat unit basis. One was the London County Council Tramways Generating Station, at Greenwich, and the other was the Underground Electric Railways Co., of London, whose generating station was at Lots Road, Chelsea. By the courtesy of Mr. A. L. C. Fell, of the London County Council, and Mr. Stanley, of the Underground Railways Co., he had received copies of these specifications. That of the London County Council occupied eleven pages; it was splendidly prepared and everything was covered. On the other hand, the specification of the Underground Railways Co. consisted of only 159 words. He thought he would be a bold man who would decide as to which of the two undertakings was getting the better terms. In the London County Council specification, the coal had to be tested by the L.C.C. chemist in their special laboratory. This coal came in in large cargo loads of about 700 to 1,000 tons at a time, and, by the terms of the contract, the Council could reject the coal if it did not come up to a certain minimum of heat units, but he found that by the time the actual results were obtained from the laboratory, the coal had probably been half used. The only test made at the generating station was to determine whether the coal was of a right size, and that there was a minimum amount of dust. The Underground Railways Co. got the heat units which they stipulated for in their small specification. Mr. Towle, the Chief Engineer at the Lots Road station, had told him that he did not use a calorimeter, as it took too long, and he did not regard it as giving sufficiently accurate results under the conditions of a power station. The method Mr. Towle used occupied twenty minutes, and cost 1½d. Mr. Towle wrote him that he found it as accurate as any calorimeter methods, and of much more value, as they got the results before they unloaded the coal. When the average B. Th. U. per ton fell below the specification, they got a rebate, and if it were above they paid nothing. The test, which was known as the Berthier's method, or the litharge method, was as follows :—

Weigh out 1 gramme of finely powdered dry coal, mix this with about 60 grammes of litharge (free from silver), also mix, say, 15 to 20 grammes of glass powder (coarse); put this in a Battersea clay crucible, and cover with a layer (table-spoonful) of common salt, and heat in a forge fire or otherwise for about twenty minutes, at a bright red. When cold, break crucible, and extract the lead button from the bottom, clean off slag, then weigh and multiply its weight in grammes by 483. This will give the calorific value of the coal in British Th. Units per lb.

In his own opinion, the test should only be used to see that they got a uniform quality of coal, but, for deciding which coal would suit their particular conditions, the only test of any use was the actual test in the boiler-house, and, owing to changes in atmospheric conditions, unless they had a test of some days' duration, they were liable to get results which were altogether inaccurate, and he went upon that method of taking a continuous test when he was dealing with different fuels to decide which was the best. In purchasing fuels, he dealt with big London firms, and his chairman had himself had the authority of the committee to close with any suitable offer they got, and report to the committee afterwards.

Mr. H. Faraday Proctor (Bristol) pointed out that Mr. Shawfield's sliding scale in regard to wages would tempt the coal-owner to increase wages, as he would then obtain more by the increased price of the coal than he paid in extra wages. Mr. Proctor also stated that he had issued a specification for coal on the calorific basis some years ago, but all the colliery owners tendered simply at so much per ton notwithstanding, and said nothing about calorific value.

Mr. E. E. Hoadley (Maidstone) said that some years ago he had sample barge-loads of several coals for testing purposes. Similar samples were sent to three laboratories for calorimetric tests, but the results all differed considerably. He also found that samples of coal which gave results within 1 or 2 per cent. in the number of heat units as tested by the calorimeter gave widely varying results on a 24 hours' test in the boilers under actual working conditions.

The President [Mr. Christie (Brighton)], before calling upon Mr. Shawfield to reply, spoke as to the arrangements in Brighton. He said that they had gone very carefully into the matter, and had found that Scotch washed singles, such as Bailie Willock had referred to, served their purpose very well. They came down in 700-ton boats, and the passage in the boat freed the coal from any excess of moisture. They bought on the bills of lading, and checked the weight as it came out of the boat. He had an elaborate system of getting the calorific value of coal, which was done regularly on six samples from each cargo. He had found it very useful in a general way, but he relied upon the pounds of coal actually fired per unit generated as the true criterion. In order to avoid the corrosive effect of moist coal upon the bunkers, Mr. Wright, in designing the station, had abandoned the use of steel, and adopted reinforced concrete, which had given no trouble whatever, nor did it crack from expansion.

Mr. E. C. Shawfield, in reply, said that if this fuel discussion had done nothing else, it had served a useful purpose in bringing out from Mr. Ayton the particulars of that very interesting test which was practised by the Underground Electric Railways Co. of London. At the same time, he was rather surprised to find that so many central station engineers were doubtful as to the wisdom of making sure that the coal agent or coal owner was delivering what he was being paid for. With regard to the question of purchasing from colliery owners or agents, it was quite obvious that in Birmingham, Glasgow, Liverpool, or Manchester they could not possibly purchase the whole of their coal supply from one or even two or three collieries, but comparatively small stations such as his own would find no difficulty whatever in making contracts direct with collieries so far as the question of quantity was concerned. Mr. Faraday Proctor had raised a rather interesting point on the wages clause. This merely represented the best terms that he could secure from the particular colliery, and as the wages in the Federated area were controlled by the Coal Owners' Association, he hardly thought that the wages would be raised through the entire area of Great Britain on his account. Replying to Mr. Hoadley and others, he said that he had tested coal regularly for nearly ten years, and had found, although there might be a personal difference up to 5 per cent. in the results of two observers, any one person should be able to reproduce his own result within 1 or 1¼ per cent.

STREET AND SHOP FRONT LIGHTING.

Mr. A. H. Seabrook (Marylebone Borough Council), who opened a discussion on this subject, said he proposed to leave the first part of the discussion to Mr. Haydn Harrison, the street-lighting expert. With regard to shop-front lighting, he would confine himself to the serious competition of high-pressure gas. In West Ham some years ago they attempted to deal with this proposition by bringing an inclusive hiring scheme of £2 1s. per 500-watt lamp per quarter, but the gas company had since been doing the same thing all over London, with the additional trouble that they had been cutting prices. He knew that on the basis of £2 1s. per quarter, including current, maintenance, supply of lamps, and depreciation in two years, it was a remunerative business. After the first two years, when they had written off the lamps, there was a very handsome surplus. He contrasted the rapid progress made in West Ham compared with East Ham, in spite of the lower charge per lamp in the latter district, and attributed it to the absence of an efficient business-getting department in East Ham. It was more expensive to cut their prices to ridiculously low figures than to employ an efficient business-getting department to look after the consumers and maintain prices. In Marylebone they had to charge considerably more than £2 1s. per lamp per quarter. At 3½d. per unit it was possible to supply a series of four arc lamps giving a total of 10,000 to 11,000

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c.p. at a cost to the shopkeeper of 2d. per hour per lamp, or a total cost per year for 900 burning hours of £30, *i.e.*, £7 10s. per lamp, inclusive of everything except hire of the installation and wiring. To give the same amount of light it would be necessary to install at least 10 high-pressure gas lamps, which at 30s. per quarter would give a total cost of £60 per annum. The gas people in London generally averaged about 30s. per quarter for a 1,000 c.p. high-pressure gas lamp, although sometimes the charge was as low as 25s., or even 20s. A most useful lamp had recently been put upon the market, viz., a 4½-ampere direct-current flame lamp, which would enable them to cut their costs considerably, and to put in a flame arc lamp of more nearly the equivalent candle-power of the gas lamps. These gave a candle-power of roughly 1,200. At 3½d. per unit they could be trimmed, supplied with current and carbons, maintained and kept clean at a total cost not exceeding 1·35d. per hour, which cost £5 per 1,200 c.p. lamp for a use of 900 hours per annum, against £6 for 1,000 total c.p. of high-pressure gas. From some years' experience in the cost of maintaining lamps, each 450 to 500-watt lamp at 3½d. per unit cost 1·4d. per hour for current, and for carbons, including wastages, breakages, &c., 0·3d. These figures were based on 100 lamps or more. Trimming and cleaning was 0·17d.; establishment, supervision, and repairs, 0·13d., making a total of 2d. per hour for 2,300 c.p., burning for 900 hours a year, and not including hire of lamps and installation. For the 4½-ampere lamp, with current at 3½d. per unit, the cost of current was 0·19d. per hour; carbons, 0·24d.; trimming and cleaning, 0·17d.; establishment, supervision, repairs, and incidentals, 0·15d., making a total of 1·35d. per hour. In these figures no allowance was made for current wasted in line resistance, because in modern lamps they did not want these. Mr. Haydn Harrison had told him what he was going to say in one direction upon street lighting. Mr. Harrison had evidently in mind the joint arrangement between the gas company and the electric supply companies for the lighting of Holborn, and intended to suggest that electric supply authorities should keep up their shop lighting and private lighting prices by some similar co-operation. He himself was absolutely against anything of the sort; he preferred to keep his opponent where he could see him, and had no sympathy with the sloppy, imbecile amiability with which a lot of people were inclined to regard their opponents. The gas companies' business-getting departments were superior, and electrical engineers were not sufficiently equal with their competitors to be able to play fast and loose, or give them an inch in any way. In the present position it was safer to keep them at arm's length.

Mr. HAYDN HARRISON said that providing conditions were equal at the start, *i.e.*, if a town were being laid out with electric light and gas lighting, and mains were being laid for both, electric light could give an equally good light in the streets at a very much lower cost. But when the streets had been lighted by gas for a considerable time from the start, without any competition, and at the gas company's own prices, and they had paid off practically every pennyworth of capital in connection with it, it was more difficult for electric light to compete now, especially as in many cases loans had been refused, and the work had to be carried on out of revenue, and the whole cost was being repaid in five years. In spite of this, however, they had still been able to put in prices for equal lighting equal to those for gas. In Marylebone, for instance, but for this they could have given 50 per cent. better illumination than at present for the same charge. The loans in Marylebone, however, would soon be repaid, and the lighting there would soon be cheaper than in any other district in London for the same illuminating value. Mr. Harrison then explained the position with regard to the street lighting in Westminster. He pointed out that half the streets were lighted by electric light still. There were long contracts running with two of the electric light companies, but the third company had had a short contract, which terminated at the same time as the gas company's contract. The recent successful tender of the gas company had not been for the whole of the lighting of the Westminster district, but for the lighting of that part which was already carried out by gas, and also for a small part which was lighted by seventy arc lamps. The electric lighting companies in London found that they could not allow this sort of thing to occur again. For the public lighting of the Borough of Holborn, in the first place, the gas company alone were asked to send in a price. Then it was suggested in council that the electric lighting companies ought to be allowed to tender, and they had put in a price, on the same specification, which was considerably below the gas company's. But the Council were still not satisfied; a new specification was drawn up, and the two companies were asked to tender again. The conditions were so onerous, however, that the managers of the electric lighting and gas companies came together and decided to submit a joint tender to carry out the street lighting between them, practically dividing the work between the two. They also said that if all these onerous conditions were to be maintained, such as the penalties for the light being below a certain standard, &c., they would be perfectly prepared to accept them, but they would want an extra 10 per cent. per annum. The result was that now that particular Council was going to pay to the electric lighting company and the gas company a sum per annum for the lighting of the streets of Holborn greater than the price originally tendered for gas, but which was remunerative to both companies. The work in front of both parties, he contended, was sufficient for them to look forward to being able to make arrangements by which they each took on the particular work for which they were particularly suited, at prices which would be remunerative. The most efficient grouping of lamps was of the greatest importance. A committee had been formed by the Institution of Electrical Engineers, which included surveyors, representatives of the Gas Association, and the Illuminating Engineering Society, and this committee was formulating a standard specification for public lighting, and it was nearly certain to be based on minimum illumination. Leaving out the most important streets, such as some of the main streets in London, where the illumination in the City had been got up to 0·8 candle-feet, he had found it most economical to employ units between 100 c.p. and 500 c.p. For the smaller streets, where the illumination was down to 0·002 or 0·001 candle-feet, 100 watt lamps placed in the existing lamp-posts or placed the same distances apart gave by far the most economical result. The next unit above that was probably 200 to 300 c.p., and that could be obtained equally well by still using 100 watt lamps with high efficiency reflectors, and the same thing applied up to 600 or 700 c.p. It would be found, with the usual rates of 1½d. or 1d. per unit for public lighting, plus all the incidental charges of maintenance and so on, that the prices would come out very nearly equal to high pressure gas, excluding the question of capital charges.

Mr. J. R. DICK (Lucy & Co.) did not recommend the employment of metal filament lamps in existing street gas lanterns, which, he said, militated against bringing street electric lighting to the notice of the passer-by. At the present time it was possible to purchase a fitting with an efficient diffusion at practically the same cost as the price of a simple conversion fitting, and they could purchase a good-looking design of lamp-post and suitable bracket at a figure which did not exceed 30s. to 35s. There was one great hindrance in municipal working to the extension of public lighting, and that was the curious antipathy of the Local Government Board to the granting of loans for street lighting fittings. It would be desirable that the Association should make representations to the Local Government Board to remove this extraordinary bias on their part. There was a good field for the extension of automatic lighting and extinguishing, but the time switches now in use were too dear. If they could get a good reliable time switch at about 20s. or 22s., the case for automatic control would be very strong. Mr. Dick concluded with some remarks on the design of fittings, pointing out that they must satisfy the eye of the man in the street as well as the photometer.

Mr. S. J. WATSON (Bury) dealt with the question of street lighting from the point of view of those places where arc lamps of the old patterns are now in use, and the suitability or otherwise of changing them to suitable groups of metallic filament lamps. In Bury they had some thirty open type arc lamps in use, and as they were getting somewhat old and dilapidated, they replaced them, after making considerable experiments with different types of lamps and fittings, with groups of three metal filament lamps, each of about 300 c.p. (in some cases 200 c.p.). Much to his surprise, he found that three 300 c.p. lamps, spaced about 70 yards apart, gave an equal illumination on the street to one of the latest type of flame arc lamps. The lamps were fitted in many instances to brackets on the tramway poles, and they had experienced no difficulties through vibration. The cost of altering these old lamps to metal filament lamps in groups was comparatively small. The fitting he had adopted was a conical open shade inverted, with three lamps arranged inside, and the lamp-holders were sunk in the fitting so that only the globe of the lamp itself projected. The fittings were not enclosed, as he considered that there was no necessity for an extra covering of glass. The annual sum paid per arc lamp was £11 10s., and he charged the same amount for these groups of metal filament lamps.

Mr. A. C. CRAMB (Croydon) was in general agreement with Mr. Seabrook. The competition of high pressure gas for outside private shops, he said, was getting a very serious matter in London and the surrounding districts. The pipes were run up outside the shop to the lantern, so that the whole of the installation could be under the control of the gas company. They offered the shopkeeper to guarantee the light and take all responsibility and trouble off his shoulders for an inclusive charge —usually £5 per 1,000 c.p. lamp. He was told in every case that if the electric light people would supply the lamps, clean, repair, and maintain them, and take the worry off their shoulders, the shopkeepers would have electric light, as they preferred it to high pressure gas. He had lost several consumers for this reason; if he had only had powers to wire premises he could have kept every one. If they had proper hiring and wiring powers they need not be afraid of gas competition, especially if they had a proper sales department to look after consumers, and, in fact, they could get £1 per lamp per annum more than the gas people if they had a proper business organisation. The gas companies were not making a big profit on this outside lighting, but they just wanted to knock the arc lamp out. Electric supply undertakings could not compete in this way if they had to employ contractors and pay them their 10 per cent. profit. They must have power to do wiring; the present position might satisfy some, but it did not satisfy him.

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Councillor CROWTHER (Vice-Chairman of the Sheffield Electricity Committee) strongly disagreed with what the President had said on the previous day as to the desirability of putting the whole of the wiring into the hands of private contractors. He had not the slightest animus against the contractor, but he was of the opinion that electric light undertakings ought to have exactly the same freedom of wiring premises and dealing with consumers as the private contractor and the gas company had.

Mr. A. H. SEABROOK, in the course of a brief reply to the discussion, said that it was a curious thing that a large number of undertakings which had surpluses and renewals and reserve funds and were contributing to the rates were at the same time trying to raise loans for things which they had far better pay for out of revenue. He thought Mr. Watson's idea of changing over their arc lamps to groups of metal filament lamps was a very good idea, for instead of giving away a lot of money to the carbon makers they kept it for themselves, as they got a bigger revenue from the sale of current.

THE DINNER.

The annual dinner of the Association was held in the Banqueting Rooms of the Dome Pavilion, and was exceptionally well attended. A new feature was the presence of ladies. The toast of the Brighton Corporation, proposed by Mr. G. Wilkinson, of Harrogate, was responded to by the Mayor of Brighton, Mr. C. Thomas Stanford, M.A. Alderman E. Geere, the Deputy-Mayor of Brighton, proposed the Association, which was acknowledged by the President, Mr. Christie. The toast of "Our Guests," including the ladies, was allotted to Mr. C. E. C. Shawfield, and was replied to by Mr. S. Z. de Ferranti, President of the Institution of Electrical Engineers.

Mr. FERRANTI said that although, as they knew, he objected broadly to municipal trading, yet as municipal trading was an accomplished fact he held strongly that it should have every facility to make it as successful as with the best commercial institutions. Nothing should be withheld from it which any private enterprise dealing with a similar business would be allowed to enjoy. He hoped that the Institution of Electrical Engineers and the I.M.E.A. would work closely together to get whatever concessions and rights were necessary to further and prosper their business. He also hoped to extend the scope of the Institution, so that it would be a place, not only for technical men, but for all interested in the business of electricity.

THE ANNUAL GENERAL MEETING.

The annual meeting was held at the Royal Pavilion at 10 a.m. on Friday, June 30th, Mr. Christie being in the chair. The first business was the election of officers, and filling the vacancies on the Council. The ballot resulted as follows:—

PRESIDENT: G. Wilkinson (Harrogate).
VICE-PRESIDENTS: C. E. C. Shawfield (Wolverhampton) (*Senior*), R. A. Chattock (Birmingham) (*Junior*).
PAST PRESIDENTS: S. L. Pearce (Manchester), W. W. Lackie (Glasgow), J. Christie (Brighton).
HON. SOLICITOR: Alderman G. Pearson (Bristol).
HON. TREASURER: J. E. Edgcome (Kingston-on-Thames).
HON. SECRETARY: H. Faraday Proctor (Bristol).
COUNCIL: A. C. Cramb* (Croydon), F. Ayton* (Ipswich), W. Wyld* (Birkenhead), H. Richardson* (Dundee), F. M. Long* (Norwich), Councillor Rowntree* (Harrogate), Councillor Crowther* (Sheffield), Bailie Willock* (Glasgow), Alderman Bruce (Sunderland), Councillor German (Brighton), A. H. Seabrook (Marylebone), Alderman C. West (Coventry), S. J. Watson (Bury), C. Furness (Blackpool).

New members of Council and those re-elected are marked with an asterisk. Mr. A. C. Cramb (Croydon), Mr. F. M. Long (Norwich), Mr. H. Richardson (Dundee), Alderman Sinclair (Swansea), Alderman J. P. Smith (Barrow-in-Furness), Bailie Willock (Glasgow), and T. P. Wilmshurst (Derby) retired from the Council in the ordinary course, whilst a further vacancy was created by the election of Mr. R. A. Chattock as junior Vice-President.

It was the general wish of the meeting that next year's Convention should be held in Harrogate, if the necessary arrangements can be made.

REPORT OF THE COUNCIL.

The following were the principal points dealt with:—

Joint Publicity Committee.—Two representatives of the Association, Messrs. Christie and Ayton, have been appointed as members of the Joint Publicity Committee, in addition to two members of the Council already members of such Committee on a different representation, Messrs. Cramb and Seabrook.

Wiring Rules.—The Association has been represented upon the E. E. Wiring Rules Committee by Mr. Christie and Mr. Edgcome, in addition to Mr. Pearce, who was appointed a member of the Committee by the Institution, and the Council have carefully considered and approved of the amended rules.

Travelling Studentship.—Two papers were received from Associates for the Travelling Studentship, and the Council have awarded the first place to the Paper on "The Motor Meter as Applied to the Measurement of Single-phase Alternating Current," by Mr. V. F. Bush, of Tunbridge Wells. The subject of the other Paper was "Steam Power Generation: the Advantages of Mechanical Draught," by Mr. J. R. Campbell Murray, of Motherwell, who has been awarded a special premium of two guineas.

Charges for Current for Traction Purposes from Combined Stations.—Messrs. S. L. Pearce (Manchester) and T. Roles (Bradford), on behalf of the Association, have held a large number of meetings with the representatives of the Municipal Tramways Association, Messrs. J. M. McElroy (Manchester) and C. J. Spencer (Bradford), and a comprehensive and valuable report is now being dealt with by a committee of the Council, previously to consideration by a joint Committee of the two Associations.



MR. GEORGE WILKINSON.
(Borough Electrical Engineer, Harrogate).
THE NEW PRESIDENT.

Engineering Standards Committee—Lamp Standard Sub-Committee.—This sub-committee has recognised that the ordinary standard bayonet socket lamp-holder is not well adapted for use with radiator lamps taking 250 watts at 100 volts, due to failure of the springs and contacts. The Committee are therefore making further investigations in this direction, and it is hoped that the result will be the production of a lamp-holder which can be used with uniform satisfaction with currents up to $2\frac{1}{2}$ amps.

Standard Specifications.—The Institution of Electrical Engineers have been engaged for some time past in revising the form of model general conditions recommended for use in connection with contracts for plant, mains and apparatus for electricity works. The Council are strongly against a clause, often found in municipal contracts, appointing the engineer of the local authority as sole arbitrator in cases of dispute.

General.—The membership shows a slight falling-off, due partly to the unusual number of engineers leaving municipal employ, but traceable also to the action of the Local Government Board in disallowing subscriptions paid to the Association by local authorities. This is a matter which the Council has under consideration. Other matters which the Council are dealing with include the suggestion for the establishment of an information bureau and the desirability or otherwise of enlarging the Council with a view of securing wider representation of the smaller undertakings. The Council and its Committees have held more meetings than usual, and are still dealing with several matters of importance, in connection with which it is deemed inexpedient at the moment to report progress.

Before the report was discussed, the student's premium was presented to Mr. V. F. Bush.

A long discussion took place upon what action the Council is taking in regard to municipal wiring powers, which the Press was requested not to report. Subsequently Mr. A. H. Shaw (Ilford) asked when the report upon current for traction purposes might be expected. Mr. S. L. Pearce said it was quite impossible to say, as the Joint Committee had only met once since the preparation of the draft report, and so far they were only one-third through the draft. A suggestion was made by Mr. W. G. Pickvance (Chief Electrical Engineer, Wrexham) that there should be included on the Council three engineer members and one Councillor representing stations up to and including 1,000 kw., and one engineer member and one Councillor representing stations from 1,000 kw. to 2,500 kw. On the suggestion of Councillor Crowther, of Sheffield, the matter was referred to the Council for consideration.

Votes of thanks to the Brighton Corporation, the President, and to the honorary officers of the Association closed the meeting.

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LOCAL NOTES

Aberdeen: *Tramway Extensions.*—The question of tramway extensions has been deferred pending reports on the working of the railless systems in Leeds and Bradford.

Accrington: *Tramway Assessment.*—The result of the arbitration concerning the tramway rating is that the tramways, which have been previously assessed at £800, and were valued by the Union valuer provisionally at £1,650, are to be assessed at £2,548. The Corporation contended that the figure should have been £650.

Australia: *Newcastle.*—In consequence of an unfavourable report by an independent expert, Mr. J. E. Donoghue, on the electricity undertaking, stating that the steam piping in the station was defective and that the arrangement of the high tension feeders was dangerous, the City Electrical Engineer, Mr. Prydon, has resigned. The post is now vacant at a salary of £350 per annum, and Mr. Donoghue has been appointed Consulting Engineer.

Bedford: *Coronation Illuminations.*—Elaborate illuminations of the Town Hall and river were carried out under supervision of Mr. R. W. L. Phillips, Borough Electrical Engineer. The installation is to remain up all the summer, and will be lighted up on special gala nights.

Belfast: *Electricity Accounts.*—The net profit on the undertaking is reported to be £13,766, of which £5,000 is to be devoted to relief of rates.

Birmingham: *Tramways.*—The cable tramways to Handsworth and King's Norton have been taken over by the Corporation. The electrical equipment is already completed, and the existing track which has been provided will be used temporarily.

Bradford: *Electricity Accounts.*—The year shows a surplus of £8,980 against £7,399 for the previous year; the income was increased by £4,117 and the expenditure by £2,537.

Croydon: *Tramway Accounts.*—There was a net profit of £8,458 from the working of the Corporation tramways last year, of which £4,800 has been transferred to relief of rates, and the balance to renewals fund. The number of passengers carried, 19,476,576, is an increase of 770,972 over the previous year. Chamberlain and Hookham meters have been fitted to all the cars, and Mr. T. B. Goodyer, the tramway manager, reports a saving of 24·77 per cent. in current consumption since the meters were installed, or £4,984 18s. The tramway employees' sports will be held at the Brighton Railway Athletic Club's ground on Wednesday, July 26th, at 2.30 p.m.

East Kent: *Light Railway.*—The Board of Trade have confirmed the East Kent Light Railways Order authorising railways from Sheperdswell to Sandwich Haven, with branches from Eythorne to Coldred and to Tilmanstone, and from Eastry to Wingham.

Edinburgh: *Railless Traction.*—The Burgh Engineer has been deputed to visit Bradford and Leeds to report on the working of the trolley omnibuses.

Glasgow: *Tramway Accounts.*—The total income for the year ended August 31st was £949,488 and the receipts £533,179. Of the balance, after rental of leased lines, &c., and capital charges had been met, a net profit of £68,678 remained, which is handed over to the "Common Good" against £53,028 for the previous year. The revenue per car mile averages 10·461d.

Guildford: *Lighting of Workhouse.*—Mr. Lankester Burne is to be retained to advise the Board of Guardians on the question of electric light at the Workhouse.

Hull: *Electricity Accounts.*—A larger profit than has previously been made is reported for the last year, amounting to £8,223 after meeting capital charges. The total revenue was £61,439, and the expense £28,687, and the working costs averaged 0·88d. per unit.

Kendal: *Electricity Accounts.*—A deficit of £568 is reported on the electricity undertaking. The total output was 88,131 units, and total costs averaged 2·87d. per unit.

Leeds: *Tramways.*— A large site is being secured for extension to the tramway department.

London: *Hackney Tramways.*—The Borough Council have approved of the proposals of the L.C.C. for the conversion to electric traction of the tramways in Dalston Lane and Graham Road.

Manchester: *Tramways.*—The annual report of the tramways gives the total mileage as over 182 miles of track. The receipts for the year were £799,079 and the expenses £519,142. After meeting capital charges and placing £86,249 to reserve, renewals and depreciation, £75,000 has been handed over to relief of rates. The traffic revenue averaged 11·043d. and the working expenses 7·174d. per car mile.

New Zealand: *Water Power.*—The first steps towards harnessing the Waira Falls for the generation of electricity are about to be taken. A survey party is presently engaged in defining the line between Kaikhoe and Horeke, and is to continue the work between the Falls and Whangerie and the Falls and Dargaville. The Government has made a grant to cover the survey.

Plymouth: *Tramways.*—A profit of £1,377 has been made as compared with £953 for last year.

Wood Green: *Electricity Supply.*—The Council have finally rejected the scheme of the North Metropolitan Electric Power Supply Co. for a bulk supply.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Broxburn.—An application for a loan of £2,000 for extension has been granted.

Dublin.—The Electric Lighting Committee has received sanction of the Local Government Board for a loan of £50,000 for an extension of the Electricity Works.

Eccles.—A loan of £3,294 for extensions has been sanctioned by the Local Government Board.

Gloucester.—A Local Government Board inquiry has been held into a loan of £14,000 for extensions.

Govan.—Tenders are invited by August 1st for H.T. switchboard extensions. Particulars from Burgh Electrical Engineer.

Jerusalem.—The time for tenders for electric tramways, etc, has been extended to September 3rd. Turkish Ministry of Public Works, Constantinople.

London: *Bermondsey.*—Extensions to the value of £18,563, including boilers, generating plant and condensers, with extensions to the boiler house, are under consideration.

Hornsey.—A Local Government Board inquiry was held last Thursday respecting an application for a loan of £9,600 for extensions to the generating station. There was no opposition.

Poplar.—Tenders are required by July 15th for coal handling plant. (See an advertisement.)

Shoreditch.—The L.C.C. have approved the grant of a loan of £11,236 for mains and house services.

York.—Tramway extensions are contemplated at a cost of about £17,000.

WIRING

London.—The L.C.C. invite tenders for the electric lighting of the trade school for girls, Belvedere Place, Borough. (See an advertisement on another page.)

Marylebone.—Municipal buildings.

St. John's Wood.—New fire station.

Wandsworth.—Church and parish hall, Garrett Lane.

PROVINCES.

Andover.—Isolation hospital.

Axminster.—New cottage hospital.

Brecon.—Two schools. Surveyor, County Hall.

Bristol.—Extension to workhouse.

Cardiff.—Electric theatre, Union Street. A. Phillips.

Edinburgh.—New training college.

Enfield.—Public library, Council offices.

Hinckley.—New workhouse infirmary.

Hull.—Rebuilding Town Hall.

Hyde.—Extensions of municipal buildings.

Leeds.—Hostel for women students, Leeds Training College. J. Graham, Secretary, Education Department, Calverly Street.



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Nottingham.—New Veterans and Union Jack Club, Earlton Road. Architect, A. Marshall, King Street.
Plymouth.—Two new churches at Old Taira Road and Alvington Street, Cattedown.
Portsmouth.—Extension to infirmary.
St. Helens.—New schools.
Sunderland.—Additions to Bede Collegiate School.
Torquay.—New municipal buildings and pavilion.

TENDERS RECEIVED AND ACCEPTED

Ashton-under-Lyne.—Venner & Co. have received the contract for meters over 10 amperes.
Barnstaple.—The tender of the D. P. Battery Co. (£1,370) for a battery at the electricity works has been accepted.
Blackpool.—Two single-deck open cars are to be purchased from the United Electric Car Co., of Preston.
Haslingden.—The tender of Siemens Brothers & Co. for light and power cables has been accepted.
London.—The tender of Dick, Kerr & Co. (£2,093) for overhead equipment of L.C.C. tramways from Brixton to Herne Hill has been accepted. The tender of the British Westinghouse Co. for checking meters for the Greenwich power station (£113) has been accepted.
Norwich.—334 new time switches have been ordered from Venner & Co., bringing up the total in use to 400.
Rugby.—The tender of the British Thomson-Houston Co. for feeder equipment and rearrangement of switchboard has been accepted.
Stoke-on-Trent.—The tender of the British Westinghouse Co. for switchgear (£6,651) has been accepted.
Worthing.—The tender of Mirrlees, Bickerton & Day for additional plant (Diesel engines) at £3,965 has been accepted.

APPOINTMENTS AND PERSONAL NOTES

Mr. A. J. Hutchinson, engineer and manager, Farnworth Electricity Works, has been presented with a marble timepiece by the staff on the occasion of his marriage.

The salary of Mr. C. Till, Sales Engineer, Hackney (£150) is to have added to it a commission of 2½ per cent. per annum on all sales in excess of £4,000.

A clerk in the sales department of the Hackney Electricity Works is required at a salary of £100 per annum, rising to £150.

A meter tester is required at Stoke-on-Trent. (See an advertisement on another page.)

Osram Lamps by Aerial Transport.—An interesting and novel experiment was carried out on Tuesday. The General Electric Co. sent a consignment of Osram lamps from Worthing to Messrs. Page & Miles, Ltd., of Brighton, by means of a "Valkyrie" monoplane. The flight, which was to have been carried out on the previous Thursday in honour of the I.M.E.A. Convention, but had to be postponed on account of the wind, was made on Tuesday with conspicuous success, and a perfect descent was effected at 8 o'clock in the Hove Marine Park (by arrangement with the Corporation); a messenger with a cart awaited the arrival of the flying machine, and immediately conveyed the case of Osram lamps to its ultimate destination. This we believe is the first time that aerial transport of merchandise has ever been attempted. A crowd of over 5,000 people had quickly gathered at the Park upon learning the news, and heartily cheered the aviator, Mr. H. Barber. Mr. Barber, who is an amateur, proposes to give any proceeds from the display to a prize fund. The feat is all the more meritorious when it is realised that the enclosure is only a very small one, measuring a little over 250 paces from corner to corner. We understand that none of the lamps were broken during transit, and, in fact, all the filaments were intact.

Electricity in Agriculture.—Mr. Emilio Olsson, of Buenos Aires, writing from 19 Southampton Buildings, London, W.C., sends us a pamphlet in which he gives some general notes of a method of applying "electrified" water in the form of "artificial rain" with the object of increasing the production of crops from an area under cultivation. It appears that the water to be employed is placed in an iron tank through which a current is passed, using the tank as the anode and a copper wire as the cathode. This, it is claimed, reduces the hardness by precipitating the calcium salts. An arrangement of sprinklers is employed to produce the "artificial rain." In an experiment described, the current employed was 0·5 ampere at 110 volts, and it was passed through the tank for half an hour, but as the size of the tank is not given in the report, no useful deductions as to the cost of application of the method can be made. It is also stated that the treatment prevents ravages by locusts, but no explanation of this is given.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic copper bars c.i.f. port of arrival, quoted on Tuesday night, was £58 10s. to £59 (last week £58 15s. to £59 5s.)

Patent for Sale.—A patent for a device of starting and cutting out electric motors is for sale. (See an advertisement on another page.)

Change of Address.—Messrs. Marsh, Son & Co., Ltd., manufacturers of and dealers in electrical supplies, have removed from 15 Gerrard Street to 167 and 169 Wardour Street, London, W. Messrs. C. H. Davies & Co., of Francis Street, Birmingham, are moving to 153 Bracebridge Street, which will be their address on and after Monday next.

Bankruptcies, Liquidations, &c.—T. C. Thomas, Electrical Engineer, of 66 Liverpool Road, Stoke-on-Trent, has been adjudicated bankrupt.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Chilian Electric Tramways & Light.—The report states that a dividend of 6 per cent. is declared on the preference shares, with £11,553 carried forward. The business shows satisfactory increase, notwithstanding some labour troubles, and new rolling stock is on order.

Mexican Light & Power.—A dividend of 1 per cent. is declared, payable July 15th.

National Telephone.—The directors recommend a dividend at the rate of 6 per cent. on the deferred stock for the half-year, carrying £200,000 to reserve and £18,000 forward.

Madras Electricity Supply.—The report for the first complete year's working of the generating station records a gross profit of £28, and, after payment of interest, &c., a final deficit on the year of £1,041, which is carried to suspense account.

Chile Telephone.—A final dividend of 4s. per share is recommended, with £3,225 carried forward.

General Electric Co.—The report for the year to March 31st, 1911, shows a net trading profit of £119,146, in addition to £8,919 brought forward. A dividend at the rate of 5 per cent. for the year is recommended on the ordinary shares, £43,615 are transferred to reserve, and £7,431 appropriated for managing-directors' and employees' bonus; carry forward, £12,214. The reserve fund stands at £202,103, and out of this it has been decided to write down goodwill and patents by £92,103.

Edmundson's Electricity Corporation.—The report gives the net profit for the year, after payment of debenture interest, &c., as £16,138, compared with £10,768 for the previous year. Including the amount brought forward from last year, £41,715 is available, which the directors recommend should be carried forward.

Electric Railway in the Pyrenees.—The new electric mountain railway from Mont Louis in France to Puigcerda in Spain, across the Pyrenees, was opened for traffic on Wednesday of last week.

GENUINE
M & M VULCANISED FIBRE.
MOSSES & MITCHELL, 122 & 124, GOLDEN LANE, LONDON, E.C.

STERLING
TELEPHONES
RELIABLE BRITISH MANUFACTURE
The Sterling Telephone & Electric Co., Ltd.
200, Upper Thames St., London, E.C.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published July 6, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

16,017/10. **Power Handle for Controllers.** W. R. SHAW and G. H. GREEN. An improved detachable power handle for electric controllers is described in this patent. It comprises a detachable casting with an elliptical bored hole having a neat sliding fit on a casting, which is permanently fixed to the controller handle, and carries an elliptical boss, so shaped to take the detachable casting. The action of the two-part power handle is such that on each cylinder spindle a permanent casting is fixed, and takes the wear, which is distributed over the whole surface of the elliptical boss when the detachable and fixed castings are in contact. The cylinder is then ready to be rotated on either the power or brake sides of the controller. Three figures.

21,157/10. **Arc Lamp Electrodes.** THE GILBERT ARC LAMP Co. and A. T. DOWDELL. In an arc lamp using two or more pairs of electrodes, the deposit due to the burning of the first pair frequently completely insulates the other pairs, so that the electrical and mechanical pressure is not sufficient to break down this insulation. An addition is therefore made to the tips of the second and subsequent pairs of electrodes of a suitable point or cutting edge of metal, which will cut through any insulating deposit left by the previous pair, and so secure the initial lighting up of the others to follow. Nine figures.

24,216/10. **Electric Lamp Cap.** F. C. MAYES. This invention has for its object to prevent the breaking of filaments in incandescent lamps, and consists of a flat, coiled spring fixed at its centre to the fixed brass cap for holding the lamp bulb, the two being secured in an auxiliary lamp cap. Two guide and lock pins are fitted to the brass cap, which ride in two slots in the lamp cap, when fixing into a lamp holder. The lamp being so fitted with suspension means within a loose auxiliary cap, enables it to oscillate freely in every direction without vibrating the filament. Two figures.

29,700/10. **Lamp Regulator.** E. H. SMITH and E. A. KAATZ. Provision is here made in a regulating device, for adjusting the brilliancy of incandescent lamps. A plug, which can be connected to an electric circuit, has a lamp socket mounted on it, and a rotatable, hollow, ventilated rheostat ring is mounted on the socket. The ring consists of an inner cylinder wall of insulating material, and an outer casing with apertures. A single coil of wire encircles a number of contact plates and the inner wall, but is insulated from the contacts, which are electrically connected at intervals with the coil, and a spring contact mounted on the plug is arranged to be brought successively into contact with the plates by the rotation of the ring. Seven figures.

3,251/11. **Electric Furnace.** H. PAULING. It is well known that when treating gases with electricity it is desirable to reduce the loss of heat by radiation to a minimum, and for this purpose the flames have been kept close to the furnace walls. If this is carried too far the furnace walls get too hot, and become conductors of electricity with the electrical pressure usually employed. In the present case this is obviated by subdividing the inside surface of the furnace wall into separate areas by channels, which penetrate to such a depth that the wall cannot act as a conductor when heated by the electric flame. Four figures.

3,747/11. **Supports for Overhead Conductors.** H. SEFTON JONES (*Oesterreichische Daimler-Motoren-Ges.*). This patent deals with the suspension and tension of the wires in a railless traction system. The conductors are suspended on U-shaped supports, one limb being surrounded with an insulated layer and provided with a head-piece, placed in a screwed-in protected bell, to prevent it from slipping out, the whole being fixed to the stirrup; the other limb is bent upwards to support the conductor. A special stirrup is designed for bends, one side being provided with a projecting arm in which there are several holes, for a tension wire to be connected, so that an inclined pull can be obtained at bends, making it possible to lay one conductor somewhat higher than the other, and so preventing the trolley from slipping off. Three figures.

Application for Restoration of Lapsed Patents

13,746/03. **Electrically Operated Signals.** S. M. YOUNG. An application has been made for the restoration of this patent, which expired due to the non-payment of renewal fees. The specification covers certain improved methods for operating signals on electric railways.

7,320/07. **Improvements in Arc Furnaces.** SALTPETERSÄURE INDUSTRIE-GESELLSCHAFT G.M.B.H. have made an application for the restoration of the above patent, which expired owing to the non-payment of the renewal fee. It relates to improvements in arc furnaces for the electrical treatment of gases.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: BRITISH THOMSON-HOUSTON Co. (*General Electric Co.*) [Electric insulating material] 13,946/10; STANILAND [Terminals for wires and cables] 14,045/10.

Dynamos, Motors, and Transformers: PRICE [Electrical machines] 14,499/10; PARSONS and LAW [Dynamo-electric machinery] 14,680/10; BUCHER [Rotary motors] 4,243/11.

Electrometallurgy and Electrochemistry: MARKS (*Langbein-Pfanhauser-Werke Akt.-Ges.*) [Manufacture of detachable electrolytic iron deposits] 25,092/10.

Heating and Cooking: SERPEK [Revolving electrical furnaces] 29,299/10; WILKINSON [Resistances] 14,912/10.

Incandescent Lamps: SPECHT and BEIGE [Lamp holders for] 19,033/10; JONES [Hand signal lamps] 25,160/10.

Instruments and Meters: NORTH [A.C. electric meters] 15,170/10; LANDIS and GYR [Electricity meters] 1,056/11.

Storage Batteries: HARDY and HUNGERBUHLER [Separators for secondary batteries] 7,086/11.

Switchgear, Fuses, and Fittings: ADAMS MANUFACTURING Co. (*Cutler Hammer Manufacturing Co.*) [Controllers for motors] 14,946/10 and 14,956/10; HOPE [Switches] 25,923/10; WIMMER [Speed-controlling device for motor-driven sawing machines] 28,683/10; SIEMENS BROS. DYNAMO WORKS, LTD. and BOLTON [Switches] 2,594/11.

Telephony and Telegraphy: SIEMENS BROS. & Co. (*Siemens and Halske Akt.-Ges.* [Circuits for telephone exchanges] 14,196/10.

Miscellaneous: FRANZ MÉGUIN & Co. [Electro-magnetic apparatus for crushing machinery, &c.] 6,212/10; BILLITER [Electrolysis of liquids] 11,693/10; HARRIS [Apparatus for actuating bells] 12,047/10; LOMAX [Earthing devices] 14,057/10; HIRST and MAURICE [Electrically-illuminated letter signs] 14,349/10; CASTLE, RIDDIFORD, BIDWILL, and MCDERMOTT [Electric alarm systems] 14,383/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electrometallurgy, &c.: RODECK [Electro-deposition of metals] 13,808/11.

Heating and Cooking: SCHNEIDER [Electric heat-regulator] 11,548/11; SOC. ANON ELECTROMETALLURGIQUE (*Procedes Paul Girod*) [Triphase current supply to electric furnaces] 13,731/11.

Switchgear, &c.: DUNNING [Electric circuit control] 13,830/11. SIEMENS SCHUCKERTWERKE GES. [Speed regulation of polyphase series motors] 13,877/11.

Traction: ALLGEMEINE ELEKTRICITÄTS GES. [Railway signalling systems] 13,985/11.

Miscellaneous: SCHMIDT [Spark plugs] 13,524/11.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

16,405 of July 10th, 1897. **Telegraphy.** OLIVER J. LODGE and A. MUIRHEAD. This invention relates to the utilisation of Hertzian waves emitted by oppositely charged conductors, sparking into one another, for telegraphing without the aid of conductors, and consists of putting in the receiving circuit a siphon recorder as receiving instrument, a coherer in direct circuit with the recorder, and arranging that the current flowing in the receiving circuit shall, after an impulse in the coherer, bring about its decohesion, and restore it ready for another impulse.

16,651 of July 13th, 1897. **Electric Railway Signals and Points.** J. A. TIMMIS. In connection with his patents 5,718/83, 7,827/91, and 21,496/93, the last two dealing with the working of signals and points electrically and automatically, the author, in this invention, introduces a track circuit, so that the train itself can put signals to danger.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: C. E. FOSTER, E. R. GROTE, and M. V. ELY, 6,110/04.

Incandescent Lamps: W. NERNST, 6,135/98.

Switchgear, &c.: BRITISH THOMSON-HOUSTON Co. (*General Electric Co.*) [Switches] 6,006/06; [Electric resistances] 6,089/06 and 6,193/06.

Telephony, &c.: W. L. WISE (*J. H. Peirce*) [Telegraph systems] 5,944/02.

Traction: G. A. TRUBE and W. CHAPMAN [Tramway brakes] 6,295/02.

Miscellaneous: C. MILDÉ, A. COURTANT, E. MINVIELLE, and C. MILDÉ [Electric bells] 6,216/06.

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British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

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Beck Flame Lamp, Ltd., Suffolk House, Laurence Pountney Hill, E.C.
British Thomson-Houston Co., Ltd., Rugby.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.
Jandus Arc Lamp and Electric Co , Ltd., Hartham Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Union Electric Co., Ltd., Park Street, Southwark, S.E.

ARMATURE REPAIRS.
Marryat & Place, 28, Hatton Garden, E.C.

BOILERS.
Stirling Boiler Co., Ltd., 58, Victoria St., Westminster, S.W.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Rickard (Wm.), Ltd., Ashbourne Road Mills, Derby.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Willans & Robinson, Ltd., Rugby.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.
M.A.N. Co., Caxton House, Westminster, S.W.

GAUGES AND GAUGE GLASSES.
Tomey (Joseph) & Sons, Ltd., Catherine St., Aston, Birmingham.

HEATING AND COOKING APPARATUS.
Bastian Electric Heating Syndicate, Ltd., Palmerston House, Old Broad St., E.C.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87–89, Cleveland Street, W.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.

INSULATING MATERIAL.
Weidmann (H.), Rapperswil, Switzerland.

INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
The Fredk. Crane Chemical Co., 22 & 23, Newhall Hill, Birmingham.

LAMPS (Incandescent).
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Brush Electrical Engineering Co., Ltd., 1, Kingsway, W.C.
Cryselco, Ltd., Kempston Works, Bedford.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
Electrical Co., Ltd., 122/4, Charing Cross Rd., London, W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Krupka & Jacoby, 11, Queen Victoria St., E.C.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

METERS.
Aron Meter Co., Ltd., 80A, Salusbury Road, Kilburn, N.W.
Bastian Meter Co., Ltd., Kentish Town, N.W.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Co., Ltd., 122/4, Charing Cross Rd., London, W.C.
Ferranti, Ltd., Hollinwood, Lancs.

MINE EQUIPMENTS AND APPARATUS.
British-Thomson Houston Co . Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
Adnil Electric Co., Artillery Lane, London, E.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Electromoters, Ltd., Louisa St., Openshaw, Manchester.
General Electric Co., Ltd., 67, Queen Victoria St. E.C.
Ingleby & Co., Elland Road, Leeds.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Sons & Maxim, Ltd., Sheffield.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
Willans & Robinson, Ltd., Rugby.

STEAM CONSUMPTION RECORDERS.
Lea Recorder Co., 28, Deansgate, Manchester.

STEAM ENGINES AND TURBINES.
Belliss & Morcom, Ltd., Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
Vickers, Sons & Maxim, Ltd., Sheffield.
Willans & Robinson, Ltd., Rugby

SWITCHGEAR.
Adams Manufacturing Co., Ltd., 106, New Bond St., W.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Brown, Boveri & Co., Ltd., Caxton House, Westminster.
Electrical Apparatus Co., Ltd., Milford Works, Queen's Rd., Battersea, S.W.
Ellison (George), Warstone Lane, Birmingham.
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WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

The large new generating station which has been put down by the Newcastle-upon-Tyne Electric Supply Co. at Dunston-on-Tyne was inaugurated last week. The generating plant at present installed consists of two turbo-alternators giving up to 9,000 kw., and one up to 7,000 kw. The station has several interesting points of design, and the switchgear is contained in an entirely separate building. (Page 395.)

Among interesting exhibits at the Royal Agricultural Show at Norwich were the new two-stroke Diesel engine of Messrs. Willans & Robinson, and the Petter "semi-Diesel" engine. (Page 398.)

Our monthly article on new electrical supplies and accessories contains notes on two recent forms of arc lamp, a new current limiter, and a motor starter and speed regulator. (Page 399.)

An illustrated article describes the Brown-Boveri automatic voltage regulator, in which the multiple contact switches are rendered almost frictionless by an arrangement of rolling contacts. (Page 400.)

The Post Office has now agreed to take over the whole of the National Telephone Co.'s plant at the end of the year, including the 23 "condemned" exchanges, instead of leaving these and other parts of the plant on the Company's hands. The price paid will be determined having regard to the relative suitability of the plant under the new conditions. (Page 401.)

Two interesting communications have been received with regard to Diesel engines, replying to some of the points raised in the recent discussion. (Page 402.)

We are able this week to publish an illustration of the aeroplane by which the first aerial delivery of merchandise, in the shape of a package of Osram lamps, was made last week. (Page 404.)

Mr. Cridge, in some remarks on the recent discussion on shop-front lighting, instanced a case in Sheffield in which a leaflet was issued saying that the cost of running a flame arc lamp was 2d. an hour, and the Town Clerk had held that this constituted a contract so that the consumer was entitled to refuse to pay more. (Page 397.)

Some interesting statistics relating to the use of meters on tramcars have been collected by Mr. T. B. Goodyear, Tramways Manager, Croydon Corporation. (Page 404.)

Among the specifications published by the Patent Office last week was one covering a new insulating compound by the British Thomson-Houston Co. Mr. H. Hirst and Mr. G. Maurice have patented a form of electric sign, and a form of inverted rectifier patented by Mr. W. A. Price enables induction motors to run off continuous-current circuits. A specification by Sir C. A. Parsons and Mr. A. H. Law describes methods of securing end connections of turbo-generator armatures, and a locking device for isolating switches is protected by Siemens Brothers' Dynamo Works, Ltd. (Page 406.)

The Bradford Corporation contemplate extensions of their trolley omnibus system, and the Brighton and Sheffield Corporations have such lines under consideration.—Profits are reported from the Belfast, Birkenhead, Glasgow, Gloucester, Fulham, and Wolverhampton electrical undertakings for last year.—A scheme for supplying electrical energy for heating and cooking at 1d. per unit, through the electric lighting wires at Glasgow, is meeting with considerable success. (Page 407.)

Large extensions to the electricity works at Sheffield (£61,000) and Wolverhampton (£19,700) are contemplated. Bradford Corporation require water-tube boilers, superheaters, travelling crane, &c.; Southampton Corporation, motor generator and condenser; and the following extensions are also under consideration:—Aldershot, £2,500; Leigh (Lancs), £6,300; Torquay, £5,000; Turton, £4,500. Overhead mains are required at Barrow. (Page 407.)

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MARCONI'S Wireless Telegraph Co. propose to pay a dividend on the ordinary shares for 1910. A dividend at the rate of 1¾ per cent. per annum is recommended by the City & South London Railway, and 2½ per cent. by the Electric Construction Co. (Page 409.)

Tramways & Light Railways Congress.—The annual Congress of the Tramways and Light Railways Association will be held at the Carlton Hotel, Edinburgh, on Thursday and Friday, July 13th and 14th. On the first day, the following Papers will be read :—(1) "Transfer Fares," by C. W. Shepherd, General Manager, Edinburgh & District Tramways Co.; (2) "A Few Reasons why Electric Traction in England Remains Stationary," by G. H. J. Hooghwinkel. In the evening the chairman and directors of the Edinburgh & District Tramways Co. entertain the Association to dinner. On Friday, July 14th, two Papers will be read :—(1) "Notes on Tramway Problems," by C. W. Mallins, General Manager, Liverpool Corporation Tramways; (2) "Tramways and Light Railways Legislation of the Future," by Alderman W. Ivey, West Ham Corporation Tramways Committee. In the evening there will be a joint dinner with the members of the Royal and Imperial Automobile Clubs of England and Germany, at the Royal Hotel.

Parliamentary.—A House of Lords Committee has passed the Central London Railway Bill which provides for the construction of a short length of railway between the present terminus of the line at Wood Lane and the existing Great Western Railway at Wormwood Scrubbs. It is the intention to run a through service of trains between the Bank and stations on the Great Western Railway to Ealing.

The London County Council (Tramways and Improvement) Bill and the Metropolitan Electric Tramways Bill were read a second time in the House of Lords last week. The East Kent Electric Power Bill has been read a second time in the House of Lords, and the Nottinghamshire and Derbyshire Tramways and the South Lancashire Tramways Bills a third time.

The Brighton Corporation have been refused a *locus standi* to appear in opposition to the Bill of the Brighton, Preston and Hove Omnibus Company, which gives powers for the running of trolley omnibuses between Brighton and Rottingdean. The Bill has already passed the House of Commons. The Corporation, while prevented from opposing the Bill on preamble, may oppose on clauses in respect of the protection of their electricity and water mains.

METERS FOR TRAMCARS

AS stated on page 389 of our last issue, considerable success has attended the use of meters on the tramcars at Croydon, and a saving of 24·77 per cent. in current consumption representing nearly £5,000 per annum has been effected since their introduction. Mr. T. B. Goodyear (Tramways Manager, Croydon Corporation) has also issued an interesting analysis of information on this subject elicited by inquiries from the tramway undertakings throughout the country. Out of eighty-eight systems forty-two now have meters fitted to all cars, seventeen have them fitted to some cars, and of twenty-nine with no meters at present fitted, seven propose to adopt them. In fifteen cases, watt-hour meters are employed; in six cases, time meters; while the rest use ampere-hour meters. In thirty-four undertakings a definite saving in current consumption is reported, but in a number of cases the information is not available. The value of meters in the detection of faulty cars is endorsed by thirty-four tramway managers, while nine state that they do not find them serviceable in this way. The saving at Croydon is the largest recorded, and in addition to the reduction of units consumed per car mile, a saving of 26 per cent. in brake shoe costs is reported. In only one case mentioned, that of Southampton, have meters been abandoned.

Wireless Telegraph Notes.—It is reported that great success has attended the trials by the Royal Engineers near Dorking of a new receiving apparatus known as War Office Secret Patent No. 5.—Tests have been in progress on the Wannsee Lake, near Berlin, of an unmanned motor-boat controlled by wireless transmitting apparatus. Complicated evolutions were performed.

Telegraph Traffic.—There has recently been some trouble with the lines in Teheran, Bagdad and Bassorah, which were down for a short while. The Falmouth-Bilbao Cable of the Direct Spanish Telegraph Company, was restored on July 2nd. The Indo-European Telegraph Company had to repair some of their lines, but the interruption was not of long duration, and the same must be recorded of the lines between Rome and Constantinople.



The success of the Osram lamp Aeroplane Flight has led to other suggestions for new and effective advertising. One of these is the cinematograph film.

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THE DUNSTON POWER STATION OF NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO.

THE continued growth of the North East Coast power system, which now covers over 1,000 square miles and supplies some 150,000 horse-power, has necessitated the erection of a further large steam-driven power station at Dunston-on-Tyne, in addition to the principal generating station of the Newcastle-on-Tyne Electric Supply Co. at Carville, and the stations utilising waste heat from coke ovens, blowing engines, &c., at Blaydon, Newport, Weardale, Bankfoot, Bowden Close, and elsewhere. The Dunston station was formally inaugurated last week, although it has been practically complete for some time. Its construction was decided upon about three years ago. Although there was still spare land at Carville, it was considered better to put the next instalment of generating plant higher up the Tyne, partly in order to obtain in the neighbourhood of the station plenty of land for further new processes which are being attracted to the district as a result of the cheap price of electrical power, and partly for the sake of practically doubling the capacity of the cable network on both sides of the Tyne by having a station at each end. The site is directly opposite the western end of the Elswick works of Armstrong, Whitworth & Co., and the frontage to the Tyne is some 900 feet. Coal supplies are available from either the Durham or the Northumberland coal-fields, and condensing water is obtained from the river. The station is laid out so as to accommodate eventually six 8,000 kw. generating units, but the engine room has so far been built for four units, of which three are already installed. For every two units there will be a boiler house, or three boiler houses in all, of which one has so far been completed. On each side of each boiler house there are four boilers—three of which are capable of driving one generating unit at full load—or eight boilers per house, so that eventually there will be 24 boilers in the station. The general arrangement of the station can be seen from the section in Fig. 1.

The boiler house consists of a roomy basement, with ash bunkers under each boiler, only requiring to be cleared once in every twenty-four hours. The ashes are removed by trucks and electric lifts to a large overhead ash bunker, with a capacity equivalent to two to three days, over a railway siding. The boilers themselves are eight in number, of the marine water-tube type, manufactured by Messrs. Babcock & Wilcox, who were the main contractors for the boiler equipment. Each has 6,725 sq. ft. of heating surface, and a normal evaporative capacity of 30,000 lbs. per hour at a pressure of 200 lbs. per sq. in. They are grouped together in pairs, each boiler having its own superheater, of the return-tube type with 1,156 sq. ft. surface, and economiser, but the gases from each pair of boilers are dealt with by one separately driven induced draught fan and one chimney, both placed immediately over the corresponding boilers. The economisers have each 2,880 sq. ft. surface, and are arranged overhead in pairs; and down the centre of the boiler house there are placed extensive coal bunkers, which are capable of holding a week's supply of coal.

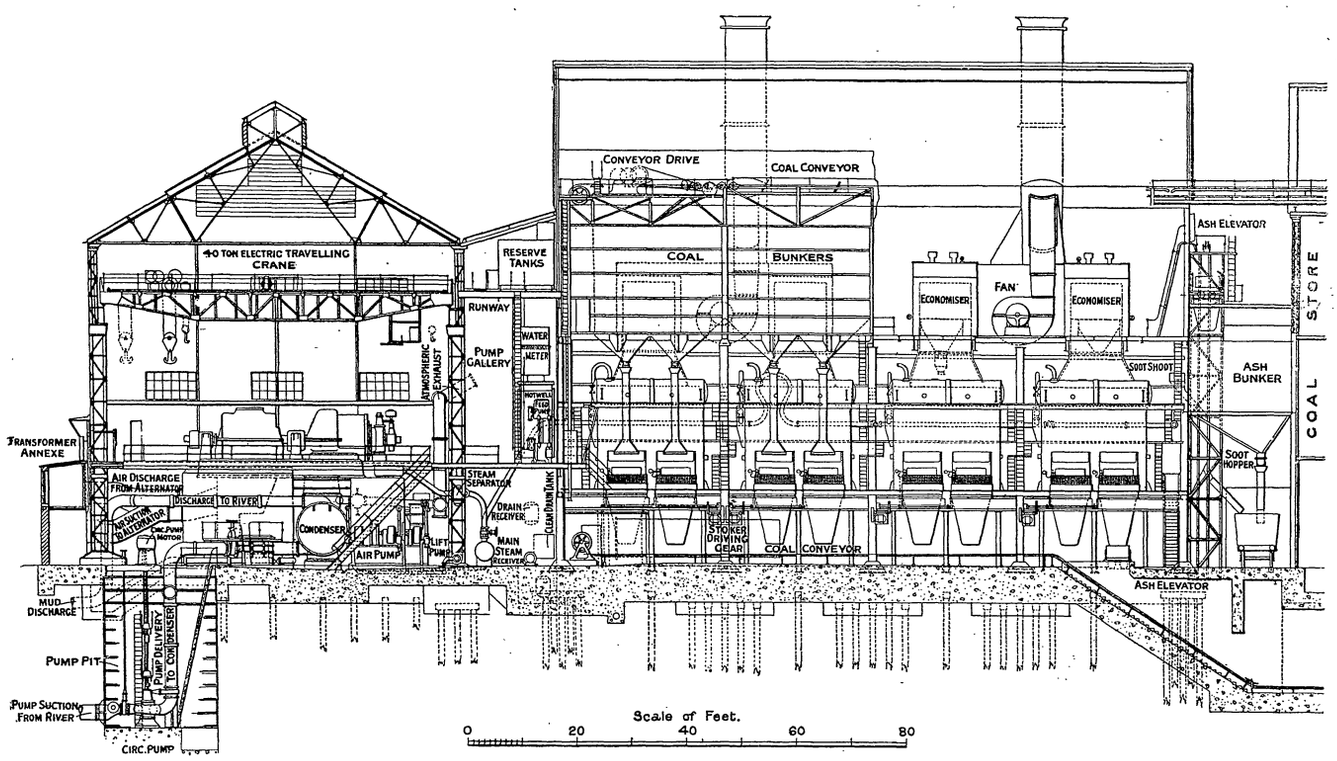


FIG. 1.—SECTION THROUGH ENGINE ROOM AND BOILER HOUSE, SHOWING GENERAL ARRANGEMENT OF PLANT.

The coal is delivered to the receiving hoppers by bottom dumping trucks, and lifted by a Babcock & Wilcox conveyor capable of dealing with 40 tons of coal per hour. There is a large coal store at the end of the boiler house, capable of accommodating some three weeks' supply of coal, in addition to that in the bunkers over the boilers themselves. This receives coal, when desired, from the same conveyor as that which feeds the boiler-house bunkers. Underneath the coal store there is a tunnel, in which there are filling hoppers, which again feed into the same conveyor. The coal from the bunkers is led by shoots direct into hoppers of the chain-grate stokers, which have an area of 168 sq. ft. per boiler.

The complete scheme involves one coal store, boiler house, and set of coal-handling plant for each set of eight boilers, and one boiler house to each two turbo-alternator units. There is one main steam pipe, feed-water pipe, hot-well feed pump, and set of ash-conveying plant for each set of four boilers. The auxiliary motors are 28 in number, all for 440 volts three-phase, ranging from 1 to 20 h.p. Two steam feed-pumps, each with a capacity of 200,000 lbs. per hour, and supplied by Messrs. Clarke, Chapman & Co., are installed.

What has been aimed at in the design of the engine room itself is to have as compact an arrangement of

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machines as possible, but to have everything, including all the auxiliary machinery, accessible to the overhead crane. This even applies to the circulating water

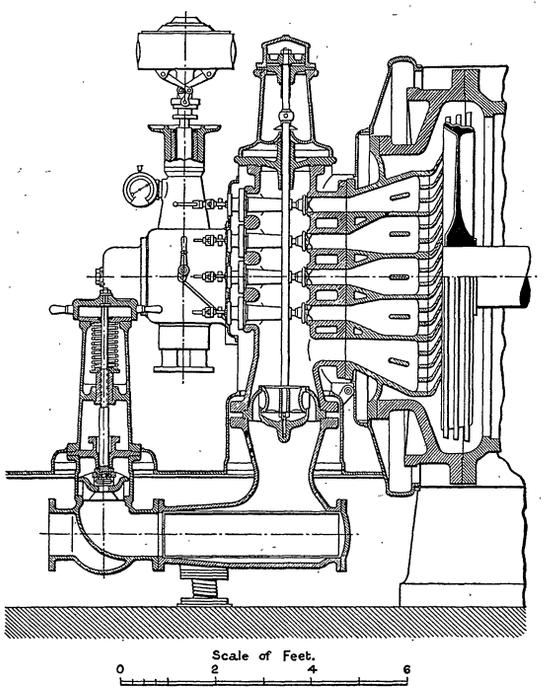


FIG. 2.—SECTION OF GOVERNOR END OF A.E.G. TURBINE, SHOWING ARRANGEMENT OF NOZZLES.

sumps, of which there will eventually be three, one for every two units. They are situated in the engine room, midway between each pair of turbines, and go down to a depth some 30 feet below the engine room floor-level. In each there are two main vertical spindle centrifugal pumps, one for each generating unit, placed at such a depth that they are drowned at all states of the tide, and driven by motors on the engine room floor-level. The suction of each pump communicates by a 24 in. cast-iron pipe direct with the in-take sumps at the river. A salt-water pump is also installed in each sump for supplying water for general cleaning purposes. Contrary to Continental practice, which in general adopts a basement design of engine room with tile or brick floors round the turbines, at Dunston the necessary access to the turbines themselves is secured by means of an open-work cast-iron floor plate and galleries. Behind the turbines on the same level and between them and the boiler house are the feed pumps, hot-wells, water-meters, &c. Beneath this pump gallery are various smaller pumps, &c., on the same basement level are the condensers and electrically-driven air pumps. The feed-pump exhausts can be taken either to the hot-well tanks or to the water softener, or direct to atmosphere.

Two of the turbo sets at present installed are of the Allgemeine Electricitäts Gesellschaft single-flow impulse type, with wheel-type rotors running at 1,200 r.p.m., and coupled to alternators capable of a continuous output of 8,000 k.v.a., or an overload output of 10,000 k.v.a. at a power factor of 0·9 at 5,750 volts three-phase 40 cycles, when the sets are supplied with steam at 190 lbs. per sq. in. superheated to 19° C. A section of one of these turbines is shown in Fig. 2, and some details of the alternators are seen in Fig. 3.

The other set is of the two-cylinder Brown Boveri-Parsons reaction type. This turbine was made by Messrs. Richardsons, Westgarth & Co. The h.p. cylinder is single flow, and the l.p. cylinder partly single and partly double flow. This is coupled to a Brown-Boveri alternator rated at 7,000 k.v.a. continuously, and overloads up to 7,800 k.v.a. at the same power factor, voltage, &c. The general arrangement of the Brown-Boveri alternator is seen in Fig. 4.

The alternators are designed to stand the severest short circuits which are likely to come upon them in practice. The exciters are arranged on the ends of the alternator shafts. Ventilation is by fans on the alternator motors themselves, and the air is drawn in through special filters, there being a separate duct and filter for each alternator. The outlet air ducts are so arranged that the hot air can either be discharged direct outside the building or into the engine room.

Each set has condensing plant, supplied by the makers of the turbines, with electrically-driven pumps. The motor-driven

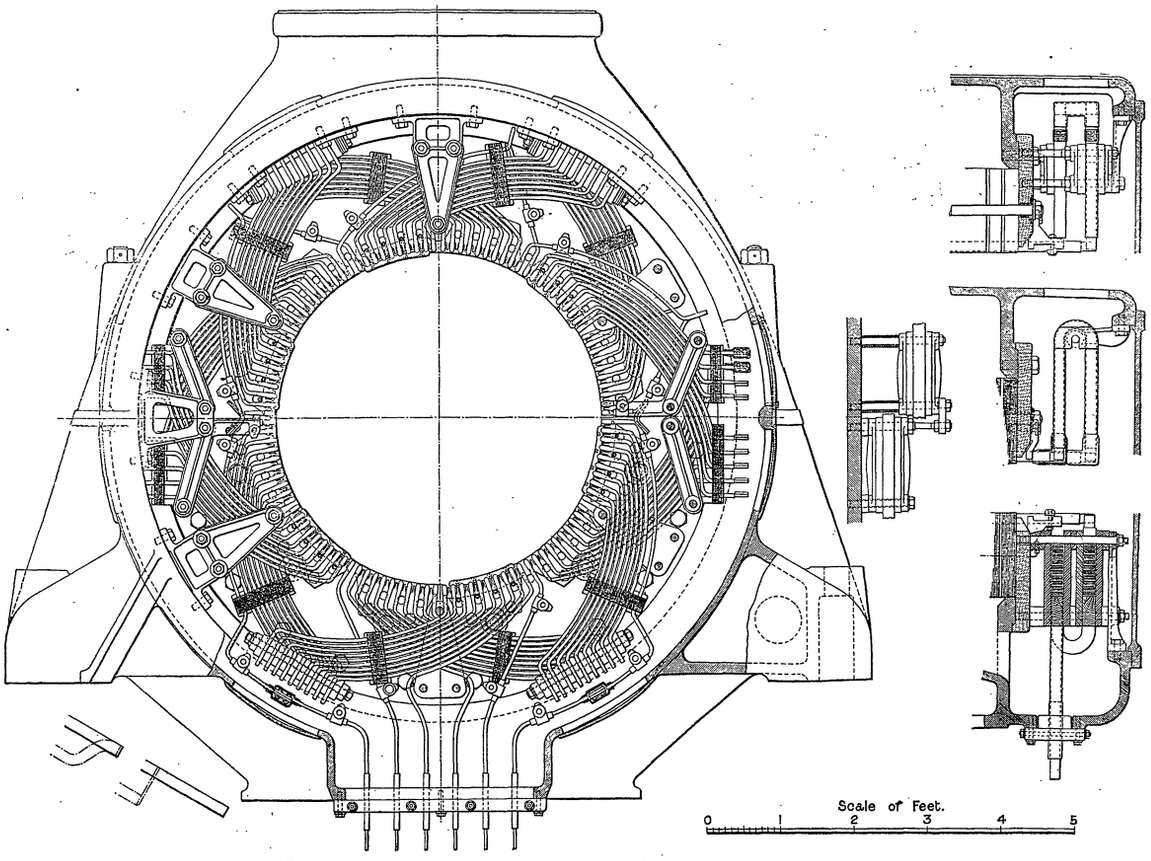


FIG. 3.—DETAILS OF END CONNECTIONS A.E.G. 8,000-KW. ALTERNATOR.

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auxiliaries belonging to each unit are normally fed from a separate 500-kw. "unit" step-down transformer, in a fireproof compartment opposite each alternator. There is also a common low-tension three-phase system fed from the main high-tension 'bus-bars in the switch-house through two 500-kw. three-phase step-down transformers. A supply can be given for starting up from these 'bus-bars to the auxiliaries belonging to each unit; normally these 'bus-bars only supply the motor-generators, rotary converter, and isolated motors, such as crane motors, throughout the works. The fields of the exciters can be separately excited. Two 50-kw. motor-generators provide a supply of direct current at 100 volts for lighting the station and charging the station battery, which is kept in circuit to ensure an absolutely independent supply of lighting. A smaller motor-generator is also used for charging two control batteries used for operating the high-tension switchgear. There are three batteries in all, the larger for lighting, giving 1,000 amps. for one hour, the two smaller 100 amps. each. A 250-kw. Westinghouse six-phase ball-bearing self-starting rotary converter supplies the power for the electric locomotives.

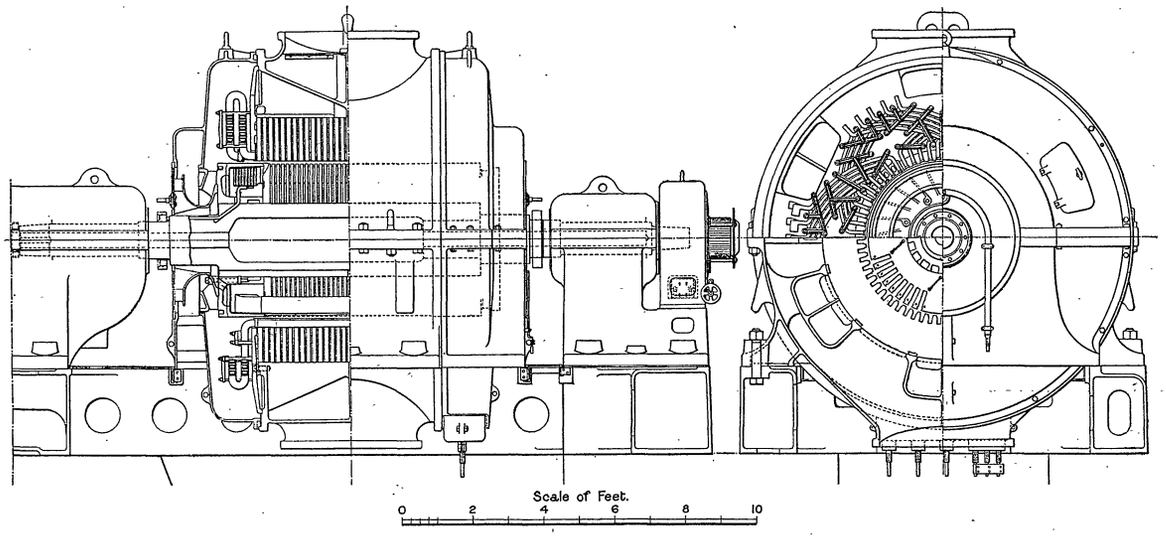


FIG. 4.—BROWN BOVERI 7,000-KW. TURBO-ALTERNATOR.

The switchgear arrangements at Dunston are perhaps the most interesting part of the station. The engine room contains practically no high-tension switchgear, as, with the exception of the ironclad panels controlling the transformers for the auxiliaries, and an indicating wall ammeter for each generator, all the high-tension gear and instruments are installed in a separate switch-house 150 yards away from the engine room. The contractors for the main high-tension switchgear were the British Thomson-Houston Co.

The switch-house is a building with concerete roof 135 ft. long by 33 ft. broad by 32 ft. high. It has two floors, and is divided into two divisions. The front of the building contains on the ground floor offices, &c. The control room containing the operating boards is on the first floor. The back part of the building, shut off by iron doors, is devoted to the switchgear itself, the main oil-break switches and 'bus-bars being on the upper floor, the isolating switches, current and potential transformers, &c., being in brickwork cells on the lower floor. The bare high-tension connections between main switches and 'bus-bars, &c., are on the underside of the roof of the lower room. The control room is 40 ft. by 30 ft., with part glass roof. It is mainly occupied by the semi-circular feeder switchboard and the smaller generator board. The operating board of black slate is divided into sections, the generator and transformer panels and 'bus-bar switches being placed separately from those controlling the feeders. The control gear is operated by means of direct current at 100 volts from two small batteries specially used for this purpose.

Each generator panel has a main ammeter and voltmeter, power factor indicator, indicating wattmeter, field ammeter, integrating wattmeter, &c. It has also a switch for controlling the governor of the turbine, and a rheostat hand-wheel in front, as well as a Chadburn telegraph to each generator. Loud-speaking telephones, supplied by Messrs. A. Graham & Co., are also used. At each end of the generator board is a synchronising panel with rotary synchronoscope. Each feeder panel on the feeder control board has a separate set of instruments, and a set of synchronising and voltmeter plugs for synchronising any other generating station with the machines at Dunston. The feeders are protected with Merz-Price balanced protective gear, supplied by A. Reyrolle & Co. Both the feeder and generator panels have chop-over control switches arranged to make or break the main oil-break switch immediately contact is made. The position of the main oil-break switch is indicated by the lighting of a red or blue lamp, and the operation last performed is automatically indicated by the position of a small coloured pin on the switch handle.

The switch-room itself has two storeys. The 'bus-bars and main oil-break switches are in the upper storey, the connections and isolating switches and current and potential transformers in the lower storey. In the upper room three moulded stone tables run along the room. The main 6,000-volt 'bus-bars rest upon insulators on the central table, and are protected by a cage of expanded metal. The 'bus-bars are divided in the middle of the room by means of a main oil-break switch, capable of carrying 20,000 kw. continuously, and opening under any load likely to be met with. On the two side tables are fixed the oil-break switches, the left side of the room being entirely devoted to feeders. The main oil-break switches are of the British Thomson-Houston Co.'s type. Each of the three cylinders containing the actual switch is in a separate cell, and in front of each cell is a hinged "uacolite" door. The motors operating the switches are arranged to wind up a spring immediately the switch has operated, so that the make or break is instantaneous on the closing of the control switch on the control board. Suitable isolating switches are provided, and all the high-tension panels are provided with balanced protective gear, made by Messrs. A. Reyrolle & Co. There is an air-compressor and set of compressor piping throughout the switch-house for cleaning purposes.

In addition to the switchgear already described, there is in the engine room a neutral isolating switch for each generator and a set of emergency tripping gear, by which the main generator switch in the switch-house can be opened from the engine room. Each generator has also an ammeter, and each generator also has its own "unit" transforming set in the transformer annexe. The leads for these transformers do not pass through the switch-house, but are taken directly from the generator terminals through "Ironclad" switchgear of the Reyrolle type, which is placed in chambers on the northern side of the engine room.

The direct-current switchgear principally consists of a 500-volt traction board, a 100-volt power and lighting board, and the main lighting distribution fuseboard.

The whole station was constructed from the designs of Mr. C. H. Merz, of Messrs. Merz & McLellan, to whom we are indebted for the materials from which this description has been compiled.

The Telephone Position.—We have received a long letter from Mr. A. R. Bennett dealing with the Postmaster-General's speech in the House of Commons on the telephone position. He takes exception particularly to the statement that there was no demand for municipal control of telephones except from Glasgow, and points out that it was only last February that a deputation representing some 300 Councils and Chambers of Commerce pressed the matter. Mr. Samuel stated that of only six municipal telephone systems which were started only two survive, but Mr. Bennett corrects this to three by the inclusion of Guernsey, as well as Hull and Portsmouth, and gives some particulars of the Guernsey system, stating that it possesses the largest exchange in the kingdom in proportion to the population. He also goes into the causes of failure of those which did not survive, and argues that these were chiefly due to conditions imposed by the Government.

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THE ROYAL AGRICULTURAL SHOW

THE electrical features at Norwich are almost entirely confined to apparatus for country-house lighting and electric supply for country estates. Very few motors are in evidence owing to the absence of power circuits, hence many exhibitors have been compelled to drive their machinery-in-motion by oil or steam engines where electric motors would have been preferred had a supply of current been available.

One of the most interesting exhibits of country-house installations are two automatic petrol-driven equipments by Messrs. R. A. Lister & Co., Ltd., of Dursley, on the system mentioned in ELECTRICAL ENGINEERING, May 18th, p. 266. Each of these sets consists of a slow-speed vertical petrol engine, with water-tank, a belt-driven dynamo, and an automatic starter all mounted upon a steel frame, the complete equipment being sent out ready for work. There is also a switchboard, upon which is mounted the "Lister" patent relay, in addition to the usual instruments and switches. The switchboard is carried upon a cabinet containing a small battery of accumulators of the "ignition" type. This battery is kept charged automatically, and its function is to maintain a limited number of lights until the relay has had time to start up the engine. Current is also taken from the battery to turn the engine when starting by running the dynamo as a motor. When first switched on, the lamps are lit direct from the battery, but if any considerable amount of current is required, the relay operates the automatic starter and starts up the engine. As soon as the dynamo begins to generate, it takes over the lighting and charges up the battery. Similar results follow the use of even one lamp for a long period, as a fall of voltage will cause the relay to operate. When all lights are switched off, the plant is automatically shut down, leaving the battery fully charged ready for the next start up. In connection with the auto-

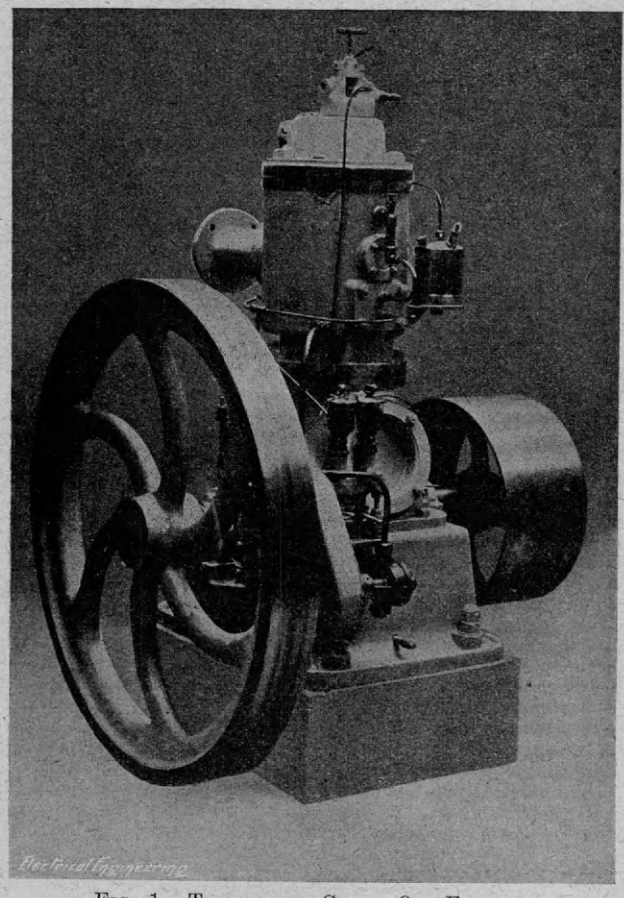


FIG. 1.—TWO-STROKE CRUDE OIL ENGINE.
(Messrs. Petters, Ltd.)

starter is an attachment which relieves the compression in the engine cylinder for starting and stopping by lifting the exhaust valve. This system was exhaustively tested by Messrs. Lister before placing it on the market, the experimental plant being started and stopped several thousand times in succession. Furthermore, each plant is started and stopped more than fifty times in succession before being sent out. The advantages of the system are too obvious to need mention.

A complete electric lighting plant is also shown by Messrs. Boulton & Paul, Ltd., consisting of a petrol engine direct coupled to a dynamo, and including the usual battery and accessories. Combined generating sets driven by oil or petrol engines are shown by eight other firms, and three dynamos direct coupled to gas engines are in evidence, one by Messrs. Tangye's, Ltd., being of 35 b.h.p., and having its own producer. Motors are to be seen driving pumps, fodder machines, and a straw press.

Although not exactly an electrical exhibit, the crude oil "semi-Diesel" engine shown by Messrs. Petters, Ltd., is of great interest in connection with private installations, owing to the remarkably low oil consumption obtained. This engine is of the two-stroke type with the comparatively low compression of 150 lbs. The oil is injected into the vaporiser by a pump under

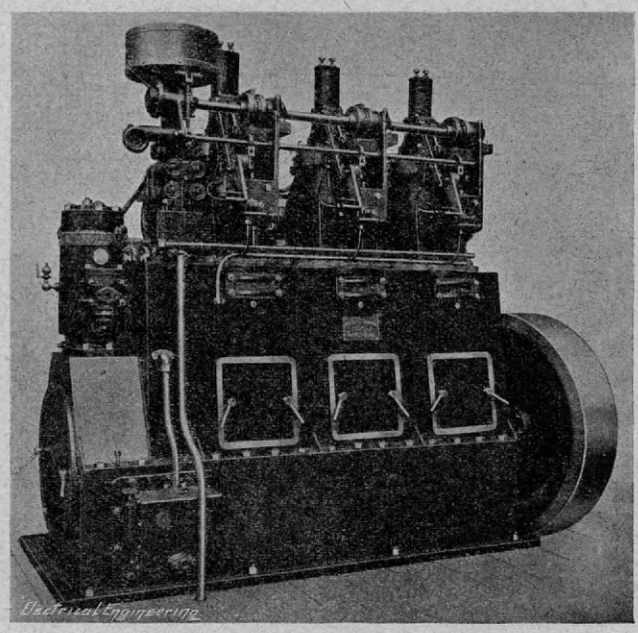


FIG. 2.—NEW DESIGN OF TWO-STROKE DIESEL ENGINE BY MESSRS. WILLANS AND ROBINSON.

the control of the governor, air only being compressed. At the end of the down stroke exhaust ports are uncovered by the piston, and the exhaust gases are blown out by pure air which has been previously compressed to a light pressure in the crank chamber. Lubrication is by rings to the main bearings and by force pump to other parts, whilst the cooling water is circulated by a rotary pump. As regards consumption, the makers are prepared to *guarantee* the low figure of half a pint per b.h.p. hour of crude or residual oil. A view of this engine is given in Fig. 1.

Another exhibit to which interest attaches for similar reasons is the two-stroke Diesel high-speed engine shown by Messrs. Willans and Robinson, Ltd., which is illustrated in Fig. 2. In this engine the piston works in a sleeve in which suitable air and exhaust ports are provided. This sleeve is moved up and down by separate cranks, and the lower end is provided with a ring piston which works in an air cylinder, and supplies air for scavenging at about 2½ lbs. pressure. At the bottom of the stroke of the piston exhaust and air-inlet ports are uncovered, and the exhaust gases are swept out by pure air, the latter being compressed on the up stroke ready for the next oil injection. Excepting for the fuel-injection and starting valves the engine is valveless, and the impulse at every revolution makes it particularly suitable for electric generating purposes. The remainder of the engine consists of the usual Diesel equipment. This engine has three cylinders which develop 75 b.h.p. at 450 revolutions a minute.

Metropolitan Association of Electric Tramway Managers.—A meeting of members of the above was held at the offices of the London United Tramways, Chiswick, on Wednesday of last week. The following were present:—Messrs. A. H. Stanley, Managing Director, London Electric Railways and London United Tramways (Chairman of the Association), Coveney (Erith), Mittelhousen (Bexley Heath), Schofield (Leyton), Ullmann (East Ham), Murray (Walthamstow), Balfour (Dartford), Hammond and Pott (Metropolitan Electric), Mason (South Metropolitan), and Goodyer (Croydon), hon. secretary. There were also present Messrs. Verdon Smith; Secretary Knapp, assistant to the Managing Director; Rozier and Baker, of Messrs. Stanley Wasbrough; Doggett and Baker, solicitors, London United Tramways. The party travelled by special car to Isleworth, where they inspected the Falk system of rail welding. A business meeting was held after tea at Chiswick. The repair shops and car-sheds were visited, and the members made a subsequent inspection of the moving staircase under construction at Earl's Court Station, and were afterwards entertained to dinner at the Welcome Club, Earl's Court Exhibition, by Mr. Stanley and Mr. James Devonshire, Managing Director, Metropolitan Electric Tramways.

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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

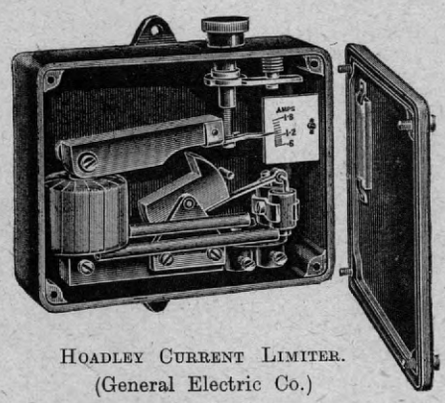
Arc Lamps.

Particular interest attaches to the line of "Arcoflamme" flame arc lamps introduced not long ago by Messrs. J. & H. Grevener (40 Southwark Street, S.E.) as these lamps are made in case of continuous currents in sizes down to 4½ amperes. This sized lamp burns for ten hours and has 16 in. inclined carbons, one with a fixed angle and the other movable. The mechanism consists of a pair of series wound coils above and a pair of shunt wound coils below, which exert a pull differentially on a face armature connected to a locking arm. This arm, which is damped by a dashpot with graphite plunger, operates a horizontal striking gear at the bottom of the lamp by means of a striking rod connecting the rocker arm direct to the bottom of the striking gear. The striking gear consists of a brass plate through which drop the positive carbons, which plate slides in a vitreous porcelain slipper-block allowing perfectly free operation. The sliding plate is connected direct by a right angle crank arm working in a wide bearing standard to the striking rod. The negative carbon merely drops through a porcelain guide plate at the bottom fixed to the arc chamber. The carbon holders are suspended by cords passing over pulleys at the top of the lamp and round drums geared to and worked by a lever escapement. Among special features are the use of a malleable iron casting for the arc chamber, the mounting of the substitutional resistance inside the top cone, and the good mechanical design of the carbon break-switch controlling it. Attention should also be drawn to the fact that the striking rod instead of being rigid is in two parts connected by a spring sleeve coupling which allows the armature free play, even if dirt should hold up the sliding plate. This arrangement removes a possible source of burn-outs.

Our attention is called in a leaflet from the Globe Electrical Co. (11 Farringdon Avenue) to their "Standard" 10 hour and 16–18 hour flame arc lamps for continuous and alternating currents. The clockwork of the feed mechanism is particularly substantial in these lamps, and enamel insulated wire is employed in the shunt coils. Special attention has been paid to the details of the insulation. Every point of attachment, whether current carrying or otherwise, is insulated, double insulation being employed on all current carrying parts. Thus the brass plate which carries the base plate and carbon guides, is first insulated from the base plate by sheet mica, and all guide rods entering this plate are porcelain bushed. The arc chamber is of cast iron. Five sizes are made from 6 to 15 amperes. Metal corded carbons are used.

Switches, Fittings and Accessories.

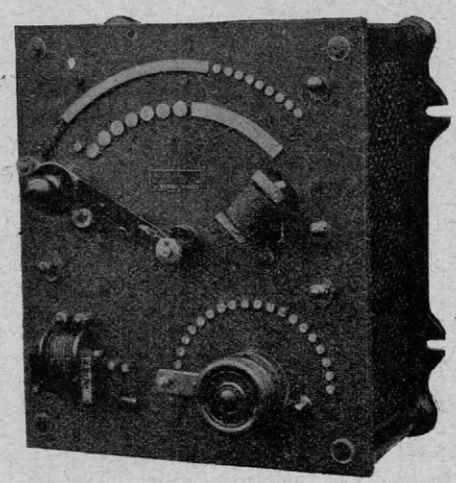
The accompanying illustration shows the "Hoadley" current-limiter, which has just been put on the market by the General Electric Co. (67 Queen Victoria Street). The instrument contains a laminated electro-magnet, one limb of which is pivotted and by means of a screw adjustment fitted to the end, can be moved round the pivot. The coil



HOADLEY CURRENT LIMITER.
(General Electric Co.)

of this magnet is in series with the consumer's lamps, and the magnetic circuit is completed by means of a Z shaped armature carrying a pair of contacts dipping into two mercury cups. On the current through the coil exceeding a predetermined limit the armature tends to revolve and lifts the contacts out of the mercury cups. The circuit is thus broken and the magnet de-energised. The contacts then fall back into the mercury cups and the cycle is repeated, producing a very decided flicker on the lights until the current is reduced to such an extent that the armature is no longer attracted. The flicker may also be stopped by turning the milled knob at the top of the instrument clockwise. This increases the air gap, and increases the amount of current necessary to attract the armature, and consequently the number of lights which can be lit without causing a flicker is also increased. This alteration can be effected by the consumer without having to send to the supply authority. Once, however, the number of lamps or amount of current required has been raised by means of the milled knob, this cannot be again decreased until the instrument has been reset by the supply authority.

We illustrate here a new patent combined starter and regulator, with overload and no-voltage releases and with speed-limiting device, for use with shunt or compound wound motors, which has been brought out by the Adams Manufacturing Co. For controlling motors driving machine tools, when shunt field regulation is employed, it is desirable to have a ready means of limiting the highest speed attainable during any given operation. In these starters the field resistance contacts are inter-connected with a supplementary field regulator, which is mounted on the starter front.



ADAMS-IGRANIC COMBINED STARTER AND REGULATOR.

When starting up a motor by one of these starters, the handle is always moved right over into engagement with the hold-on magnet, the amount of resistance inserted in the shunt field circuit being predetermined by the position of the supplementary regulator handle. The regulator is readily set for any desired speed, and when once set, the speed attained by the motor in repeating any given operation will be the same every time it is started up. The overload device (when fitted) and the no-voltage release are always operative, and the motor always starts on full load.

Some very attractive designs of switch plates for flush-type switches in a variety of styles in metal, wood and ivory, are contained in a catalogue just issued by D. H. Bonnella & Sons, Ltd. (58 and 60 Mortimer Street, W.), which also contains a selection of switch movements, plugs, sockets and bell pushes.

Miscellaneous.

Messrs. Girldlestone & Co. (23 Davies Street, W.) are agents for the Elworthy-Kolle system of ozone ventilation and air purification. The apparatus in this system, including its electrically driven fan, ozoniser, &c., is compactly arranged in a cabinet. The arrangement of the apparatus is such that draughts are claimed to be avoided, and the air indrawn through the ozone producer gives a high efficiency. A report by Sir W. Ramsay states that there is remarkably little rise of temperature, and that no oxides of nitrogen are produced.

Batti-Wallahs' Society.—Arrangements have been made for the Batti-Wallahs' Society to visit and inspect the R.M.S. *Olympic* at Southampton on July 29th. The party will be subsequently entertained at lunch by the president, Mr. W. Slade Oliver, on board the Royal Motor-Yacht Club's yacht *Enchantress*.

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THE BROWN, BOVERI AUTOMATIC PRESSURE REGULATOR

CENTRAL station engineers and others to whom the satisfactory automatic regulation of the pressure of the supply systems under their control presents more or less of a problem, will be interested in the automatic voltage regulator developed recently by Messrs. Brown, Boveri and Co. We understand that a number of these regulators are already in operation, both in England and on the Continent, and that very satisfactory results are being experienced with them. The makers inform us that these instruments are guaranteed to keep the pressure constant within 1 per cent., irrespective of the variations of the speed or load of the generators. On account of the special type of rolling contacts, which form a particular feature of their construction, they are practically frictionless, and hence operate exceedingly rapidly.

As will be seen from Fig. 1, the regulator, in the case of alternating currents, consists of a "shaded pole" electro-magnet, acting upon a light cylindrical aluminium rotor. The electro-magnet is wound with a fine wire winding in series

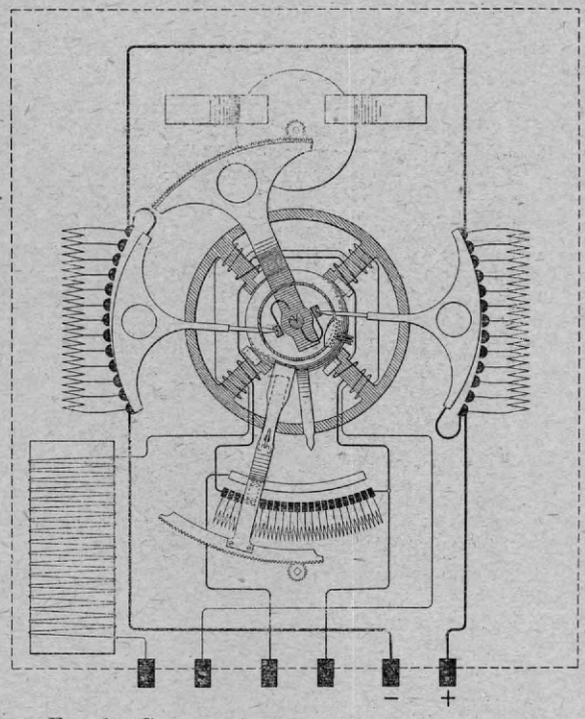


FIG. 1.—GENERAL ARRANGEMENT OF CONNECTIONS.

with an external resistance, and connected to the secondary of a pressure transformer placed across the mains (or directly across the main circuit, if the pressure does not exceed 500 volts), and also a heavier winding connected to a current transformer in the main circuit.

The field produced by the fine wire winding is dependent upon the pressure of the circuit, and for a definite value of the pressure, a certain torque is produced on the moving system. This torque is opposed by a flat spiral spring, the tension of which can be varied, while an additional spring is provided, so adjusted that the resisting torque has a constant value for any position of the armature. The movements of the armature caused by the pressure variations on the circuit are communicated to an almost frictionless contact system, which comprises two or more contact sectors, centred in jewelled bearings, mounted on springs, carried by the armature spindle. These sectors are so suspended that they roll over the contacts, disposed radially, relative to the centre of the armature.

In order to make the action dead beat, an eddy current damping arrangement, as shown at the top of the diagram, is provided. The sector geared to this is connected to the armature through a spiral spring by a sleeve arrangement, so that there is a small time lag between the movement of the armature and the movement of the damping sector. Thus if the full load is thrown suddenly on the alternator, the exciter field current will be increased by the regulator to a value higher than that which actually corresponds to full load, on account of the short circuiting of the resistance, since the contact sectors will momentarily take up their extreme position. A little consideration will make it clear that this is essential, for, owing to the self-induction of the exciting circuit, and the inertia of the turbine or engine-governor, it is necessary to increase the exciter pressure by an amount which more than corresponds to that required for the alternator when running steadily at full load. As soon as the alternator pressure tends to increase, however, the regulator automatically inserts resistance into the field circuit of the exciter until the contact sectors take up the correct position, at which point the period of regulation is at an end. Similarly, when the whole load is suddenly taken off, the contact sectors first move in the opposite direction, causing a large amount of resistance to be inserted in the exciter field circuit, after which they go back to the normal position. The damping arrangement is so effective that there is always a dead beat return to the correct position. It will thus be seen that the regulator is able to follow very rapidly every variation in pressure, and to control it in such a manner that the maximum variation seldom exceeds 1 per cent. from the normal pressure. The regulator can be set for any definite pressure by varying the spring control by the screw adjustment provided.

The regulator can be used to over-compound the machine if desired, so that the pressure drop in the external circuit can be compensated for. This over-compounding is effected by the action of the current winding already mentioned, which is wound in opposition to the pressure winding, and thus has the effect of increasing the exciting current over and above that required to keep the generator pressure constant by an amount dependent upon the magnitude of the load. Provision is made for adjusting the amount of over-compounding which can be effected by additional series of contacts, seen at the lower part of the regulator, connected to a diverting resistance.

The regulator can be adapted for hand operation by a device which locks the whole moving system to the lower contact arm, so that it can be controlled externally by a key on the shaft of a small pinion, gearing with the toothed sector carried at the end of the contact arm. The regulator can be

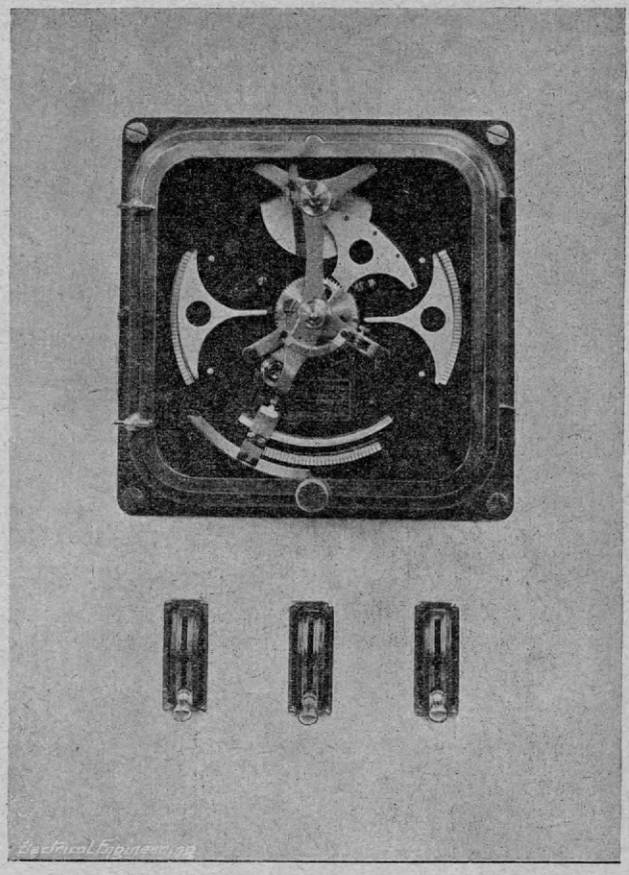


FIG. 2.—REGULATOR FOR EXCITING CURRENTS UP TO 10 AMPERES AT 125 VOLTS.

connected up to regulate the pressure of one or more similar alternators with direct coupled exciters, and by means of switches it can be made to control any one of the machines separately, or, if desired, the one regulator can be made to control two or more similar machines in parallel. When the machines working in parallel differ in size or in construction, it is sometimes preferable to regulate the bus-bar pressure by carrying out all the automatic regulation on one machine only.

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Thus, for instance, in the common case of a station in which reciprocating and turbine plants are installed, the requirements of the case are generally fully met by automatically regulating one or more of the turbo-alternators, the better governing of the latter enabling them to take up all the peaks of the load, which are carried at constant pressure, with the help of the regulator.

Fig. 2 shows the type of regulator for exciting currents up to 10 amperes, at 125 volts, corresponding to exciter outputs up to about 50 K.W., and an aggregate alternator output up to 5,000 K.W.

The pressure regulator for continuous current work differs from the alternating current instrument in that a wound armature is used in series with the pressure winding of the field, instead of the aluminium drum. The "shading" coils are also, of course, omitted. Messrs. Brown, Boveri inform us that the D.C. type has been employed with very satisfactory results in connection with boosters and buffer batteries, and for controlling the speed of large direct current motors, the pressure at whose terminals varies considerably, as is frequently the case on power circuits supplying current to a number of works or for traction. In this case a very small dynamo or magneto is driven either from the motor shaft or from the line shaft belted to it, the terminals of the magneto being connected to the pressure terminals of the regulator and the regulator resistances in series with the field circuit or the motor. In this way the slightest difference in speed causes a variation in the pressure at the terminals of the exciter, which, in turn, causes the regulator to operate and decrease or increase the amount of resistance in the motor field circuit to the extent necessary to maintain the speed of the motor at the correct value. Quite a number of these regulators are now being employed for this purpose, and experience shows that the speed of the motor or line shaft can be kept constant irrespective of temperature, pressure, or load variations.

THE TELEPHONE TRANSFER

Post Office agree to take over all the Company's Plant

CONSIDERABLE progress has been made with the arbitration proceedings with regard to the transfer of the National Telephone Co.'s system to the Post Office at the end of this year. The Postmaster-General, it will be remembered, had given notice that he did not propose to take over certain portions of the plant in London and other competitive areas owing to its being unsuitable for his requirements, and the question as to its suitability or otherwise was being fought out before the Railway and Canal Commissioners.

In our last issue we gave an account of Mr. Gill's evidence on Monday last week, and a portion of the evidence he gave on Tuesday. Among the other points which he dealt with on Tuesday and Wednesday last week, in addition to those reported in our last issue, was proposed scrapping of subscribers' instruments and lines. It was acknowledged by the Solicitor-General that the Post Office have been engaged for some time in installing telephones in the subscribers' offices in the areas of the 23 metropolitan exchanges which they object to take over from the Company, as they also object to take over all subscribers' lines and instruments connected to these exchanges. This, Mr. Justice Lawrence, the presiding judge, characterised as a creation of plant for the purpose of evading the purchase agreement, and he expressed the opinion that this was not the natural excess of plant occurring when there were two competitors in the field, which had been dealt with by the Court of Appeal in its recent decision. But, even if the complete exchange with distributing wires attached to the subscribers' instruments were ready by the end of the year, Mr. Gill maintained that the Post Office would need the National Telephone Co.'s plant to tide them over the transfer. Besides the subscribers' lines and junction lines leading to these 23 exchanges, Mr. Gill explained that there were 880 C.B. instruments, 6,852 "convertible" instruments (made for initial use on the magneto system and subsequent use on the C.B. system), and 13,266 local battery instruments, which could easily be converted for use on C.B. exchanges, as had been done by the Company itself in similar cases. He next dealt with the questions of operation, and said that the average time taken to answer calls on the condemned 23 exchanges varied from 4·9 seconds (at Croydon) to 9 seconds at Harlesden, while the average on the 17 metropolitan C.B. exchanges owned by the Company was 5 seconds. The cost of working the local battery exchanges was 156d. per 1,000 effective calls as against 127d. on C.B. exchanges. At an inquiry to ascertain similar figures in 1908 in order to arrive at an arrangement with the Post Office for joint working—particularly in Glasgow—the agreed figure for the cost of working the National system was 118·64 and the Post Office at the time 216·68.

As stated in our last issue, a discussion as to the meaning of the definition of metallic circuits, elicited from the Attorney-General a statement that the Post Office would not consider subscribers' speaking lines subject to objection on the ground that they were used for signalling with earth return, nor would he object to power circuits for the same reason. In the case of the Post Office objection to iron wires, it was also stated that although the definition in the notice might imply objection to practically all lines on account of induction coils with their iron wire cores being associated with them, the objection was, in fact, only to be taken to apply to actual iron-wire circuits; but it appears that there are altogether only 57 miles of plain iron-wire circuits, and in addition 29 miles of copper-clad iron wire put up with the consent of the Post Office.

The next point discussed was the objection taken to lines placed upon, along, or across any railway worked, or about to be worked, by electric power. Mr. Gill said that all proper precautions were taken, and that the only accident he could remember was the simultaneous fire which took place in 1905 at the Bank Exchange and Oxford Court. In this case, the electrification of the District Railway was under construction, and the positions of the telephone lines in the tunnel were being altered; although the railway company had agreed not to make their rails live without giving notice to the Company, this had been done in one instance, and a railwayman had left a piece of steel troughing lying against the rail and a telephone wire which had occasioned the fire alluded to. Wires on railways could be adequately protected by fuses, and the Post Office had since 1907 taken powers to attach their wires to tramway trolley poles. Mr. Gill also explained the unreasonableness of the objection taken to lines connected to lines on railways, as they would in any case be quite suitable as soon as the line on the railway had, if necessity really arose, been diverted or rendered safe.

In cross-examination by the Solicitor-General, Mr. Gill admitted that the Avenue exchange had reached its ultimate capacity, and that, if he were planning an entirely new system for the area served by the Avenue, Bank, and Westminster exchanges, he would employ C.B. entirely; and that, if the enterprise of the National Telephone Co. were not coming to an end this year, he would have gone much further than he had in transferring magneto to battery. On the other hand, even if the licence had been non-terminable, he would certainly not have converted all the area by now. A scheme was put to him in which the closing of the Avenue, Bank, and Westminster exchanges had been suggested by the Company in March, 1903, but he explained that this was merely drafted for a preliminary discussion, that part of the scheme was carried out, but that, when they came to close quarters with it, it was modified in a number of places. He admitted that there were no magneto exchanges in New York city.

In the course of this cross-examination the Solicitor-General said that even if the Post Office had to purchase the overhead cables, they would abandon them. He also said that the objection to junction wires to and from the "condemned" exchanges to others referred only to the part from the exchange to the first point of call if they passed through other exchanges on the way.

An interesting answer was given to a question asked Mr. Gill with regard to operating. He said that Westminster and Bank could certainly be worked with fewer operators if on the C.B. system, but Avenue was working particularly economically, and he was not sure that he could work it cheaper on the C.B. system: "I am perfectly sure the Post Office could not," he added.

Mr. W. W. Cook, Assistant Engineer-in-Chief to the National Telephone Co., was the next witness. He said that he had experienced no trouble with telephone wires laid a little distance from electric railways or under rails, and said that there were cases in which the Post Office had bare wires both alongside and crossing railways.

Mr. Cook was still under examination when the Court adjourned on Wednesday. On resuming on Friday, no announcement was made as to agreement having been arrived at on further points, and the examination of Mr. Cook was continued. On Mr. Gill's point as to the large and unnecessary scrapping of subscribers' instruments proposed, he said that in an investigation with regard to Westminster—not for the purpose of this case—it had been found that the cost of local battery instruments was almost identical with that of C.B. instruments, owing to the various auxiliary apparatus and extensions many subscribers had; only about one-third of the subscribers had merely simple instruments, and probably the same proportion would obtain in Bank and Avenue. The average time taken to answer a call on Bank, Avenue, and Westminster exchanges was 5·5 seconds, and he would be very surprised if the Post Office could show a better result. He regarded the Post Office scheme of wholesale and immediate replacing of exchanges as an unsound one, which would only be justified on emergency; and no emergency existed as none of the exchanges were worn out. A large amount of the plant was actually of the type used in the P.O. exchanges, *e.g.*, there were numbers of central battery jacks and C.B. type relays. He also explained the difficulties the Post Office would experience under their scheme, by their not being acquainted with the traffic con-

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ditions; it was necessary to distribute the subscribers so that those with the greatest frequency of calls were evenly spread out among the operators, and it was also necessary to know the calling rates of the various subscribers in order to arrive at the correct number of junctions. He was of opinion that the Post Office carried underground distribution too far, as it gave greater flexibility if the lines were run underground to distributing points, and thence wires were used along the sides of the houses and overhead.

Cross-examining Mr. Cook, the Attorney-General read a passage from the 1906 edition of Mr. Poole's "Telephone Handbook," in which the magneto system was referred to as obsolete. Mr. Cook agreed that Mr. Poole was a member of the company's technical staff, and said that while agreeing generally with his point of view, he thought that the word obsolete was too strong.

Mr. H. F. Parshall then gave evidence with regard to telephone lines on railways. He said that on the Central London Railway their power cables, distribution cables, and telephone cables are carried on common hangers and had never given trouble. He had experienced more trouble with cables in ducts than in tunnel. On the Lancashire Power Co.'s system the crossings of the 11,000-volt overhead lines with telephone lines were very numerous, and they had had no danger or inconvenience.

Mr. Parshall was followed by Mr. S. Z. de Ferranti and Sir Alexander Kennedy, both of whom were very emphatic on the point that any plant removed for a condemmed exchange could, in the main, be taken to store and used again with very little expense. Mr. Ferranti regarded the objection of the Postmaster-General to lines near railways as unreasonable, as the development of electric railway and power supply cables in the future would be so enormous that it would be inevitable that all classes of cables must be laid in close proximity to one another. At the present time, it was pointed out, there are a considerable quantity of telephone cables along the District Railway which are working satisfactorily, and the difficulty of getting satisfactory routes in towns would necessitate the use of the railways for this purpose.

Both these witnesses have carried out a test reproducing the condition at the time of the fire at the Bank exchange, which has already been mentioned. A cable at a voltage equal to the traction voltage was short circuited on to a model telephone exchange, but no damage was done; the protective devices acting perfectly. At the time of the Bank fire referred to, the protective devices had not yet been installed. Sir Alexander Kennedy also gave evidence on the question of the change over. He failed to see how every National subscriber could be changed over on December 31st, and that, therefore, a large part of the plant objected to would have to be used by the Postmaster-General until the change actually took place.

On Monday a long discussion subsequently took place as to the position of cables containing one private wire, and a larger number of wires which the Postmaster-General objected to. The Company's contention is that the existence of one private wire, which the Postmaster-General is bound to take over, brought the whole cable within the category of "suitable" plant, owing to the difficulty of separation. The Attorney-General, on the other hand, said that such a cable should be declared unsuitable always with the reservation that the full price, as a going concern, would be paid for the private wire. He went further, and offered to pay for all private wires existing in such cables, but to give the Company the whole cable, and to lay new private wires himself.

Mr. Hammond Hayes, who was for twenty-two years with the American Telegraph and Telephone Co., and their predecessors, until 1902 in charge of the experimental department, late assistant and chief engineer, was next called on behalf of the National Telephone Company. He said that in New York City all the exchanges are on the central battery system, but the local battery exchanges, which were displaced, are used in other parts of the States where the traffic conditions are not so dense. Mr. James Swinburne followed on the lines of the evidence given by Mr. Ferranti and Sir Alexander Kennedy, and his examination had not concluded when the Court rose on Monday.

On Tuesday morning a conference took place between the parties, which kept the Court waiting until 1.30 p.m. The Attorney-General then announced that an agreement had been come to which would put an end to the part of the proceedings then before the Court. He asked the Court to make a declaration as to the points raised in the notices of objection by the Postmaster-General in a form which had been agreed, which would clear the way for the valuation, subject to the reservation of the right to the Postmaster-General to argue the degree of suitability of any particular piece of plant.

Mr. Justice Lawrence announced that the Court would give an order in the terms asked for, and made no order as to costs.

We have reason to know that the agreement arrived at is briefly that the Post Office will take over the whole of the National Telephone Co.'s plant, including the "condemned" exchanges, and that the price to be paid for it will be determined, having regard to the relative suitability of the plant for the requirements of the service under the new conditions. Instead of certain parts of the plant being ruled out as unsuitable for the requirements of the service at the end of the year and being left on the Company's hands to dispose of as best they can, and the remainder being sold to the Post Office at its actual value, the whole of the Company's plant will be transferred and the price will be determined in proportion to the degree of suitability of the various items of plant. On the other hand, it is not likely that this price will be agreed between the two parties without further recourse to arbitration before the Railway and Canal Commissioners.

It is unlikely that there will be any change in the Post Office plans for reorganising the service, plans which involve dispensing with some of the older exchanges of the National Telephone Co. in districts in which the Post Office has exchanges or is building new ones. The new exchange which is being built in Creechurch Lane, near to the present Avenue exchange, will take the place of and be called "Avenue," and the Bank and Westminster exchanges will ultimately be closed, and the subscribers chiefly transferred to the Central and Victoria exchanges respectively, where, we believe, there is a large amount of spare equipment, and whose ultimate capacity is quite double their present capacity. It is to be hoped, however, in the interests of the subscribers, at any rate, that no real attempt will be made to transfer the whole of the 23 "condemned" exchanges simultaneously at midnight on December 31st, but that the transfer will be made gradually, so that the service can proceed with absolute smoothness during this critical period.

DIESEL ENGINES

MR. G. E. HEATH, of the Diesel Engine Co., Ltd., has sent us some observations on the discussion on Diesel engines at the Convention of the Incorporated Municipal Electrical Association (see last week's ELECTRICAL ENGINEERING, p. 383). Mr. Heath was down to speak, but shortness of time and the large number of other speakers prevented him from being called upon. Mr. Heath says that throughout the discussion the remarkable fuel consumption was not questioned, and refers to engines which have been in continuous daily operation during some six to seven years, throughout which time the consumption per unit generated was for all practical purposes the same as the figures obtained upon the test-beds. It is well known, he says, that any Diesel engine will run with a consumption of something under half a pound of fuel per b.h.p.-hour, or it will not run at all. The low consumption is just as much a factor of the engine as the cycle and principles upon which the engine works. He points out once more that the engine is a self-contained producer of power, which can be readily started at a moment's notice, and that the elimination of stand-by losses makes the fuel costs independent of load factor. A further point of importance, he says, is that the consumption of fuel is in no way dependent upon the attendant labour, being entirely automatic in its action, so that when the fuel contract is settled for a number of years, the engineer can say with certainty that for such time his fuel cost will be a definite figure.

He points out that the Diesel engine differs from the gas engine in two main points; first, compression of air only and not an explosive mixture, thereby obviating all possibility of pre-ignition, back-firing, &c., and secondly, the automatic burning at constant pressure of the fuel injected, such combustion being supported by the heat of compression of the air previously mentioned. There is no explosion, and an indicator card from a Diesel engine gives a very close approximation to a card from a steam engine. The absence of any explosion gives freedom, and consequently smoother working. It is mainly due to this fact that Diesel engines can be built with large cylinders with every degree of certainty and confidence. There is no evidence, he maintains, that the state of affairs predicted by Mr. Day regarding repairs and maintenance exists in the larger cylinders in actual practice. There are, he says, a geat number of engines with cylinders considerably larger than 150 b.h.p. which have been working in different parts of the world for some years, and with the most satisfactory results. A two-stroke engine has been built, and has been running for the last twelve months, with a capacity of 1,200 b.h.p. in the one cylinder; and if proper attention is given to the design of the cylinder-covers and piston-heads, there is no reason whatever why these larger engines should not work equally as well as small engines of 50 or 60 b.h.p. per cylinder.

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Mr. Heath characterises Mr. Boot's experience of repair costs as abnormal. With a modern engine supplied by the writer's firm, he maintains that without exception the figures given in Mr. Howard's Paper would more than cover the repair costs, and in no case have such results recorded by Mr. Boot been approached within 50 per cent. The standard set of spares supplied with each engine is considerably less than that mentioned, and such a set is sent to Chili, South Sea Islands, and up-country stations in India, where only native labour is available; and, with an exception here and there, no requisition for further spares have come through for a number of years. Provided attention is given to the design and construction, and, most important of all, to the rating, no such costs will occur.

With engines of larger cylinders, if the rating is kept low, Mr. Heath contends that all complication of water-cooled pistons can be avoided.

Lubricating costs may in some cases be high, particularly where forced lubrication has been adopted. In such cases the difficulty of keeping the lubricating oil from the fuel in combustion has led to this system of lubrication being superseded by returning to the ordinary ring lubrication for bearings, whilst the small end and piston only have forced lubrication. As a rule-of-thumb guide, it may be stated that lubricating oil costs do not exceed 1/10 to 1/12 fuel oil costs. In view of disappointing experiences with early engines using forced lubrication, the Diesel Engine Co. have reverted to the original form of lubrication.

With regard to horizontal engines, the greatest drawback appears to be probable wear on the liners due to the weight of the pistons, and owing to the high compression this seems likely to give trouble, which can be avoided by the use of vertical engines. There are difficulties in the fuel injection owing to the position in which this valve has to be placed, and general inaccessibility of the valves will be very apparent to those responsible for the upkeep. The floor space required is greatly in excess of that for a vertical engine, and overhauling is certainly more difficult to carry out. Only one example of this type of engine was referred to, and it will be interesting to see how the results come out in the way of maintenance and repairs in a few years' time.

Mr. Heath concludes:—The new type of engine designed by the writer's firm for electric lighting purposes embodies many special features; the greatest success has attended this engine, and in several recent cases it has superseded gas plant. The results obtained at the works of Messrs. Hoffmann, of Chelmsford, are especially of interest, as in that case two Diesel engines, supplied by the Diesel Engine Co., of 330 b.h.p. each, run continuously during the week for 120 hours, the fuel costs amounting to 0·134d. per unit, as against 0·34d., which was the cost for gas engines, working under exactly the same conditions, previous to the Diesel plant being installed. It is obvious that it is impossible to lay down any hard and fast rules for the comparison between steam, gas, and oil, as each case has to be considered entirely on its own merits, taking into consideration all the various factors. Provided this is properly done, it can be safely claimed that in 95 cases out of 100 the figures for Diesel engines will be the lowest. It is worthy of note that in no single instance where Diesel engines have been installed in central stations or elsewhere have they ever been replaced by either gas or steam engines, and when extensions have been necessary the policy of installing Diesel engines has been continued.

We have also received the following letter from Mr. P. von Miaskowski, Manager of the London office of the M.A.N. Co.:—

To the Editor of ELECTRICAL ENGINEERING.

SIR,—The doubts so strongly expressed in the course of the discussion of Mr. Howard's Paper on Diesel engines, read before the I.M.E.A. Convention at Portsmouth last week, about the possibility and advisability of high-power Diesel engines, are, according to the experience of my firm—the M.A.N. Co.—only in so far justifiable, as it would certainly be a mistake to enlarge single-acting four-cycle cylinders above a certain limit, which may be put at about 250 b.h.p., and not at 150 b.h.p., as mentioned by Mr. Day, or to increase the number of cylinders without limit. The high-power Diesel engine must be built as a two-cycle engine, either single or double acting, or as a double-acting four-cycle engine.

To substantiate the above figure of 250 b.h.p., I may mention that quite a number of M.A.N. Diesel engines, consisting of 2, 3, or 4 single-acting four-cycle cylinders of an output per cylinder of 200-220 b.h.p., have been running satisfactorily for years. The high-power Diesel engine of the double-acting four-cycle type is represented up to the present by one engine of 600 b.h.p. (*i.e.*, 300 b.h.p. per cylinder), which has been running for 2½ years at the Augsburg Works of the M.A.N. Co., and by one engine of 1,600 b.h.p. (with 400 b.h.p. per cylinder), which was built also by the M.A.N. Co., and has now been running for some time at the Municipal Electricity Works of Halle, in Germany. These engines are, in general, designed on exactly the same lines as the double-acting four-cycle gas engine, only instead of the ignition plugs fuel needles are provided, and the small fuel pumps and the air-compressor are additional parts. Hundreds and hundreds of such high-power gas engines, representing more than a million b.h.p., have been running satisfactorily for years all over the world.

My own firm alone received during the year 1910 orders for 43 such engines of an average output of 1,891 b.h.p. per engine, and has orders for 8 double-acting Diesel engines now in hand.

Large two-cycle Diesel engines, either double-acting or single-acting, of 1,000 b.h.p., or of a good deal larger output, have also been already constructed, and have been running satisfactorily on the test-beds of a number of makers all over the world. To say—as several of the speakers did—in the face of such facts that an internal combustion engine cannot be built in larger units is either a deliberate shutting of the eyes or shows an astonishing ignorance of what has been going on in the engineering world outside this country. The absolute confidence which my firm has in the future of the high-power Diesel engine refers, of course, only to carefully and substantially built engines, which are not overrated and run at moderate speeds.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

CALENDAR.—A very convenient aluminium revolving waistcoat-pocket perpetual calendar, available up to 1927, is to hand from Barry, Head & Co., iron, steel, and metal merchants, 110 Cannon Street, E.C.

DYNAMO TENDERS' ACCESSORIES.—Messrs. Haslam & Schontheil (11 Windsor Place, Cardiff) have sent us a leaflet giving particulars of a useful line of cylindrical bellows for blowing out armatures, and "National Electric Compound" for cleaning and preserving commutators.

ALUMINIUM.—A leaflet from the British Aluminium Co. (109 Queen Victoria Street, E.C.) contains a reprint of an interesting article on the use of aluminium wire in traction motors, and some excellent photographs of aluminium overhead lines and welded central station connections.

METERS.—A new ampere-hour meter, which the Union Electric Co. (Park Street, Southwark) are putting on the market, is described in an attractive booklet. This is for continuous current, and is known as the Fortiter meter, being manufactured by the same firm as the Excello lamp. The meter is of the commutator type with extremely light moving parts, with the armature coils laid flat on the brake disc, which is strengthened by a turned-up edge. The brushes are of phosphor-bronze faced with gold, and bearing on a silver commutator. With a high torque and small watt loss, a very good curve of accuracy is obtained.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

FITTINGS, &c.—A well-illustrated catalogue of electric light fittings, signs, plates, and other metal work applied to the electrical trades is to hand from Messrs. Cranmer & Cheshire (Steward Street, Spring Hill, Birmingham). Some very artistic fittings in a variety of styles are included, and some representative drawings of architectural ironwork, billiard pendants, signs, &c. Ornamental switch-plates and radiators are also illustrated, and the list concludes with some well-chosen examples of cast-iron bulkhead and other fittings, arc lamp winches, &c.

THE WHOLESALE HARDWARE CLUB.—We have received a booklet containing prospectus, list of members, &c., of the Wholesale Hardware Club (Royal London House, 14 Finsbury Square), which was founded in 1906, and deals in many ways with the interests of the wholesale hardware trade, besides having social avantages. The membership embraces about 200 firms.

SMALL TOOLS.—A handsomely got-up booklet of over 200 pages, forming a catalogue of small tools, gauges, and standard parts manufactured by Ludw. Loewe & Co., is being issued by G. Goodchild & Partner (30-32 Farringdon Road). The catalogue is not only particularly well illustrated and arranged, but has a completeness especially as regards milling cutters rarely found in such publications. The book does not exceed a size conveniently carried in the pocket, and should be of great use to all connected with machine-shop equipment.

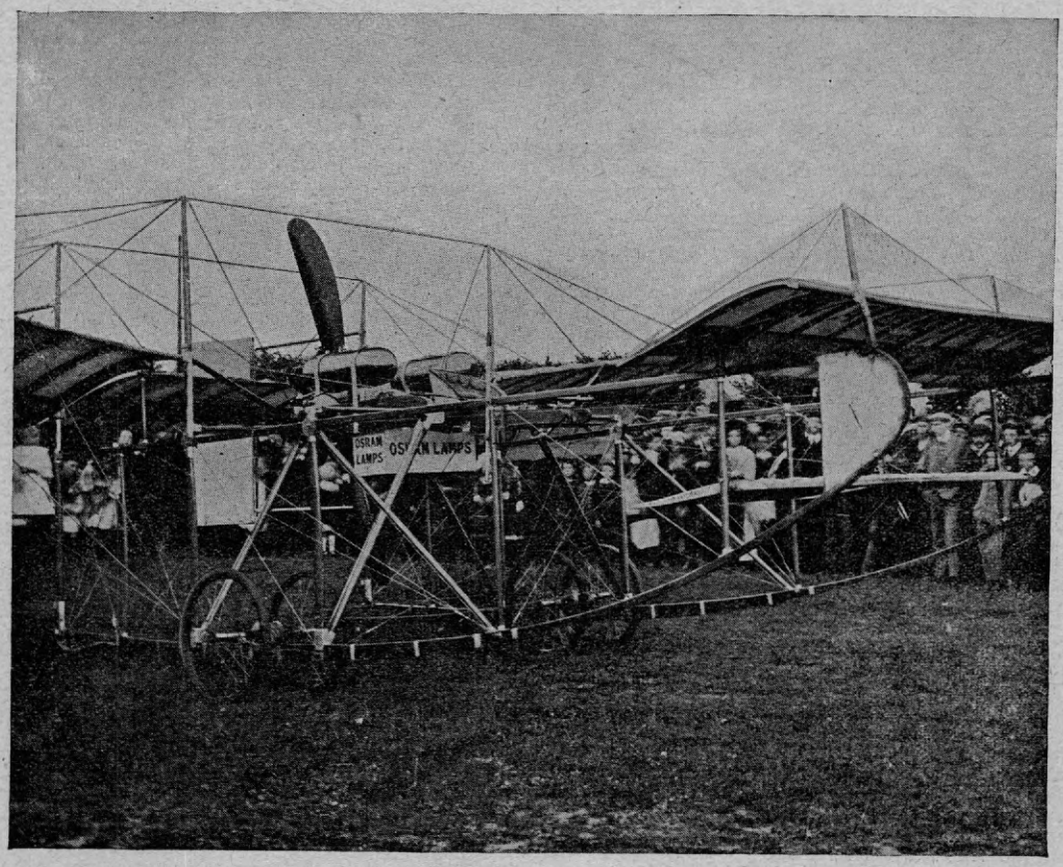
The Iron and Steel Institute.—Arrangements are well advanced for the October meeting in Italy. Among the papers to be read is one by Cav. Ing. Remo Catani, on the application of electrical energy to the manufacture of iron and steel in Italy. The tour will include visits to Savona, Genoa, Pisa, Rome, Naples, Terni, Florence, and Milan, with excursions to Elba and Piombrino.

The Home Office Mining Rules.—Owing to the number of objections raised by mine-owners to the proposed new special rules relating to the use of electricity in mines, the Home Office announces that Mr. J. Swinburne, F.R.S., has been appointed as arbitrator in the matter. It is hoped that arbitration will not be necessary, but as objections have formally been made, the appointment of an arbitrator is required by the Act.

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OSRAM LAMPS BY AERIAL TRANSPORT

WE are now able, through the courtesy of the General Electric Co., to give an illustration of the aeroplane referred to in a note on page 390 of our last issue, by which a consignment of Osram lamps was delivered by aerial transport last week. The lamps in question were being sent from Worthing to Hove to Messrs. Page & Miles, whose cart met the aeroplane at the Hove Marine Park. The illustration shows clearly the position of the package of lamps on the machine. Mr. Barber, when the lamps had been removed, ascended again and returned to the flying ground at Shoreham. There was a considerable amount of wind at the time, and the flight was made at an altitude of about 1,000 ft. at a speed of 70 to 80 miles per hour.



VALKYRIE MONOPLANE BY WHICH A DELIVERY OF OSRAM LAMPS WAS MADE LAST WEEK.

SHOP FRONT LIGHTING

MR. A. J. CRIDGE, of the Electrical Co., Ltd., has sent us some remarks with regard to the discussion on shop front lighting at the Convention of the Incorporated Municipal Electrical Association (see ELECTRICAL ENGINEERING of July 6th, p. 386). Mr. Seabrook, in his opening remarks, had referred to the figure of 2d. per hour as a charge which could be made in respect of supply to arc lamps. Mr. Cridge says that if Mr. Seabrook charges by means of a time meter, he would not have any trouble; but cites a case in Sheffield, in which the circulation of a leaflet saying that the cost of running a flame arc would be 2d. per hour, led to difficulties with a consumer. The energy was charged at 4d. per unit in the ordinary way, and the consumer's installation in this case consisted of one arc lamp only. The consumer had noted the hours of use, and had refused to pay more than the equivalent of 2d. per hour for the supply. It was held by the Town Clerk that it was necessary to accept the sum offered, as the leaflet constituted a contract to which the Corporation was bound to adhere.

Mr. Cridge also emphasised the usefulness of a business-getting department. He had had charge of one at Sheffield, which, he says, was evidently respected by Mr. Seabrook, who had annexed several members of its staff. He lays stress on the necessity of taking publicity and business-getting seriously, and not playing at it. One frequently sees advertisements requiring men for a few months only—some spasmodic trial being in the air. How on earth, says Mr. Cridge, can anybody expect to get hold of a good man unless they offer him continuity of employment as one of his prospects? In such circumstances, undertakings would only secure a poor specimen, and in consequence, would vote publicity no good. He wonders, from reading the gas papers, whether there really is any distinct idea of business-getting in the gas companies. The gas publicity committee is new, and he thinks that if they had men in the gas industry who made the serious and well-sustained effort which some of the electric supply undertakings do, the gas people would go forward much more rapidly than they had done. He advises electrical men to take in a gas paper and read it carefully week by week, as a means of bringing them to a wholesome state of humility.

Long-distance Telephony.—Experiments have been made in the early part of this week in telephonic communication over the new London-Paris telephone circuit, which includes a "loaded" channel cable (of which full details were given in ELECTRICAL ENGINEERING, March 17th, 1910, page 167) between Edinburgh and Paris, and subsequently between Aberdeen and Paris, as well as Glasgow and Paris. Conversations were easily maintained with the *Daily Mail* Paris office.

Deaths from Electric Shocks.—James Byers, an apprentice at Messrs. Palmer's Shipyard, Jarrow, was killed on Friday from electric shock. The verdict of the Coroner's jury was that the death was in consequence of a motor frame and drilling machine at which he was working not being earthed in accordance with Rule 21 of the regulations made under the Factories Act regarding the use of electricity.

A young man named Robert Anderson received a fatal electric shock on Monday in the Jarrow sub-station of the County of Durham Electrical Power Distribution Co.

Dispute between London Electric Supply Companies.—The dispute between the London Electric Supply Corporation and the Westminster Electric Supply Corporation, concerning an agreement entered into under the London Electric Supply Act, 1908, was before an Appeal Court consisting of the Master of the Rolls, and Lords Justice Farwell and Kennedy, this week. The details of the case were given in ELECTRICAL ENGINEERING, March 9th, p. 132, and April 13th, p. 190. Under the agreement in question, the London Company handed over to the Westminster Company the management of their business in the Westminster area, under certain conditions. The London Company supplied only alternating current, and the complaint was that the Westminster Company were endeavouring to secure all the London Company's customers, and supply them through the Westminster mains. Mr. Justice Joyce, who heard the case, held that in effect the Westminster Company had purchased the Westminster portion of the London Company's business, and that in the absence of any specific clauses in the agreement to the effect that they were not to induce the London Company's consumers to change over, they had not broken the agreement. The Appeal Court upheld this decision.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published July 6, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

13,946/10. **Insulating Material.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co. of America*). Insulating material which increases in disruptive strength with rise of temperature, made from condensation products of phenols and aldehydes dissolved in alcohol and paraffin oil dissolved in amylacetate. This compound can be used for impregnating cloth.

14,045/10. **Terminals.** C. N. STANILAND. Terminals or connectors consisting of an externally threaded metal base, recessed internally, into which fits a loose metal sphere held in position by an internally threaded metal cap. One figure.

14,349/10. **Electric Signs.** H. HIRST and G. MAURICE. Electrically illuminated signs or letters in which the cells or recesses are made integral with or attached to the front of the sign, and not projecting, each carrying a lamp-holder arranged so that the lower part of the filament is below the surface of the device, whereby the lamps are supported by the front with their illuminating portions close to the surface to be illuminated. Three figures.

14,499/10. **Conversion of Currents.** W. A. PRICE. This describes means for converting continuous currents into currents suitable for driving alternating-current motors, comprising relatively moving parts for rapidly interrupting the current or changing the connections, and one or more electrolytic condensers acting in conjunction with auxiliary inductive and non-inductive circuits to obviate sparking. Six figures.

14,680/10. **Turbo-Generators.** SIR C. A. PARSONS and A. H. LAW. A method of securing end connections of turbo-generator armatures by bolts passing through the coils and screwed into the shaft or into a massive steel ring fitted over the shaft, or fitted into such a ring by caulking into dovetail grooves, or with T-shaped heads slipping into undercut grooves. Seven figures.

14,912/10. **Electric Heating Apparatus.** F. A. WILKINSON. Resistance elements for electric heating apparatus comprising an earthenware or similar frame, open at the front or back, in which a row of helical coils of wire in series are suspended by tightening springs in conjunction with strips of mica or other insulating material slotted at intervals, and attached to the ends at convenient points. Three figures.

15,170/10. **Meters.** G. NORTH. Induction-type alternating-current meters in which a magnetic core forming a nearly closed magnetic circuit is used for the flux induced by the shunt coil, and has three polar projections adjacent to the moving disc, each traversed in the same direction by a portion of the shunt flux, the return path being through the support of the core. Series coils are wound on two of the projections, so that the series flux traverses them only in opposite directions. Four figures.

25,923/10. **Enclosed Switches.** V. HOPE. These switches are enclosed in a casing with a hinged cover, and the handle shaft is mounted on the cover and the switch shaft in the base. The shafts, which are parallel to the hinges of the cover, are connected together by levers and links in such a way that when the cover is open it is impossible to close the switch. Three figures.

1,056/11. **Meters.** H. LANDIS and K. H. GYR. A variable rate meter of the class comprising in combination with two sets of counters, an electromagnetic device whereby the two sets are alternatively put into operation according to the strength of the current passing. In order to obviate the error due to the different values of the current at which the magnet picks up and releases, the armature is periodically pulled off mechanically. Two figures.

2,594/11. **Isolating Switches.** SIEMENS BROTHERS DYNAMO WORKS, LTD., and R. A. R. BOLTON. To prevent accidental opening on heavy short circuit, these isolating switches of the ordinary knife form are fitted with a spring locking catch which can only be disengaged by a pull on the ring provided to open the switch by a hooked pole or otherwise. The ring is attached to a lever mounted on the blade which pushes up the catch when it is pulled. One figure.

7,086/11. **Separators for Secondary Batteries.** F. W. HARDY and E. H. HUNGERBÜHLER. Secondary battery separators in the form of baked plates made from compressed powdered material consisting of an aluminium silicate such as China clay, Cornish stone, or ball clay with or without strengthening material.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: KLOSTERMANN, 15,143/10; QUINT [Enclosed, inverted type] 15,710/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: KRANNICHFELDT [Insulating device for twisted ends of electric wires] 7,511/11.

Dynamos, Motors, and Transformers: NEWTON [Constant voltage machines] 15,423/10.

Electric Ignition: SAUERBREY [Means for finding the correct position of the current distributor in] 790/11.

Electrometallurgy and Electrochemistry: HIGGINS (*Higgins*) [Electrolytic reduction of organic bodies] 18,969/10.

Incandescent Lamps: THOMPSON [Construction of small lamps] 15,004/10.

Batteries: JOHN and BERRY [Primary battery] 19,729/10.

Switchgear, Fuses, and Fittings: JOHNSON [Electric switch] 12,184/10; COMPAGNIE DE L'INDUSTRIE ELECTRIQUE ET MECANIQUE [Combined speed and current regulator for series machines] 14,766/10; ADAMS MANUFACTURING Co. (*Cutler Hammer Manufacturing Co.*) [Motor controllers] 14,851/10; THOMAS [Control of series dynamos] 15,388/10; PATON [Interlocking switchbox] 16,486/10; GRAY [Controlling devices for dynamos] 28,246/10.

Telephony and Telegraphy: SMITH (*Huth*) [Receiving method for wireless telegraphy] 24,421/10; GIRARDEAU [Wireless sender with direct excitation] 3,949/11.

Traction: MATHIESON [Automatic device for overhead equipment] 14,534/10; SEFTON-JONES (*Oesterreichische Daimler-Motoren Ges.*) [Collectors for overhead conductors] 25,012/10.

Miscellaneous: MORRIS, ELLIS, and MURPHY [Method of obtaining rapidly varying currents] 14,588/10; KRANNICHFELDT [Production of incandescence bodies] 26,045/10; APOZNANSKI (Manufacture of accumulator plates) 27,176/10; FRISBY [Electric current gauges] 28,994/10; SIEMENS BROS. & Co. and RIBER [Means for fixing and insulating contact springs] 6,736/11 and 6,737/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: LYON, 1,828/11.

Incandescent Lamps: MÖLLER [Manufacture of] 1,162/11.

Telephony: STEINBERGER [Telephone mouthpieces] 13,641/11.

Switchgear, &c.: SIEMENS-SCHUCKERTWERKE-GES. [Automatic regulators for electric circuits] 14,432/11.

Traction: DESCUBES [Control of points and signals] 14,059/11.

Miscellaneous: LOWRY and LEIMBACH [Terrestrial exploring by induction] 14,057/11.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

16,718 of July 14th, 1897. **Electrical Recording Instruments.** H. L. CALLENDAR. An electrical recording apparatus, in which the recording device is attached directly to the sliding contact of one terminal of a galvanometer or relay on a straight bridge wire, the sliding contact being automatically maintained always at the balance-point by means of a pair of clock motors controlled by a relay, and connected to the recording point through a differential gear.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: F. J. GERARD and L. FIEDLER [Electrodes] 6,972/04.

Distribution Systems, &c.: W. E. BURNAND [Transformers] 6,095/01; J. S. PECK [Distribution] 25,330/02.

Electric Ignition: F. R. SIMMS, 7,195/98.

Electrometallurgy, &c.: J. S. MORRISON [Electro-plating] 6,451/98.

Storage Batteries: W. FENNELL [Secondary batteries] 6,145/03; E. COMMELIN and R. VIAN [Secondary batteries] 6,619/04.

Telephony, &c.: J. G. HOLMSTRÖM [Telephones] 6,605/03.

Traction: A. NEELEMANS [Railway switches and signals] 6,546/03; H. W. LAKE (*Hall Signal Co.*) [Railway signals] 6,598/06.

Miscellaneous: O. IMRAY (*Industriewerke Kaiserlautern Metall-und-Porzellan Fabrikation Ges.*) [Lighting and extinguishing gas] 6,625/98; C. ILGNER [Rolling mills electrically controlled] 7,188/02; W. BEST [Miners safety lamps] 6,376/03; E. and E. VACHERON [Illuminated signs] 5,996/05; BRITISH THOMSON-HOUSTON Co. (*General Electric Co. of America*) [Vapour electric apparatus] 6,818/06.

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LOCAL NOTES

Belfast: *Electricity Accounts.*—There was a net profit of £13,766 upon the working of the electricity undertaking last year. The total number of units sold increased by 8 per cent. The profit has been allocated as follows:—Depreciation of motors on hire, £1,500; renewal suspense account, £7,266; in aid of rates, £5,000. A proposal by the Electrical Engineer for the extension of the electricity works has been postponed until the next meeting.

Birkenhead: *Electric Lighting Accounts.*—The net profit of £952 upon the electric lighting undertaking for last year has been transferred to relief of rates, the amount in the previous twelve months being £1,000. The renewals fund now stands at £13,899, and the outstanding debt is £127,357, against which there is the sum of £2,794 in hand for sinking fund and stock redemption fund, at present unapplied..

Bradford: *Trolley Omnibuses.*—The Tramways Committee recommend that application be made for a Provisional Order authorising the running of trolley omnibuses on two new routes in the city.

Brighton: *Trolley Omnibuses.*—The Tramways Committee recommend that a deputation visit Leeds to inspect the trackless trolley system there, and that consideration be given to the question of establishing a similar system of traction along the Preston Road.

Carnarvon: *Electric Lighting of Castle.*—Among the considerable alterations which have been made to Carnarvon Castle in connection with the investiture of the Prince of Wales to-day is the introduction of electricity. Supply is being given from the local electricity works, and altogether some 10,000 c.p. have been installed. The installation work was carried out by the National Electric Construction Co., under instructions from the Office of Works.

Chittagong, India.—A licence has been granted by the Municipal Commissioners of Chittagong to the agents of the A. E. G. Lahmeyer Company for the supply of electric lighting and power to that town. Chittagong is the headquarters of the Assam Railway, and it is understood that the Railway is supporting the scheme. The main streets are to be lighted, and the power will be used for the driving of the punkahs, or fans, so much used in that part of India. The preliminary scheme is being drafted by Mr. H. R. Speyer.

Dewsbury: *Dispute with Tramways Company.*—The Council have referred to a special Committee a dispute with the tramways company with regard to suggested tramway to Dewsbury Moor. The tramway company have refused to construct a line in this direction, as they do not think it will be a financial success within a reasonable period.

Glasgow: *Electricity Accounts.*—The accounts of the Electricity Department for the year to May 31st show a net surplus of £6,680, after meeting capital charges and £44,552 for depreciation. The surplus has been transferred to reserve, which now stands at £27,468. The cost per unit has been reduced by 0·1d. During the year the scheme whereby domestic consumers can obtain a supply of energy for cooking, heating, and other domestic purposes at a flat rate of 1d. per unit, without separate wiring, has been adopted with favourable results. Although the scheme was only put into operation in October, up to the present 300 consumers have availed themselves of it.

Gloucester: *Electricity Accounts.*—The electricity accounts for the past year show a surplus, after meeting capital charges, of £1,077. After meeting a sum for the purchase of meters, a balance of £941 is carried forward. It has been decided in future to purchase all meters out of revenue. The number of units sold increased by 181,842, and the increased revenue from private consumers amounted to £750.

Linlithgow: *Electric Lighting.*—Mr. George Balfour, of London, has given notice of his intention to apply for an Electric Lighting Provisional Order.

London: *Fulham: Electricity Profits.*—There was a net profit of £3,861 upon the electric lighting undertaking last year, against £4,551 in the previous twelve months.

Oulton Broad: *Electric Lighting.*—The Oulton Broad Electricity Co., Ltd., have agreed to sell their undertaking to the Council, and to enter into a contract to carry on the electricity works which are to be erected. The agreement is, of course, subject to the approval of the Board of Trade.

Sheffield: *Trolley Omnibuses.*—The Tramways Committee have presented a report, in which considerable extensions of the tramways are contemplated. They also recommend the introduction of trolley omnibuses along the new Rivelin Valley Road, and back to Manchester Road.

Torquay: *Tramway Extension.*—Trial runs have been made over the extension of the Torquay tramways to Paignton. Everything went off satisfactorily, and the line now awaits the Board of Trade inspection.

West Ham: *Electric Tramway Accounts.*—There was a net profit of £8,513 upon the working of the tramways last year, after the payment of £5,071 in rates and taxes, against £6,972 in the previous year. The sum of £977 has been set aside for additional top covers to cars; alterations for running cars on the conduit system at Mile End absorb £612; and £6,923 are added to renewals fund.

Wolverhampton: *Electricity Accounts.*—There was a net profit of £5,231 upon the working of the electricity undertaking for the past year. The gross profit was equal to 8·4 per cent. on the capital expenditure. The new 2,000-k.w. generating set is not completed and is nearly nine months overdue. The loss of the services of this set placed the undertaking in a very serious position during the last winter, the actual load upon the station at times being considerably in excess of the normal capacity of the generating plant. As a result of heavy and continuous overloads, certain breakdowns occurred which involved abnormal expenditure in repairs and maintenance. Mr. Shawfield estimates the abnormal expenditure under various heads during the year at £2,838. In spite of this the cost per unit has been reduced from 0·562d. to 0·557d. It has been decided to allocate in future all expenditure on free wiring to revenue instead of raising further loans for this purpose. There was an increase of 2,528,369 in the number of units sold for all purposes during the year; the total number of units sold being 10,818,089. The bulk of the increase is for power purposes, but the Committee report with satisfaction the largest increase in the lighting units since 1903.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Aldershot.—An inquiry was held last week concerning a loan of £2,500 for extensions to the electricity works. It is proposed to instal a Diesel engine.

Barrow-in-Furness.—Overhead mains extensions are to be carried out at an estimated cost of £407.

Bradford.—Tenders are invited for two water-tube boilers, stokers, and superheaters, and one 12-ton electrically-operated overhead crane. (See an advertisement on another page.)

Bradford.—It is proposed to extend the electric supply mains to Apperley Bridge at an estimated cost of £4,145.

Leigh, Lancs.—The Corporation have applied to the Local Government Board for permission to borrow £6,300 for extensions to the electricity works.

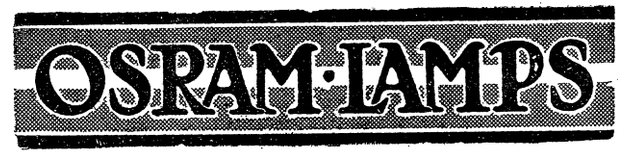
London: *Islington.*—The L.C.C. have sanctioned a loan of £5,500 for extensions to the electricity works. A proposed loan of £1,500 for transformers has been reduced by the Finance Committee of the L.C.C. to £500.

Sheffield.—Extensions to the electricity undertaking at an estimated cost of £61,000 are recommended by Mr. S. E. Fedden, the Chief Electrical Engineer. The new plant will include three boilers, economisers, a 6,000-kw. turbo-alternator, and switchboard.

Southampton.—The Corporation invite tenders for a motor-generator, also a condenser. (See an advertisement on another page.)

Torquay.—An inquiry has been held concerning a loan of £5,000 for electrical extensions.

Turton, Lancs.—The district Council have decided to spend £4,500 on its electricity undertaking. The Board of Trade has consented to the use of overhead wires in certain parts of the district.



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Wolverhampton.—Tenders are invited for a 264-cell 6,000-ampere storage battery, &c., two motor-driven boosters, and switchgear and instruments. (See an advertisement on another page.)

The Electricity Committee recommend a scheme of extensions at the Commercial Road generating station at an estimated cost of £19,700.

WIRING

Aberdare.—Drill hall and caretakers' quarters for Glamorgan Territorial Force Association. Architects, Messrs. Evans, Williams & Evans, Pontypridd.

Acton.—School at Rothschild Road, Acton Green. Education Department.

Bacup.—Tenders are invited for the electric wiring and fitting of the baths and other Council premises.

Belfast.—New buildings at Queen's University. Architect, Mr. W. H. Lynn, Belfast.

Bolton.—Extensions to Townleys Hospital. Architect, J. Ward, 24 Mawdsley Street.

Edinburgh.—Hall in East London Street. John Hope's Trustees. Proposed new police headquarters.

Glasgow.—Church and offices at corner of Battlefield and Cathcart Roads. Architect, J. Galt.—New bobbin mills, by Gibb Timber & Bobbin Co.

Huddersfield.—New school at Woodhouse. Architects, Messrs. J. B. Abbey & Son, 34A New Street.

London.—New premises for the Royal Geographical Society.

Maidenhead.—Proposed town hall.

Newcastle-on-Tyne.—New hall near Northumberland Street.

Shipley.—Extensions to public slaughter house. Architect, Mr. W. Illingworth, Market Street, Bradford.

MISCELLANEOUS

Australia.—Specifications may be seen at 73 Basinghall Street of telegraph, telephone and electric light material for which tenders are required by August 23rd at the office of the Deputy-Postmaster-General, Sydney.

London: *L.C.C.*—The Highways Committee recommend the extension of the tramways in East India Dock Road to the county boundary at Barking Road Bridge, upon the conduit system, at an estimated cost of £27,880.

In connection with the purchase by the L.C.C. of the trolley lines belonging to the Metropolitan Electric Tramways, Ltd., between Manor House and Finsbury Park, an expenditure of £31,600 is recommended upon reconstructing this line for working also upon the conduit system.

Melbourne.—Tenders are required by August 8th for measuring instruments for Melbourne G.P.O. Particulars from Commonwealth Office, London.

Northwich.—Inquiries are being made as to the relative cost of electricity and gas for street lighting.

Russia.—Tenders by August 1st for tramway construction by the Municipality of Stavropol, Caucasus.

Spain.—According to the *Board of Trade Journal*, tenders will be received up to July 24th at the office of the *Gobierno Civil de la Provincià de Terida*, Terida, for a telephone system at Cervera, and by July 26th at the office in Santander for telephones at Torrelavega.

Torquay.—Network fuses are to be installed at an estimated cost of £340.

York.—Extensions to the city tramway system are under consideration.

Case under the Home Office Factory Regulations.—The Charing Cross, West End & City Electricity Supply Co. have been summoned at West Ham for failing to comply with the Home Office Rules at their Bow generating station. The case arose from the fact that a man named G. C. Avent received a severe shock from 10,000-volt connections behind the switchboard, and, although he was not killed, received injuries necessitating the amputation of one arm. It appeared from the evidence that the man acted contrary to instructions in entering the H.-T. chamber, and the summons was eventually withdrawn.

Electrical Trades' Benevolent Fund.—The following have been received since the last list was published in ELECTRICAL ENGINEERING. Subscriptions:—J. Y. Fletcher, £1 1s.; Brook, Hirst & Co., £1 1s.; Frederick Smith & Co., £2 2s.; Breedon, Joseph & Co., £2 2s.; R. Lynen, £1 1s.; Pritchetts & Gold, £1 1s. Donations:—Eckstein, Heap & Co., £5 5s.; J. & H. Grevener, £3 3s.; J. W. Mumby, 6s.; H. Lotery & Co., £2 2s.; Gillespie & Beales, £1 1s.; T. W. Lench, £2 2s.; Morgan Crucible Co., £1 1s.; Brown Bayleys Steel Works, £1 1s.; Robert Kearsley & Co., £1 1s.; J. Yates & Co., £1 1s.; Vacuum Oil Co., £1 1s.; Martin, Earle & Co., £3 3s.; Walter Scott, £2 2s.; Brecknell, Munro & Rogers, £1 1s.

TENDERS RECEIVED AND ACCEPTED

Blackburn.—The Electricity Committee have placed the following contracts:—Messrs. John Stirk & Sons, Ltd., a lathe; Messrs Yates & Thom, a boiler; and the British Westinghouse Electric and Manufacturing Co., Ltd., a 2,000-kw. turbo-generator and two rotary converters.

Bolton.—The tender of W. Townson & Sons for a new car shed with electricity works by J. Booth & Sons has been accepted.

Dudley.—The tender of Messrs. Belliss & Morcom for a new steam engine at £675, plus £30 for alterations to the foundations of the discarded engine, has been accepted.

Gloucester.—The tenders of Messrs. Siemens Bros. & Co. for the supply of feeder and distributor cables at £1,211 10s., and that of the British Insulated & Helsby Cables, Ltd., for cables at £817 3s. and distribution pillars at £199 10s., have been accepted.

London: *L.C.C.*—The Highways Committee recommend the acceptance of a tender by Messrs. Gardner, Locket, & Hinton, Ltd., for 150,000 tons of washed small nuts steam coal from the Grangerigg Coal Co.'s pits, Lanark, at 10s. 11d. per ton.

The following tenders have been received for four car traverses for the Streatham, Camberwell and Hammersmith car sheds:—Brush Electrical Engineering Co., £2,297; Dick, Kerr & Co., £2,452; Hurst, Nelson & Co., £2,525; Cowans, Sheldon & Co., £2,592; S. S. Whiteley & Co., £2,768; S. H. Heyward & Co., £2,780; Heenan & Froude, £2,962; Stothert & Pitt, £3,822. The first named tender is recommended for acceptance.

Battersea.—Contracts are to be entered into with Mr. Haydn Harrison and the Foster Engineering Co. for street lantern and metal filament lamps respectively.

Nottingham.—The Stanton Ironworks Co., Stanton, near Nottingham, has placed an order with Messrs. Fraser & Chalmers for two turbines and blowers to work in conjunction with existing reciprocating engines in connection with their extensive blast furnaces.

Among important orders recently received by the British Westinghouse Co., we note the following:—Greenock Corporation, two 2-450-k.w. rotary converter sets D.C. switchgear, &c.; Sir William Arrol & Co., for Admiralty Portsmouth, 4-50, 2-5, 2-10-h.p., 440 v. type A. motors, control gear and spares; Cowan Sheldon for Imperial Japanese Navy, 3-60 h.p., 1-25 h.p. 220 v. 500 r.p.m. G motors, control gear and spares; Ransomes & Rapier, Ltd., for Admiralty, Devonport, 1-2, 1-4, 1-6 1-7, 2-15, and 2-20 h.p. D.C. motors 440 v. and control gear and spares; B.A.G.S. Railway, Co., Ltd., 4-20 h.p. 440 v. 1450/1500 r.p.m. three-phase 50 per 50 CB, and starters 1-25, 3-15, 3-10, 1-5 h.p. 550 v. 950 r.p.m. G motors and starters; Cjers, Mills & Co., Ltd., one Westinghouse Rateau blower to deliver 25,000 c.ft.. free air per min. against terminal pressure of 6½ to 8 lbs. per sq. in. direct driven by 900 h.p. 3,000 r.p.m. single-velocity wheel turbine; Manchester Corporation, 50 magnetic brakes; Blackburn Corporation, one 2,000-kw. 3,000 r.p.m. A.C. turbo-generator set with surface condensing plant, &c.; one 800-kw. rotary; South Shields Corporation, one 1,500-kw. high pressure turbine (impulse type) coupled to one 1,000-kw. D.C. generator and one 1,100-kw. A.C. generator in tandem with surface condensing plant, Lea recorder and Brown Boveri regulator; East Indian Railways, Co., two 400-kw. D.C turbo-generators and spares; J. Howden & Co., one 1,000-kw. turbo type alternator; Randfontein Mines, one 265 and one 40 b.h.p. A.C motors; La Plata Trams, ten 200 tram-car equipments.

Annual Conversazione of the Institution of Electrical Engineers.—A large number of guests, including several distinguished visitors, were received by the President and Mrs. Ferranti at the conversazione last Thursday at the Natural History Museum, South Kensington. Musical selections were given by the band of the Royal Engineers and the Alexandra Ladies' Quartette. The function was very successful, even if, owing probably to the heat, it was not quite so well attended as in former years.



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APPOINTMENTS AND PERSONAL NOTES

An additional commercial assistant is to be engaged in the Battersea Council's electricity department at a salary of £2 per week and commission.

Mr. Guy Campbell has recently resigned his position with Holophane, Ltd., and is now sales manager for the Benjamin Electric, Ltd., of 117 Victoria Street, Westminster, S.W.

The Beckenham Electricity Committee recommend that the salary of Mr. J. E. Tapper, Borough Electrical Engineer, be increased from £300 to £350 per annum.

The Ealing Electricity Works' staff have presented Mr. R. Golding, shift engineer, with a watch on the occasion of his leaving to take up a position in Australia.

The Marylebone Electric Supply Committee call the attention of the Council to the termination, in March, 1912, of the agreement with Mr. Arthur Wright as Consulting Engineer, and recommend that the six months' notice provided for in the agreement be given.

The following increases of salary have been sanctioned by the Dover Corporation :—Mr. L. W. Woodman, Chief Electrical Engineer, from £425 to £475 per annum; Mr. R. C. Harpur, Mains Superintendent, from £200 to £225 per annum; and Mr. E. W. Smith, Works Superintendent, £200 to £225 per annum.

The late Mr. E. Boulnois, Chairman of the Central Electric Supply Co., left estate valued at £55,157.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. George Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £58 15s. to £59 5s. (last week £58 10s. to £59).

Change of Address.—Messrs. J. & H. Grevener, formerly of Eldon Street House, E.C., and 7 and 9 Finsbury Street, have removed to a commodious six-floor building at 40 Southwark Street, S.E

Bruce Peebles & Co.—The annual works outing was held this year at Crieff. A party numbering over four hundred left Edinburgh soon after seven in the morning. Sports, drives, walks, golf, &c., were enjoyed to the full. Lunch and tea were served in the Porteous Hall, the party returning to Edinburgh late in the evening.

The Benjamin Electric.—This firm have opened new offices and showrooms at 117 Victoria Street, S.W., and have purchased the stock and goodwill of C. F. Trippe, of 36 Brooke Street, Holborn. The works and warehouse remain at 1a Rosebery Avenue.

Reduction in Cable Prices.—Owing to the fall in the market price of rubber, reductions are being made by the India-rubber, Gutta Percha & Telegraph Works Co., British Insulated & Helsby Cables, and the members of the Cable Makers' Association in the prices of 2,500, 600, and 300 megohm 600-volt C.M.A. and Association pure Indiarubber flexibles, the discounts on which are now, as from Monday last, 27½ per cent.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Marconi's Wireless Telegraph Co.—The report for 1910 states that during the year the business of the Company showed considerable expansion, the net profit amounting to £60,513. It is proposed to recommend a dividend upon the ordinary shares, but the amount is not stated. Mention is made of the fact that Mr. Marconi has applied for a patent for a duplex system of wireless telegraphy, the invention having already been submitted to a successful test at the Clifden station. Reference is also made in the report to the new company which will fit all vessels flying the German flag. Both the Marconi and the Telefunken companies hold shares in this, but the work of installation will be carried out exclusively by the Deutsche Betriebsgesellshaft für Drahtlose Telegraphie m.b.H. under licences from the other two companies.

Puebla Tramways, Light & Power.—A net profit of £61,678 has been made, out of which, after paying interest, &c., £5,440 has been carried forward.

Electric Construction Co.—The net profit for the year to May 31st was £15,042 after meeting debenture interest and crediting £5,000 to depreciation. The directors recommend a 2½ per cent. dividend on the ordinary shares, the transfer of £5,327 to general reserve, and to carry forward £6,131. The directors report a better demand for electrical machinery, and a marked increase in net profit during the past year, although little improvement has taken place in prices.

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Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
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Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Union Electric Co., Ltd., Park Street, Southwark, S.E.

ARMATURE REPAIRS.
Marryat & Place, 28, Hatton Garden, E.C.

BOILERS.
Stirling Boiler Co., Ltd., 58, Victoria St., Westminster, S.W.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82-85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
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Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

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Belliss & Morcom, Ltd., Birmingham.
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Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

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Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

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Krupka & Jacoby, 11, Queen Victoria St., E.C.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

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Bastian Meter Co., Ltd., Kentish Town, N.W.
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WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

An article by Messrs. F. J. Moffett and N. B. Rosher describes an alternating current lift installation, in which use is made of a special form of centrifugal slipping clutch. (Page 413.)

In a Paper read recently before the South African Institute of Electrical Engineers, Mr. L. B. Woodworth described some forms of magnetic separator suitable for the concentration of tin ores. (Page 413.)

Brief particulars are given of the large single-phase locomotives now being constructed for the Dessau-Bitterfeld section of the Prussian State Railway system. The Allgemeine Elektricitäts-Ges. and Siemens-Schuckertwerke Ges. are each supplying electrical equipments with Winter-Eichberg and compensated series motors respectively. (Page 414.)

We give some notes on the electrical equipment of the new White Star liner *Olympic*. The generating plant aggregates 1,600 kw., and extensive use is made of electricity for power as well as lighting. (Page 404.)

An original communication to the Institution of Electrical Engineers, by Mr. W. R. Cooper, describes a new primary battery in which the electrolyte is continuously forced through a porous carbon electrode. (Page 415.)

Mr. Horace Boot, consulting electrical engineer, was unsuccessfully sued in London on Monday for a "quid pro quo" in connection with an introduction to members of the Chichester District Council which resulted in the formation of the Chichester Electric Light & Power Co. (Page 415.)

Among the specifications published by the Patent Office on Thursday last week was one by J. G. Mathieson describing an automatic contact device in connection with the overhead equipment of tramways. B. A. Quint has patented an enclosed arc lamp of the inverted type, in which the striking mechanism is effected by a shunt coil. A receiving method for wireless telegraph work by W. O. Smith makes use of a periodic alteration of the capacity and self-induction. A portable insulator for wire-ends in connection with ignition work is protected by J. Krannichfeldt, and a novel process for the manufacture of highly porous composition accumulator plates is covered by J. Apoznanski. (Page 416.)

Among our "Electric Traction Notes" this week the case for the single-deck tramcar as against the double-decker is alluded to. (Page 417.)

Experimental Automatic Telephone Exchanges are being established by the Post Office at Epsom and Caterham Valley on the Strowger and Lorrimer systems respectively. A further statement with regard to the position of the National Telephone Co.'s staff was made by the Postmaster-General on Friday.—Legal proceedings are pending between the Marconi Co., Ltd., and the Lodge-Muirhead Syndicate, each side alleging that the other has infringed its patents. Other notes on telephone and telegraph matters will also be found on p. 417.

It is proposed that the Corporation should acquire the whole of the British Electric Traction Co.'s tramways in Birmingham.—Complaint is made in the annual report of the West Ham borough electrical engineer at the short period allowed for loans for the Sales Department.—An arbitrator is to be appointed to deal with the purchase by the L.C.C. of the London

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United tramways in London.—An unsuccessful libel action was taken against the Bootle Council's electrical engineer last week.—The L.C.C. have allowed the Stepney Council to suspend for three years the repayment of a loan of £15,700 for mains. (Page 418.)

ELECTRIC lighting schemes are under consideration at Biddulph, Cardigan, Rugeley, and Douglas (I.O.M.). —Local Government Board enquiries have been held at Doncaster (£12,000) and Luton (£13,000).—A loan of £8,000 has been sanctioned at Ilford, a 1,000-k.w. generating plant is required by a firm at Wolverhampton, plant extensions are to be carried out at Newcastle-under-Lyme, and lead-covered cable is required at Wednesbury. (Page 419.)

UNDER a new agreement, Edmundson's Electricity Corporation are to finance the Urban Electric Supply Co. to the extent of a further £100,000. (Page 420.)

CATALOGUES AND PAMPHLETS, &c., RECEIVED

AUTO-TRANSFORMERS.—A list from Messrs. Carney & Pearn, Ltd. (Nutsford Vale Works, Manchester, S.E.; London Office, Record Electrical Co., Caxton House, Westminster), gives particulars of "C. & P." auto and double-wound transformers from 0·5 to 10 kw. These are designed for low voltage drop, and are claimed to be quite silent in working.

FANS.—The new electric fan list of the Sun Electrical Co., Ltd. (118–120 Charing Cross Road), besides containing a full range of all the more ordinary forms of fans, includes some interesting novelties in the shape of a combined fan and table lamp, and a combined table fan and fruit dish.

TRANSFORMERS.—The Foster Engineering Co. (Morden Road, Wimbledon) have put on the market a special heavy-current step-down transformer for supplying electric furnaces used in lamp filament manufacture. The output is 2,000 amperes at 6 or 8 volts. This piece of apparatus is illustrated on a new leaflet, which also shows a group of regulating transformers recently completed for a metal filament lamp works.

METAL FILAMENT LAMPS.—A new edition of their list of Foster metal lamps is to hand from the Foster Engineering Co. (Morden Road, Wimbledon, S.W.). These lamps are made entirely at the Wimbledon works, and range in size from the 10-c.p., 25-volt lamp to the 600-c.p. lamp made for voltages up to 260. They are made in a variety of different bulbs, and exceptional strength is claimed for the filaments.

SIGNS.—A leaflet from Simplex Conduits, Ltd. (113–117 Charing Cross Road) illustrates several attractive patterns of illuminated signs which they are making up in their works in various metals and finishes, according to individual requirements. They are so designed as to combine advertisement and window lighting, and several alternative arrangements of lamps may be used.

WATERTIGHT WALL PLUGS.—Messrs. A. Reyrolle & Co., Ltd. (Hepburn-on-Tyne) have sent us a new leaflet describing a pattern of 50-ampere watertight wall plug, which they have introduced to meet the demand for a strongly-made plug for crane work, docks, shipyards, &c. An extra pin is provided for the earth connection, and the design is such that this pin makes contact before the current-carrying pins, and breaks after them.

CENTRAL LONDON RAILWAY.—A most handsome Coronation Souvenir in the form of a book illustrated with three-colour reproductions of sketches of London, and with the letter-press printed in gold, has been issued by the Central London Railway, with the title of "Some London Views," interesting particulars of the railway and the districts through which it runs are given.

CONVERTERS, MOTOR GENERATORS, METAL FILAMENT LAMPS.—Leaflets dealing with the above, and embracing particulars of small double commutator converters and motor generators, driven by A.C. motors, for cinematographs and other purposes, and the "Leanda" metal filament lamp, are to hand from the Electrical Engineering & Agency Co., Ltd. (Bank Buildings, 109-111 New Oxford Street, W.C.). This is the first time we have mentioned the name of the company in this column, and our readers will be interested to know that the managing director of the company is Mr. Charles Leven, who was formerly manager of the Lahmeyer Electrical Co., Ltd., whose offices have been taken over by the new company.

Association of Consulting Engineers.—Since the draft rules, drawn up by the Provisional Committee, were circulated in December last, a number of meetings have been held to deal with points that have been raised by various engineers, and negotiations have been in progress, which, however, were not completed in time to call a general meeting to consider the rules and formally to enrol members during the present month, as had been hoped. Meantime, Mr. Dykes, the honorary secretary, would be obliged if all letters were sent to his new address, 11 Victoria Street, Westminster, S.W.



FOREMAN:—We are nearly ready, mum. We are plugging the wall ready to put up the fuse board to-morrow.
LADY OF THE HOUSE:—Fuse board! I won't have such a thing in the house. The young man from the Gas Company says that there are sometimes fires from the fusing of electric wires.
FOREMAN (*with great presence of mind*):—Very well, mum. Shall I put in a distributing board instead? It will cost very little more and we always use them in the best houses.

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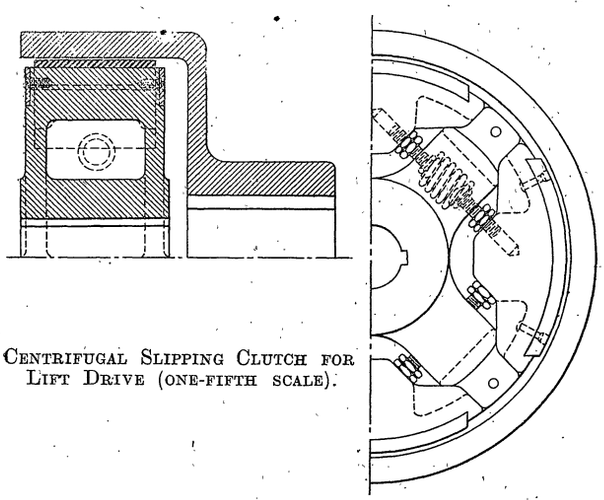
A.-C. MOTORS FOR LIFTS

By F. J. Moffett and N. B. Rosher

ALTHOUGH it is now coming to be recognised fairly generally that there is no serious difficulty in driving an ordinary lift-gear by means of an A.-C. motor, there is still a certain amount of hesitation on the part of many engineers in adopting this type of motor. It may, therefore, be of use at the present juncture to give a short description of some lifts which have been equipped with three-phase motors to our specification.

The lifts in question are three in number, and are intended for an average load of 5 cwt., but can deal with a load of 8 to 10 cwt. without any difficulty. The speed is 80 ft. per minute in the case of two of the lifts, and 100 ft. in the case of the third. In each case the motor is a 5 h.p. 440 volt, 25 cycle, 750 r.p.m., three-phase squirrel-cage motor, which drives the worm of the worm-gear by means of a patent slipping clutch, both motor and slipping clutch being supplied by the Lancashire Dynamo & Motor Co. There are two reasons for the employment of this slipping clutch: firstly, because squirrel-cage motors possess a bad starting torque, and secondly, the cage requires to be started without shock.

This type of slipping clutch, which is shown in the accompanying figure, depends for its action on the centrifugal effect. The part of the clutch which is fixed on the motor spindle consists of two or more slipper blocks, which slide on radial arms moving outwards in a radial direction against the action of springs as soon as the motor gets up speed. The other part



CENTRIFUGAL SLIPPING CLUTCH FOR LIFT DRIVE (ONE-FIFTH SCALE).

of the clutch consists of a hollow pulley keyed on the worm shaft. The slipper blocks are not in contact when the clutch is at rest, but fly outwards when the motor reaches a certain speed, and bear on the inner surface of the pulley with a pressure depending on the speed, the weight of these blocks, and the strength of the springs controlling same.

The current taken by a squirrel-cage motor when at rest is several times as much as the current taken when developing full load torque at normal speed, and the torque which this type of motor is capable of exerting when starting from rest is usually only a fraction of its full-load value. If, however, the rotor is free to rotate without load until it reaches, say, 50 per cent. of its normal speed, the case is entirely different. The time during which a heavy starting current is demanded is reduced enormously, and the load comes on gradually only after the predetermined speed point has been attained. At 50 per cent. normal speed and above this the torque, which can be exerted by the motor, may rise as high as twice the normal torque corresponding to full load or even more. With the motor spindle coupled to the worm shaft by means of this device, the complicated controller, with arrangements for inserting resistance in circuit at starting and cutting out same as the motor gains speed, becomes unnecessary and the power lost in heating these resistances is saved. The controller used in the lifts in question is a simple oil-immersed reversing switch of the barrel type, operated by means of the usual hand rope passing through the cage. The starting-current is, of course, heavy, but only lasts for a second or two, and has no disturbing effect on the rest of the power system.

It will be of interest to give the power taken by one of these lifts as compared with those operated by direct-current: we are in a position to give these figures as one of the lifts was converted from direct- to alternating-current working. It may be mentioned in passing that the reason for the adoption of alternating current for these lifts was that the supply for power and lighting throughout the works was of this nature, and it was in consequence inconvenient and expensive to have a supply of direct current merely for the purpose of the lifts; also the price per unit for alternating current was less than half that for direct current.

Lift Driven by 5 h.p. 220-volt D.-C. Motor.

Cage empty: Down, 2·5 E.H.P.; up, 2·05 E.H.P.
Cage+5 cwt.: Down, 1·75 E.H.P.; up, 3·70 E.H.P.
Average, 2·5 E.H.P.

Lift Driven by 5 h.p. 440-volt Three-phase Motor.

Cage empty: Down, 2·25 E.H.P.; up, 0·5 E.H.P. (generating).
Cage+5 cwt.: Down, nil; up, 2·5 E.H.P.
Average, 1·06 E.H.P.

It will be seen that the result of the conversion is remarkable from the point of view of the consumption of energy, the units used in the case of D.-C. working being more than twice as many as those required when working with three-phase current. Part of this economy is, of course, due to the fact that under certain conditions the three-phase motor is running as a generator slightly above synchronous speed and returning power into the mains, and part may be due to the D.-C. motor not being so efficient and requiring more energy for field excitation. In the powers given no account is taken of the C^2R. losses in the resistances, so that the total economy is even greater than is indicated by the above figures. The conversion to A.-C. working consisted in removing the D.-C. motor and brake magnet, and substituting for them a three-phase motor and single-phase brake magnet: no alteration whatever was made in the gearing, cage, balance-weight or guides.

In the case of two of the lifts which were equipped for three-phase working, single-phase solenoid brakes were used, but it was found that these caused considerable vibration owing to the low periodicity of the supply, which was 25 cycles per second. In the third lift a three-phase solenoid brake was employed, and this entirely removed the vibration.

MAGNETIC SEPARATORS

A PAPER on this subject by Mr. L. B. Woodworth, read in January at a meeting of the South African Institute of Electrical Engineers, is contained in a recent issue of the Transactions of this Institute. Magnetic separators are in extensive use in South Africa in connection with diamond and gold mines, but the author deals particularly with forms suitable for application in concentration of tin ores. He summarises the requirements of a good separator as follows: Simple in design, low power consumption, easy to repair, and flexible as regards adjustment, and speed; it should introduce the mixture to be separated into the magnetic field slowly and at a constant speed; the strength of the magnetic field

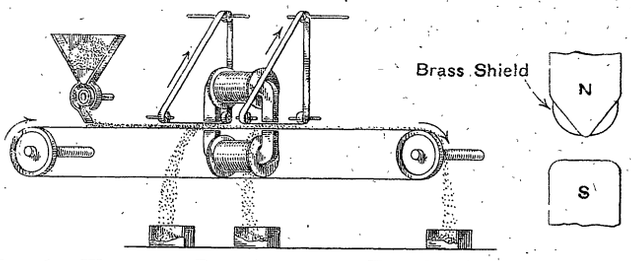


FIG. 1.—WETHERILL-ROWLAND SEPARATOR.

FIG. 2.—ARRANGEMENT OF POLES.

should be adjustable, and should act with uniform intensity throughout the separating zone; mechanical design of throw-"off" horns, chutes, conveyor, and cross belts should be so arranged as to permit an easy removal of the magnetic particles from the separating zone.

The adjustment of the field can be made either by series or parallel grouping of the coils, by rheostat or voltage variation, or by variations in the length of the air-gap. He then proceeds to describe the Wetherill-Rowland separator shown diagramatically in Fig. 1. In this apparatus the upper-pole field is bevelled and has brass shields, and the lower-pole piece is flat, as shown in Fig 2.

This arrangement gives a highly concentrated field along the lower edge of the upper-pole piece, which is necessary in the separation of feebly magnetic minerals. The ore is fed from the hopper (Fig. 1) upon the conveyor belt. As the magnetic

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particles pass through the separating zones they are attracted to the upper pole-pieces, and are held to the under side of the cross belts by the magnetic field. The cross belts travel at right-angles to the conveyor belt, and carry the magnetic particles away from the separating zone.

The gaps are usually so set that the strongly magnetic oxides of iron will be thrown off by the first and the more feebly magnetic impurities by the second. A two-zone machine can deal with 25 cwt. of ore per shift of ten hours, and the precentage of metallic tin can be raised from 30 to 74

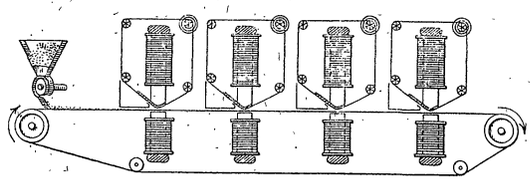


FIG. 3.—IMPROVED SEPARATOR SUGGESTED BY THE AUTHOR.

with a consumption of 17 amperes at 65 volts. Four-zone machines are also described, which can remove all but 3 per cent. of the feebly magnetic matter on cross belts. A certain amount of this, which falls back on to the side of the main belt, can be removed by a deflecting scraper or by an electrostatic separator. Suitable adjustment of the speed of the belts is important. Separate variable-speed motors should be employed for the conveyor and feed gear and for the cross belts, as it is advisable to be able to control the relative belt speeds during operation.

One disadvantage in operation of a separator of the cross-belt type is that the particles change their direction of motion when entering a separating zone. The particles travel at a certain speed and direction when on the conveyor belt, and the instant they come under the influence of the upper magnetic pole they are drawn against the under side of the cross belt and travel at increased speed and in a direction at right-angles to their former direction. In the separation of tin ore the tin particles have a tendency to move over on the conveyor belt to the side where the throw-off horns are, and in many cases it will be found that tin is carried over.

To meet this objection the author proposes the design shown in Fig. 3, where, during separation, the magnetic particles are drawn up against the under side of the take-off belt of the upper-pole piece, and without change in direction of motion are drawn up the throw-off shoe until carried out of the influence of the magnetic field. Further separation can be effected on the spray-pole system in the case of some classes of ores.

A form of tube separator was also described, in which a brass drum revolves on rollers between the poles of a magnet, with one pole of small surface and one of larger surface. Inside is a fixed inclined trough, down which the ore travels. The magnetic particles are lifted out of the trough and are held against the side of the tube, being carried over until they are out of the influence of the magnetic field. They then fall into the launders and are washed away.

Death on South London Single-Phase Railway.—An employée in the telegraph department of the London, Brighton, & South Coast Railway was engaged near the overhead traction wires last week at the Crystal Palace Low Level Station, when a steel tape which he was using came in contact with them. He received a severe shock and fell from the ladder upon which he was standing, and when picked up was found to be dead.

Osram Lamps in Siam.—We are informed by the General Electric Co. that the funeral rites for the late King Chulalonkorn were conducted in the light of Osram lamps, aggregating upwards of 100,000 c.p. The Eastern agents of the G.E.C. state that the Siamese papers referred to the brightness of the scene as indescribable.

The Institution of Mechanical Engineers.—The following Papers are down for reading at the Zürich meeting of the Institution of Mechanical Engineers on Tuesday and Wednesday, July 25th and 26th. Electric Traction in Switzerland, by M. E. Huber-Stockar (Zürich); Results of Experiments with Francis Turbines and Tangential Turbines, by Dr. F. Prásil (Zürich); Some New Types of Dynamometers, by Dr. A. Amsler (Schaffhausen); Rack-railway Locomotives of the Swiss Mountain Railways, by Mr. T. Weber and Mr. S. Abt (Winterthur); Steam Turbines, by Mr. H. Zoelly (Zürich); Modern Diesel Oil Engines, by Mr. F. Schubeler (London); High Pressure Water Power Works, by Mr. L. Zodel (Zürich).

ELECTRIC LOCOMOTIVES FOR THE PRUSSIAN STATE RAILWAYS

SOME particulars of the single-phase locomotives for the Dessau-Bitterfeld section of the Prussian State Railway system are given in *Elektrische Kraftbetriebe und Bahnen*. These are of the now almost universal design, in which one, or at most two, large motors are raised well above the frame, and drive the wheel axles through coupling-rods and an intermediate shaft or false axle. This construction gives better running qualities owing to the high centre of gravity of the whole locomotive, and enables the motors to be readily inspected and repaired. Two different patterns are being constructed, one for the express and normal passenger trains, and the other for the heavy goods service. They were designed by the Königliche Eisenbahndirektion, Halle, with the co-operation of the Hanover Maschinenbau A.-G., Siemens-Schuckertwerke Ges., and the Allgemeine Elektricitäts-Ges.

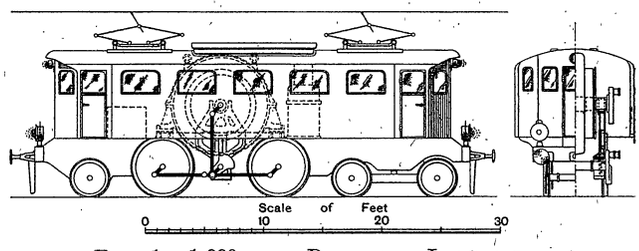


FIG. 1.—1,000 H.P. PASSENGER LOCOMOTIVE.

The general design of the A.E.G. passenger service locomotive is illustrated in Fig. 1. It has a four-wheel bogie, four coupled driving-wheels, and a pair of trailing-wheels. The driving-wheels are 5¼ ft. in diameter, and thus run at 365 r.p.m. when a speed of 68 miles per hour is reached. The bogie and trailing-wheels are 3·3 ft. in diameter. The total weight of the locomotive is 70 tons, and the useful adhesive weight is estimated at 28 tons. As shown in the figure, there is only one motor. This is a 1,000 h.p. A.E.G. Winter-Eichberg single-phase commutator motor, and will develop 700 h.p. continuously. Power will be supplied to the locomotive at 10,000 volts 15 cycles, and will be transformed down to about 600 volts for the motor. A maximum tractive effort of 13,000 lbs. at the driving-wheel periphery is developed, and the maximum speed is specified at 81 miles per hour. The motor drives a false axle, which is coupled to the driving-wheels. The mechanical portions of these locomotives have been constructed by the Hanover Maschinenbau A.-G., and Siemens-Schuckertwerke and the Allgemeine Elektricitäts-Ges. will each supply electrical equipments. In the former case, the motor will be of the Siemens-Schuckert compensated series type.

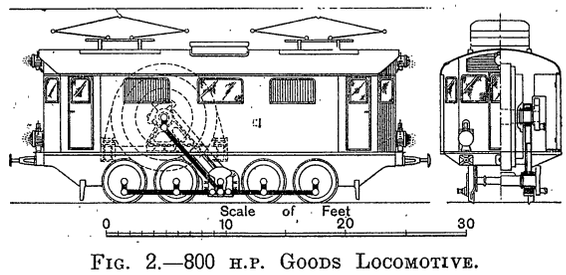


FIG. 2.—800 H.P. GOODS LOCOMOTIVE.

Fig. 2 shows the general design of the A.E.G. goods locomotive. The four axles are coupled together, and to the false axle driven by a single 800 h.p. motor. In this case the motor is not perpendicularly above the false axle, but some 4·5 ft. to one side, in order to give a simple arrangement of the remainder of the electrical equipment. The continuous output of the motor is about 600 h.p., and the maximum speed 37 miles per hour. A tractive effort of 20,000 lbs. at the driving-wheel periphery is developed. The total weight is about 58 tons. Four of these locomotives are being constructed, the other three electrical equipments being supplied by the Lahmeyer-Ges., the Maffei-Schwarzkopffwerke, and the A.G. Brown, Boveri et Cie. The motor of the last-named firm will be of the Deri type, in which all the control is effected by altering the position of the brushes on the commutator. The Lahmeyer motor will be a compensated series motor, and that of the Maffei-Schwarzkopffwerke a series motor with double commutator.

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ELECTRICAL EQUIPMENT OF THE "OLYMPIC"

ELECTRICITY will be largely employed, both for lighting and power, in the two new 45,000 ton White Star liners, *Olympic* and *Titanic*, the former of which has already been launched from the yard of her builders, Messrs. Harland and Wolff, Ltd., of Belfast. Among the purposes for which electricity will be employed, in addition to lighting, are: the deck cranes; cargo, boat, and engine-room winches; passenger elevators; stores, mail, and pantry lifts; ventilating and stokehold fans; cabin fans; motors for the cylinder-lifting gear, turbine-turning and lifting gear, and condensor sluice valves; the workshop machine tools; conveyor for marconigrams; gymnastic apparatus; kitchen and pantry machinery, such as the ice-rocker, dough-mixers, potato-peelers, roasters, knife-cleaners, mincers, hot plates, and electric irons; electric heaters; electric baths; main steam whistles; sounding machines; stoking indicators; boiler room telegraphs; clocks; watertight doors; helm indicator; illuminated pictures; chimes; bells; loud-speaking and service telephones; submarine signalling; and wireless telegraphy.

The generating plant on the *Olympic* consists of four main 400-k.w. 100-volt continuous current generator, driven by reciprocating engines manufactured by Messrs. W. H. Allen, Son, and Co., of Bedford. The generators, also by Messrs. Allen, are of the ten-pole type, compound wound, fitted with interpoles, and run at 325 r.pm. They are in a compartment below the orlop deck, adjoining the after end of the turbine-room. There are also two 30 k.w. auxiliary sets above the water-line, which can be supplied with steam from either of several boiler rooms.

The main switchboard is on the orlop deck level, commanding a view of the machines below. Illuminated signals to the engine-room are provided. There is a 25 panel feeder board, distinct from the machine board, supplied by Messrs. Dorman and Smith. Forty-eight feeders, up to 61/12 in size, radiate to various parts of the ship. In general, the single wire system is employed, but a certain amount of bonded return leads are provided to avoid stray currents. The power and lighting bars can be kept separate or coupled as required. The main feeders pass up steel trunkways, one on each side of the ship, to distributing fuse-boards, on each deck. In the machinery spaces, lead-sheathed armoured cables are used, and in the boiler-rooms the cables are run in steel pipes. All wires leading through a watertight bulkhead are collected together in a steel tube filled with bitumen. More than 200 miles of cable have been used.

About 10,000 lamps are fitted, ranging from 16 to 100 c.p., and Tantalum lamps have been employed almost throughout. A carefully planned system of emergency lamps, on separate circuits, are placed at suitable points. The fittings include some of the most artistic character.

Some 520 Prometheus electric heaters, taking in all over 5,000 amperes, are installed, and there are 150 motors, from ½ to 40 h.p., in use for various purposes. No less than seventy-six of these, taking some 5,250 amperes, drive ventilating fans. Eight electric cranes have been supplied by Messrs. Stothert and Pitt, and there are also four 3-ton electric cargo winches, and four 15 cwt. electrically driven boat hoists, made by the Sunderland Forge and Engineering Co. Electric winches are also in use in the engine-room. The passenger and service lifts were all installed by Messrs. R. Waygood and Co. Electric bells, involving 1,500 pushes, are employed throughout, and forty-eight Magneta electric clocks are installed.

A very complete telephone exchange system, connected to a 50-line switchboard, is provided, and Messrs. Alfred Graham and Co.'s loud-speaking Navy telephones are employed throughout. There are also numerous service lines between definite points on the ship. The wireless telegraph outfit is a standard 1½ k.w. Marconi equipment. For the above details we are indebted to a special issue of *The Shipbuilder*.

THE BENKO PRIMARY BATTERY

AN original communication to the Institution of Electrical Engineers, by Mr. W. R. Cooper, describes the Benkö primary battery and its applications. This cell depends essentially on the idea that if the layer of electrolyte on the positive plate (that is, electro-negative element) is removed as fast as polarisation sets in, the E.M.F. will be maintained constant. A carbon electrode is used sufficiently porous to allow the electrolyte to flow through it, thus continually providing a fresh supply to the surface that is tending to polarise. The carbon is a flat tube surrounding the zinc plate and suitably closed at the ends with lead caps. The whole is enclosed in a sealed outer chamber, and the electrolyte enters the inner chamber formed by the carbon through a pipe, and is removed by a pipe connected to the outer chamber. The supply of the electrolyte (which is a mixture of sulphuric acid and sodium bichromate) is from a lead-lined tank above the battery. A single cell measures 1¾ by 6¼ by 9¼ ins. high, weighs 8·8 lbs., and has a continuous output of 26·25 watts (17·5 amperes). The open circuit E.M.F. is 2·0 volts. Results of a number of tests are given in the communication, showing good constancy of output, and the maximum current is given as 90 amperes per sq. ft. of zinc continuously. Four watts can be given per lb. of cell, or 670 watts per cubic foot total volume. Apart from laboratory and miscellaneous uses, such as charging of ignition batteries, the cell is recommended for telegraphy, and the author makes quite a good case for its use for small lighting installations, taking as an instance a country-house installation of fifty 10 c.p. 25-volt metal filaments, for which the battery would cost about £20 and the total cost of making would be about 2s. per unit. This is compared with a generating plant and accumulators costing about £200, which, including interest and depreciation, is calculated to give total working costs of 1s. 10d. per unit.

A CONSULTING ENGINEER'S "QUID PRO QUO"

AT the Westminster County Court on Monday, His Honour Judge Woodfall heard an action in which Mr. Horace Boot, consulting electrical engineer, was sued by Mr. George Bartlett, solicitor, of Chichester, in connection with the introduction of electric light into the town. Mr. Bartlett introduced Mr. Boot to some members of the Chichester Council, with the view to developing the electric lighting provisional order. As the result, the Chichester Electric Light & Power Co. was formed, with Mr. Boot as consulting engineer. Mr. Bartlett put in a claim for twenty guineas for introducing Mr. Boot, but the latter disclaimed any agreement to pay cash for the introduction, and offered twenty fully paid shares in the Chichester company. Mr. Bartlett argued that a cash payment was "the usual *quid pro quo*," and that £100 was the ordinary fee. The reply of Mr. Boot was that he understood Mr. Bartlett would raise capital for the new company, and in return he would have been offered a seat on the board. In the absence of any agreement between the parties judgment was given for Mr. Boot.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Hydro-Electric Practice." By H. A. E. C. von Schon. 383 pp. 9¾ in. by 7½ in. 140 figures. Second edition. (London: J. B. Lippincott Co.) 25s. net; abroad, 26s. 2d.

"The Ventilation of Electrical Machinery." By W. H. F. Murdoch. 79 pp. 7¼ in. by 4¾ in. 30 figures. (London: Whittaker and Co.) 3s. net; abroad, 3s. 2d.

"Whittaker's Arithmetic of Electrical Engineering." 166 pp. 7¼ in. by 5 in. 11 figures. Second edition. (London: Whittaker and Co.) 1s. net; by post, 1s. 2½d.

"Steam Turbines." By J. W. Roe. 143 pp. 9¼ in. by 6¼ in. 77 figures. (New York: McGraw-Hill Book Co.) 8s. 6d. net; abroad 8s. 11d.

"Mathematics for the Practical Man." By G. Howe. 143 pp. 5¼ in. by 7½ in. 42 figures. (London: Constable & Co.) 5s. net; abroad, 5s. 3½d.

"Quarternions." By A. Latham Baker. 92 pp. 5¾ in. by 8½ in. (London: Constable & Co.) 6s. net; abroad, 6s. 3½d.

"A Text-book of Heat." By R. W. Stewart and J. Satterby. 480 pp. 6¾ in. by 5 in. 210 figures. (London: W. B. Clive.) 4s. 6d.; abroad, 4s. 10½d.

The British Association.—Arrangements are now well in hand for the meeting of the British Association at Portsmouth, from August 30th to September 6th. This year's President is Sir William Ramsay, and Section G (engineering) will be presided over by Prof. J. H. Biles. The vice-presidents of the Section are Prof. W. E. Dalby, Mr. C. Hawkesly, and Prof. J. E. Petavel, Prof. E. G. Coker is Recorder, and the other sectional secretaries are Messrs. A. A. Rowse, H. E. Wimperis, and H. Ashley. A full list of the Papers is not yet available, but according to *The Times*, one of the discussions will be on the relative merits of superheated steam, gas, and Diesel engines, on which subject Papers will be read by Capt. H. R. Sankey, Mr. Tookey, and Mr. C. Day. Prof. T. W. Howe and Capt. Sankey are to show experiments in wireless telegraphy. Electric steering gear will be dealt with by Mr. B. P. Haigh; electric propulsion by Mr. H. O. Moon. Dr. T. S. Owens will put in a plea for smoke abatement, and Mr. Worby Beaumont will give his views on rail corrugation.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published July 13, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

14,534/10. **Automatic Contact Device.** J. G. MATHIESON. An automatic contact device for use in connection with the overhead equipment of tramways for operating signals or automatic points is covered by this patent, and consists in supporting a fixed bracket having arms projecting towards the cable from the span-wire insulator; also two downwardly projecting arms pivoted to bracket, and a contact rod carried by the free ends of the arms for operation by the trolley pulley, with set screws for adjusting the contact-rod arms, so as to allow the rod to be operated to complete or break an electric circuit, with or without springs for assisting the downward movement of the rod. Three figures.

15,143/10. **Arc Lamps.** F. KLOSTERMANN. This invention relates to a device for regulating arc lamps, and comprises the combination with a balance frame and a loose pulley, of a pivoted brake, and a spring arranged so that when the balance frame is moved by a series electro-magnet the action of the spring on the pivoted brake locks the loose pulley to the frame, and moves the carbons apart. Four figures.

15,710/10. **Enclosed Arc Lamps.** B. A. QUINT. In an enclosed arc lamp of the inverted type the striking mechanism, which is effected by a shunt coil, comprises a clutch device carried upon a hollow armature operated by a shunt solenoid, the movable carbon being mounted within the armature. The carbon is arranged so that when released by the clutch upon the coil being energised, it can be travelled forward by a spring placed in the hollow armature. A dashpot device is provided, adapted to allow the armature to be moved freely in one direction against gravity, and to come into operation to retard the armature when the solenoid is de-energised. Four figures.

16,486/10. **Interlocking Switchbox.** W. PATON. Interlocking devices are provided for automatically locking the cover of the switchbox by the action of moving the switch lever and closing the circuit, so that the box cannot be opened while the lever is in the "on" position. Means are also provided for covering and uncovering the terminals, by fitting within the switchbox a sliding protector which is connected to the switch lever shaft. Five figures.

19,729/10. **Secondary Battery.** D. W. JOHN and J. H. BERRY. It is well known that whenever anything goes wrong inside ordinary portable accumulators, it is necessary to strip off the lid, thus necessitating a certain amount of trouble in making an acid-proof joint when the lid is replaced. In this patent the cell is made circular and the lid screws in place and has a flange bearing on the top of the cell, so that there is some certainty of getting the plates properly located, as the lid always comes true. Three figures.

24,421/10. **Receiving Method for Wireless Telegraphy.** W. V. SMITH (*Dr. Eric F. Huth*). A method of receiving continuous electrical oscillations is covered by this patent, which makes use of the periodical alteration of capacity and self-induction. It consists of putting one of the receiving circuits periodically out of tune to such an extent that its frequency is below 40,000 per second, and that simultaneously the circuit containing the detector is tuned electrically, and the interrupter which causes the disturbance is tuned mechanically to the lower frequency. Three circuits are provided and arranged so that neither the antenna nor the detector circuit is periodically altered in frequency. Three figures.

27,176/10. **Accumulator Plates.** J. APOZNANSKI. A novel process for the manufacture of highly porous composition plates for electric accumulators, in which the paste-filled plates are dried at a high temperature, is carried out, by arranging the filled plates between acid-proof cover plates, so that the gas which is generated at the raised temperature is utilised for producing innumerable pores and at the same time hardening the mass.

6,736/11. **Fixing and Insulating Contact Springs.** SIEMENS BROTHERS & CO., LTD., and C. R. RIBER. This specification describes means for fixing and insulating contact springs used in telephone jacks and relays. The springs are assembled within a metal holder and isolated from one another by pieces of insulation, which also serve as distant pieces, the holder being shaped in such a manner that the whole can be clamped rigidly by altering its exterior form by pressure or other means. Six figures. Another method by the same authors, and described in their patent 6,737/11, consists in sealing the springs within the metal holder, and at a suitable distance, with insulating cement. In order to prevent them from being withdrawn they are notched at the end, which is sealed within the holder, and to stiffen them they may be dished or fluted. Three figures.

7,511/11. **Portable Insulator for Wire-ends.** J. KRANNICHFELDT. When using electric ignition for exploding detonators in moist earth, especially in sinking shafts, when the wire connections are often under water, short circuits frequently occur, and it is to avoid the trouble of wrapping the ends of the twisted wires with insulating tape or ribbon that this insulator has been devised. The twisted naked ends of the wires are pressed into a tube containing a viscous, water-tight insulating material, such as a mixture of asphalt with tar or wax. The tubes are preferably made of paper, closed at one end and open at the other, and are impregnated. Three figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.
Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: PECHIN [Couplings for] 15,789/10; KORTING and MATHIESON AKT.-GES. [Enclosed arc lamps] 3,891/11.

Dynamos, Motors and Transformers: AKT.-GES. BROWN, BOVERIE, ET CIE. [Voltage regulation of alt-current machinery] 15,415/10; JUSTON and BUNZLI [Magneto-electric current generators] 28,177/10.

Electric Ignition: REDRUP [Ignition devices] 15,134/10; BROOKS and ALSTON [Electric contact breakers for ignition systems] 19,525/10.

Electrometallurgy and Electrochemistry: MASSIP [Electric furnaces and the manufacture of steel] 22,777/10.

Heating and Cooking: HIRST and ARCHER [Electric heating apparatus] 24,238/10.

Instruments and Meters: LAMBOT [Automatic electric recording devices] 15,619/10; CHAMBERLAIN and HOOKHAM, LTD., and JAMES [Electricity motor meters] 10,816/11.

Switchgear, Fuses, and Fittings: ELECTRIC AND ORDNANCE ACCESSORIES CO. and COLLINS [Electric switches] 19,182/10.

Traction: CHRISTIAN [Trolley poles for electric traction] 15,414/10.

Miscellaneous: JAMES [Electrical arrangements for protecting ships' bottoms] 14,181/10; BRITISH ELECTRIC AUTOMATIC MACHINES, LTD. (*Internationale Abel'sche Brief-marken-Automaten-Vertriebsges*) [Regulation device in coin-freed apparatus] 15,178/10; WHITE [Electrically controlled ejector vacuum-cleaning apparatus] 15,695/10; FRANKENBURG & SONS, LTD., and FLEMING [Electric lighting] 28,724/10; STILL [Reflux condensers] 3,269/11; ALLGEMEINE ELEKTRICITÄTS-GES. [Coin-freed mechanism] 9,942/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distributing Systems: WESTINGHOUSE [Power transmission mechanism] 12,574/11.

Instruments, &c.: ALLGEMEINE ELEKTRICITÄTS-GES. [Prepayment apparatus with maximum tariff device] 14,527/11.

Miscellaneous: ELEKTRICITÄTS AKT.-GES. HYDRAWERK [Electric elements] 6,664/11; WEINTRAUB [Production of varying high-frequency currents] 14,504/11.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

17,523 of July 26th, 1897. **Coin-freed Electric Meters.** F. J. BEAUMONT. In these meters, in order to show when the current value of the coin is getting exhausted, an arrangement of a resistance in connection with the supply mains, and a suitable appliance operated by the usual meter mechanism is adopted, whereby the main circuit is broken, causing the current to flow through a resistance, and thus lowering the light as a warning that another coin is required.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: H. BREMER, 6,615/01; P. HÖGNER, 7,383/02; CROMPTON & CO. and A. E. SPENCER [Supporting lamps] 7,587/06.

Dynamos, &c.: J. T. MOULD [Electromagnetic motors] 7,590/03.

Electric Ignition: J. A. TORRENS [Sparking plug] 6,337/05.

Electrometallurgy, &c.: A. J. M. THIROT and L. A. MAGE [Electro-deposition] 28,342/06.

Switchgear, &c.: A. S. and G. C. LUNDBERG [Electric couplings] 6,647/99; C. F. HILKIER [Electric switches] 6,863/05.

Telephony, &c.: A. J. BOULT (*E. K. Gruhn*) [Autographic telegraphs] 6,271/01.

Traction: L. MANNSTAEDT [Electric conduits] 7,818/06; BRITISH THOMSON-HOUSTON CO. (*General Electric Co.*) [Railway signals] 7,831/06; A. C. BOUNEVIALLE [Railway signals] 19,378A/06.

Miscellaneous: W. H. SCOTT [Electrical apparatus for hoisting] 5,860/00; C. L. WALKER [Fire alarms] 6,899/03 and 6,899A/03; S. H. THOMAS [Vapour electric apparatus] 6,557/06; O. A. BRUNN [Electric lighting] 27,684/06.

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TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

A FURTHER announcement with regard to the position of the National Telephone Co.'s staff on the transfer of the telephone system was made by the Postmaster-General on Friday, when the Telephone Transfer Bill was read a second time without opposition. He said that 10,000 of the staff would for the first time have pensionable rights. Those who could not be put upon the "Establishment" and be entitled to pensions would be granted an equitable allowance. With regard to the twelve senior members of the company's staff who were receiving salaries of over £700 per annum, the company were at present unwilling to part with five, as they needed their services in connection with the arbitration, and of the others some had nearly reached the age limit. The remainder he hoped to get into the Post Office service in order to have the advantage of their large experience and ability. He assured the House that no exaggerated desire to maintain the dignity either of himself or of his department would keep him from approaching these members of the company's staff with regard to the actual terms of their remuneration.

It has been known for some time that the Postmaster-General has had the intention of giving automatic telephone systems a trial. We are now able to announce that orders have been given for two 500-line full automatic exchanges, with which experience will be gained as to the relative cost of installation and working and reliability of two different systems under British conditions. At Epsom an exchange will be equipped on the Strowger system (see ELECTRICAL ENGINEERING, May 25th, page 293) by British Insulated & Helsby Cables, Ltd.; while at the Caterham Valley exchange apparatus on the Lorrimer system will be installed. There is a good deal of difference in the two systems. In a Lorrimer exchange a power plant is necessary, for the apparatus contains parts which are continuously revolving, and which are arrested in suitable positions when the call is originated; while in the Strowger system no movement takes place until the actual calling current impulses are sent. Again, in the Lorrimer system the figures composing the call are, so to speak, stored up in the calling apparatus when a button is pressed, and the complete call is signalled. In the Strowger system the subscriber sets his apparatus successively for the units, tens, hundreds, &c., sending separate impulses which actuate the step-by-step electromagnetic switches in the exchange. It may be mentioned that the Strowger system, although newer than the Lorrimer, in more in use, there being upwards of 280,000 stations already equipped on the American continent.

Correspondence has passed between the Postmaster-General and the Liverpool Cotton Association with regard to the future administration of the telephone system. The Association had suggested that a Standing Advisory Committee upon the commercial development of the telephone business should be formed, made up of representatives of the Chambers of Commerce of London, Liverpool, Manchester, Glasgow, Birmingham, Newcastle, Bristol, Hull, Belfast, and Cardiff, two representatives appointed by the Government, and under the chairmanship of the Postmaster-General or the Assistant Postmaster-General. The Association, however, have now expressed themselves satisfied with the Postmaster-General's reply, in which he says that a scheme is being introduced for decentralising the administration of the telephone service in order to place responsible officers more closely in touch with the commercial bodies.

In answer to a question in the House of Commons on Thursday, the Postmaster-General said that at present telephone calls are registered by the operator, but he was obtaining samples of an automatic device which would distinguish between effective and non-effective calls.

Marconi's Wireless Telegraph Co. have commenced proceedings against the Lodge-Muirhead & General Telegraphy Syndicate, alleging infringement of patents, and the Lodge-Muirhead Syndicate has retaliated by instituting similar proceedings against the Marconi International Marine Communication Co.

According to *L'Electricien*, the French Government, although sending out wireless time-signals twice daily from the Eiffel Tower, have refused to license receiving stations on the premises of clockmakers in the Navarre district. There is, however, a receiving station at La Chaux-de-Fonds, over the Swiss border, to which the Navarre manufacturers refer their chronometers.

The July issue of the *Post Office Electrical Engineers' Journal* is largely devoted to telephone matters, containing articles on telephones in England and the U.S.A., advertising the telephone, the telephone in British East Africa, and the London telephone system in 1920: a forecast. Other articles deal with the fire-alarm systems at the General Post Office, mechanical analogies applied to radio-telegraphy, telegraph construction on the Canadian Pacific Railway, lead-covered aerial cables, and the preservation of timber, besides other articles, notes, and news.

The half-yearly report of the National Telephone Co. shows a net profit of £576,278, compared with £544,516. Dividends at the rate of 6 per cent. per annum are recommended on the first and second preference shares, 5 per cent. on the third preference shares, and 6 per cent. on the preferred and deferred stocks. No mention is made in the report of the purchase by the Government.

The cable between Zanzibar and Mombassa failed on the 11th inst., followed closely by that between Bathurst and Bissao. Both these cables form part of the Eastern group. The most important breakdown, however, is that of the cable between Guam and Manila on the 12th inst., belonging to the American Pacific Cable Co.

ELECTRIC TRACTION NOTES

AMONG the Papers read at the Congress of the Tramways and Light Railways Association at Edinburgh last week was one by Mr. G. H. J. Hooghwinkel, in which he strongly advocated the use of the light single-decked cars, almost universal on the Continent, instead of the existing heavy double-deckers which he characterised as "two-storied monstrosities expressly designed to pound and damage our expensive tracks." He considered single-deck cars, in combination where necessary with trailers, would be quite capable of meeting our traffic conditions, especially if, as abroad, passengers are allowed to stand on the platforms; and he emphasised the saving in the cost of line construction owing to the much lighter track required. A large number of small cars also gave a better load-curve at the generating station. Mr. Hooghwinkel also recommended in this connection the bow contact instead of the trolley wheel, one of its advantages being that it permitted much simpler overhead construction.—Mr. C. W. Mallins (General Manager, Liverpool Corporation Tramways), in a Paper dealing with a variety of subjects, also spoke in favour of the single-deck car, and among other topics mentioned the high cost of Parliamentary powers, and the hardship suffered by promoters of tramway schemes in being made to bear the cost of road widenings.

In this connection, a reply by the President of the Board of Trade to a question in the House of Commons on Monday is of interest. The London County Council are, as an experiment, running coupled cars during certain busy hours, and already the Board of Trade are advised that the coupling of double-deck cars should not be permitted owing to their great weight. Before any general permission can be given to the running of coupled cars, it is felt that further experience is necessary.

The use of trolley omnibuses has been very favourably reported upon by a sub-Committee of the Dundee Tramways Committee. A trolley omnibus scheme, at an estimated cost of £14,500, is contemplated at Heimatstal, Austria-Hungary.

The Bradford tramway accounts for the year ended March 31st, 1911, show a large increase in net revenue, which has enabled £20,000 to be allocated to relief of rates, and £19,374 to be added to the renewals fund.

The Metropolitan Railway has declared a dividend for the half-year at the rate of 2 per cent. per annum, as against 1¼ per cent. a year ago, when, however, £10,000 was placed to electrical renewal fund. The City & South London Railway has also declared a higher dividend than during the corresponding period last year (partly owing to "Coronation traffic"), viz., at the rate of 1¾ as against 1¼ per cent. per annum.

We regret to report the death of Mr. R. B. Goodyer, which occurred on Saturday last from heart failure. Mr. Goodyer had had a long connection with tramway systems, having held managerial appointments with the Edinburgh, Rothesay, and Paris tramways, and for over twenty years was manager of the Cardiff branch of the Provincial Tramways Co., Ltd. Mr. Goodyer's son is the Tramways Manager to the Croydon Corporation.

An interesting announcement concerning the scheme for converting the East London Railway to electric traction may be anticipated at the meeting on Tuesday.

A dividend at the rate of 3 per cent. per annum is declared by the Chatham & District Light Railways Co. for the June half-year, carrying forward £1,706.

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LOCAL NOTES

Birmingham: *Tramways Purchase.*—A proposal for the acquisition of the whole of the British Electric Traction Co.'s lines in Birmingham at an estimated cost of £151,500 is before the Corporation.

Bootle: *Libel Action.*—Mr. H. D. Clothier, the Borough Electrical Engineer, was sued at Liverpool last week for libel by an employee in the Electrciity Department. It appears that a report was presented to the Council by the Electrical Engineer stating that a certain mishap at the electricity works was due to the action of the employee in question, who was subsequently dismissed. The defence was that the report was made on a privileged occasion, and that the only action was against the Corporation. The jury took this view, and a verdict was entered for Mr. Clothier.

Carlisle: *Electricity Accounts.*—There was a net profit of £3,346 upon the electricity undertaking last year, an increase of £296. Two 500-kw. generating sets were installed during the year, and two water-tube boilers and accessories. There was a large increase in the power demand, 768 additional horse-power being installed.

Dawlish: *Street Lighting.*—The Council have decided to give the gas company three months' notice to terminate the existing street lighting contract, and is to give consideration to the whole question of street lighting.

East Barnet: *Street Lighting.*—The Council are dissatisfied with the high price of gas, and have threatened to introduce electric lighting into the streets unless substantial reductions are made by the gas company.

Higham Ferrers: *Electric Lighting Order Revoked.*—The Board of Trade have revoked the Electric Lighting Order granted in 1906 for the districts of Higham Ferrers, Rushden, and Wellingborough (Rural). A Northampton firm have given notice of their intention to apply for a Provisional Order for the borough of Higham Ferrers.

Ilford: *Hospital Carnival.*—The Council's Electricity Department sent two decorated cars to take part in the local hospital carnival recently, named "Electricity in the Mansion" and "Electricity in the Cottage" respectively. These cars, which were accompanied by six collectors dressed in suitable costumes representing various makes of lamps, were awarded two out of the four certificates given for this class of entry. We congratulate Mr. Shaw and his staff on the result of their effort.

London: *L.C.C. Tramways Purchase.*—The Highways Committee report that they have been unable to come to terms with the London United Tramways, Ltd., as to the price to be paid for the purchase of the company's lines in the County of London. Arrangements are therefore being made for the appointment of an arbitrator under the Tramways Act, 1870.

Poplar: Electricity Accounts.—There was a net profit of £3,877 upon the working of the electricity undertaking last year, compared with £4,425 in the previous twelve months, which it is recommended should be carried forward. The average price obtained per unit was 1·2d., compared with 1·6d. During a period of three years the output has increased 73·6 per cent.

Stepney: Repayment of Loan.—After considerable negotiation, the Finance Committee of the London County Council have agreed to allow the Council to postpone for the first three years the repayment of a loan of £15,700 for mains. The loan is for thirty years, and the repayment is to be made only during the last 27 years.

Madeira: *Diesel Engines.*—The British Consul at Madeira in his report for 1910 states that the Madeira Electric Light Co. have extended its mains in many directions. The company is substituting Diesel oil engines for its present steam plant, and the distribution system will be gradually changed to the three-wire system.

Portrush: *Electric Lighting.*—Messrs. Miller, Wilson & Pegg, who have placed an electric lighting scheme before the Council, are urging the desirability of applying for an Electric Lighting Order, but the Council has further delayed the matter pending negotiations with the gas company.

Swansea: *Electricity Profits.*—The Tramways and Lighting Committee recommend that the electricity supply profits shall be transferred to reserve fund.

Weymouth: *Electric Lighting Accounts.*—There was a net profit of £387 10s. upon last year's working of the electricity undertaking. The number of consumers was increased by 140

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during the year. This is a larger increase than the three previous years together.

West Ham: *Electricity Accounts.*—The total revenue of the electricity undertaking for 1910-11 was £93,235, compared with £79,262 in the previous year. The average price obtained per unit was 0·93d. The total costs were 0·888d. per unit. There was a marked improvement in the revenue from power supply, which amounted to 29·7 per cent. Mr. H. H. Couzens, the Borough Electrical Engineer, complains that the Sales Department is only allowed three years in which to repay its loans, and that in consequence the capital charges for the first six months of the new loans amount to £1,582. Eliminating these capital charges, there is a profit of over £1,000 for the first year on the Sales Department. Revenue has been debited with £3,070, in respect of improvements at the power-house and the purchase of meters. The net profit for the year, after charging £5,671 rates and taxes, is practically £4,000, compared with a loss of £2,807 in the previous year. This balance is to be applied to the special writing down of the battery, rectifiers, and 300-kw. set at the generating station.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Biddulph.—An electric lighting scheme is under consideration. It is proposed to take a supply in bulk from a private generating plant in the district.

Cardigan.—A deputation from the Council has been visiting a number of places with a view to the introduction of an electric supply scheme.

Doncaster.—A Local Government Board inquiry was held last week concerning a loan of £12,000 for extensions to the electrical undertaking. Evidence was given of certain amounts expended in anticipation of the loan being sanctioned, and the Inspector intimated that the Electricity Department would receive a somewhat strong letter from the Local Government Board on the subject.

Douglas (I.O.M.).—A special committee has been appointed to consider an electric lighting scheme for the town.

Ilford.—Sanction has been received by the Council to a loan of £8,070 for mains, meters, switchboard, &c.

Luton.—An application for a loan of £13,150 has been inquired into.

Newcastle-under-Lyme.—Extensions to the electricity works are to be carried out. Messrs. Lacey and Sillar are consulting engineers.

Rugeley.—A committee has been formed to investigate the question of an electric supply undertaking.

Southport.—Application is to be made for a loan of £1,500 for mains.

Wednesbury.—The Electricity Committee invite tenders for 150 cells, and 2,400 yards 0·25 sq. in. concentric lead-covered paper-insulated cable and joint boxes.

Wolverhampton.—The Knowles Oxygen Co., Ltd., of Wolverhampton, a 1,000-kw. generating plant complete with buildings. The load factor will be 95 per cent.

WIRING

Accrington.—Church. Architect, H. Ross, 15 Cannon Street, Accrington.

Belfast.—Additions to Purdysburn Hospital. Architects, Young & Mackenzie, Scottish Provident Buildings.

Croydon.—Fourteen houses, Aurelia Road. C. S. Banks, 16 Oakfield Road.

Dublin.—Wagon and carriage shops for Great Southern and Western Railway Co. Particulars from Secretary.

Glasgow.—Home for Boys at Rutherglen. Whitevale Refuge.—District Library at Possilpark.

Hastings.—Electric lighting of Clive Vale and Tower Schools.

Johnstone (N.B.).—Public slaughter house.

Lancashire.—Annexe at Whittingham Asylum. Builders, Messrs. E. Taylor & Co., Ltd., Littleborough.

Manchester.—Considerable additions to Eccles and Patricroft Hospital. Architect, J. Knight, Haworth Buildings, 5 Cross Street, Manchester.

Pembroke (Ireland).—Electric lighting of artisans' dwellings on the Old Mill and Auburn Road sites. Particulars of contract from Town Clerk.

Weymouth.—Secondary school. Architects, Crickmay & Sons, St. Mary Street.

MISCELLANEOUS

Australia.—The Deputy Postmaster-General, Melbourne, invites tenders by September 5th for 10,000 telephone protectors, and sundries. Specifications, &c., from 73 Basinghall Street, or 72 Victoria Street, London.

Birmingham.—The Light Railway Commissioners have granted the Corporation an Order for the construction of a line to Quinton.

Brazil.—Tenders are invited by September 25th for the supply of electrical fittings, fans, &c., in connection with the electric lighting of the new postal telegraph building in Porto Alegre. Local representation is necessary, says the *Board of Trade Journal.* Tenders to the "Directoria Geral do Expediente, Ministerio da Viaçao e Obras Publicas," Rio de Janeiro.

British Columbia.—Owing to the increase in the trade and population of the cities and districts served by the British Columbia Electric Railway Co., an additional £600,000 capital is to be issued.

Bulgaria.—Some particulars of interest in connection with the installation of electric tramways in Philippopolis (Bulgaria) are, says the *Board of Trade Journal*, at the disposal of British firms on personal application at 73 Basinghall Street, E.C.

Rome.—A Central News Cable states that the Rome Municipality have decided to consider a scheme for the construction of tube railways, embodying the best features of such lines in London and Paris.

China.—An extensive programme of telegraph and telephone extensions in China is to be carried out during the next financial year.

Italy.—A scheme for the construction of new tramways in Rome is under consideration.

Madeira.—H.M. Consul at Madeira, Capt. J. Boyd, in his report for 1910, states that a telephone service would be a great boon.

Tasmania.—A ratepayers' meeting has passed a resolution in favour of the purchase of the local tramway system now worked by the Hobart Electric Tramway Co.

A proposal has been made to construct an electric railway from Hobart to Huon. It is estimated that this line would open an area of about 100,000 acres of Government land, and Mr. W. G. T. Goodman, Chief Engineer and General Manager of the Adelaide Municipal Tramways Trust, is to be asked to report. The estimated cost is £223,000.

TENDERS RECEIVED AND ACCEPTED

Aberdeen.—The D.P. Battery Co., Ltd., have secured the contract for the renewal of the Cults sub-station battery of the Aberdeen Corporation.

Barrow-in-Furness.—Orders for steel poles, bases, and trimmings and overhead trolley wire have been placed with Messrs. John Spencer, Ltd., and the British Insulated & Helsby Cables, Ltd., respectively.

Bolton.—The Electricity Committee have accepted the following tenders:—Foster Engineering Co. and Messrs. W. E. Burnand & Co., single-phase transformers; Messrs. Ferranti & British Westinghouse Co., three-phase transformers; British Insulated & Helsby Cables, Ltd., service-boxes, cable-boxes, &c.; British Thomson-Houston Co., incandescent lamps; British Westinghouse Co., Bat Meter Co., and Messrs. Chamberlain & Hookham, A.-C. meters; Electrical Co. and Bastian Meter Co., direct-current meters; Messrs. Ferranti, Ltd., motor starters; British Westinghouse Co., continuous-current motors.

L.C.C.—The tender of Messrs. Dick, Kerr & Co., at £2,810 11s. for stoneware ducts is recommended for acceptance.

The tender of Messrs. Le Carbone has been accepted for tramway parts and equipments.

Hackney.—The Electricity Committee recommend that the contract for 100,000 pairs of yellow flame arc lamp carbons be given to Messrs. Geipel & Co. at £2 15s. per thousand pairs. It was originally recommended that the contract be split up as to one-third to Messrs. Ship Carbons, Ltd., Messrs. Underwood, Ltd., and Messrs. Geipel & Co. at £3 per thousand pairs. It was pointed out to the Council that Messrs. Underwood are agents for Ship Carbons, and that this proposal involved placing two-thirds of the order for Ship Carbons. When approached in this connection Messrs. Geipel offered to reduce their price as mentioned above.

Swinton and Pendlebury.—The Council have accepted the

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tender of Messrs. Callenders Cable Co. for an overhead cable to Messrs. Hollands' mineral water works at Moorside.

Worthing.—Subject to the Local Government Board sanctioning the necessary loan, a tender for additional generating plant at the power station, at a cost of about £4,000, has been accepted. We understand that the scheme includes a Diesel engine.

The Mirrlees Watson Co., Ltd., have received the following orders for condensing plants :—Surface Condensing Plant : Two sets for Stoke-on-Trent Electricity Works, per Messrs. Jas. Howden & Co.; three condensers for Messrs. Gwynnes; Nova Scotia Steel Co.; Torquay Electricity Works, per the B.T.-H. Co.; repeat order for the Govan Corporation, per Messrs. Jas. Howden & Co. Jet Condensing Plant : St. Helens Corporation; Messrs. Bolckow Vaughan, Leasingthorne Colliery; Lancashire & Yorkshire Railway, Formby Power Station, per the B.T.-H. Co.

Mr. Haydn Harrison informs us that he is supplying large numbers of his special grouped H.C.P. lanterns to replace open type arc lamps, and also other street lighting conversion fittings. He has lately completed, or has in hand, the following important contracts :—Beckenham, seven miles of streets; Caversham, seven miles of streets; West Hartlepool, tramway route and other streets; Lancaster and Maidstone, replacement of arc lamps; Tunbridge Wells, replacement of arc lamps; Battersea, replacement of 436 street arc lamps; Walker (Newcastle), 400 street lamps; Curragh Camp, Ireland; Imperial Paper Mills, Gravesend; L.B. & S.C. Rly., supply of all tungsten lamp fittings for new car-sheds and repair shops connected with the electrification of the London, Brighton & South Coast Railway.

APPOINTMENTS AND PERSONAL NOTES

Mr. C. W. Hill, General Manager of the Bournemouth Corporation Tramways, has tendered his resignation, having been appointed to an important post with an electrical trading company in London.

Mr. J. G. Lorrain, the patent expert, was married last week to Miss Dorothy Thwaites, daughter of C. Thwaites, M.Inst.C.E., of Sutton.

Mr. R. A. S. Duncan, Charge Shift Engineer at the Greenwich generating station, has resigned upon obtaining another appointment.

Parliamentary Intelligence.—The Winchester Corporation (Electric Supply) Bill and the Newcastle Corporation Bill were read a third time in the House of Commons last week.

The Brighton Corporation, which was recently refused a *locus standi* to oppose the Brighton, Hove & District Railless Traction Bill, except as regards protection to the Corporation electricity, gas, and water mains, have now withdrawn the whole of their opposition.

The Central London Railway Bill has been read a third time in the House of Lords.

Smoke Abatement.—A meeting of the Advisory Committee of the Manchester and Salford Smoke Abatement Exhibition was held in the Manchester Town Hall on Thursday last. Amongst those present were Councillor G. Howarth (Chairman of the Manchester Electricity Committee), and Mr. S. L. Pearce (Electrical Engineer to the Manchester Corporation). Councillors William Kay and W. Dagnall, and Mr. E. D. Simon (Secretary of the Smoke Abatement League of Great Britain) were elected to the Advisory Committee. Councillor Howarth promised on behalf of the Manchester Electricity Committee that electrical domestic appliances sold at the exhibition would be fixed and wired by the Corporation free of charge. It was proposed by Councillor Kay and seconded by Mr. S. L. Pearce, that a letter should be sent to the National Electrical Manufacturers' Association (Incorporated) with a view to obtaining their active support to the exhibition.

The Olympia Electrical Exhibition.—Arrangements have been made by the management for an elaborate display of cooking demonstrations in the galleries of the exhibition. For this purpose manufacturers who are exhibiting have had space granted to them without rental charge, and with a free supply of current, conditionally that they provide the demonstrations in question during the run of the exhibition. It may also be mentioned that one of the large firms of house furnishers and electrical contractors have already secured a large block of space in the galleries, where they are erecting a model electrical home. This, we understand, will be of a most elaborate description, and will be quite worthy of a great international exhibition. It is contemplated to install a garage, electrical laundry, electrical kitchens, country-house lighting, and a series of living-rooms, all equipped in such a manner as to show the advantages of electricity in the home.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, London, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £58 10s. to £59 (last week, £58 15s. to £59 5s.).

Bankruptcies.—C. F. Lindop, electrical engineer, 62 Dale Street, Liverpool, has been adjudicated bankrupt.

Liquidations.—The Bombay Hydro-Electric Syndicate, Ltd., is to be wound up voluntarily. Mr. F. J. Horne, 214 Gresham House, Old Broad Street, London, is liquidator. A meeting of creditors will be held at 208 Gresham House on July 24th. Claims on or before August 14th.

Griffiths' Electric Contractors, Ltd.—A company is being formed under the name of Griffiths' Electric Contractors, Ltd., to undertake the finance, design, construction, and operation of electrical works and schemes in all parts of the world, including electric railways, water-power and other transmission schemes, &c. Powerful interests, both in England and France, are represented, and the London Board of Management is to consist of J. Norton Griffiths, M.P. (President), E. P. Powles, R. D. McCarter, and J. Kerr Bock, the last two of whom will act as consulting engineers to the company; and the company will have the benefit of the experience of Messrs. Griffiths & Co., the well-known contractors, who are, amongst other work, at present carrying out the Chilian Longitudinal Railway. The company's activities will not include the manufacture of plant, nor will they be allied to any particular manufacturing firm. The London offices are at Griffiths House, 59A London Wall, E.C., and there are branch offices in East and West Canada, South America, Australia, New Zealand, South Africa, Spain, Turkey, &c.

Reductions in Price of Stannos Wires.—We are informed by Messrs. Siemens Brothers & Co., Ltd. (Caxton House, Westminster, S.W.), that, owing to increased manufacturing facilities and the reduced price of rubber, they have increased the discounts off the price of "Stannos" wire and fittings as from Monday, the 17th inst. Particulars will be supplied on application.

City & Guilds of London Institute.—In consequence of the rebuilding of Gresham College, the head offices of the City & Guilds of London Institute have been removed temporarily to 3 St. Helen's Place, London, E.C.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Edmundson's Electricity Corporation.—At the annual meeting last week it was stated that the new agreement with the Urban Electric Supply Co. provided for the carrying out by Edmundson's of all new construction work at cost price *plus* 10 per cent., and the financing of the Urban Co. to the extent of a further £100,000. The output of the Edmundson companies has increased during the past four years by nearly 2,000,000 units, and the profits by over £35,000, on an increased capital expenditure of approximately £200,000.

General Electric Co.—Mr. H. Hirst presided at the annual meeting on Monday, when the report and accounts given in our issue for July 6th were adopted. After expressing regret at the great loss which the company had sustained in the death of Mr. G. Byng, the Chairman commented on the large reserve fund, viz., £202,103, and the satisfactory working of the British General Electric Co. in South Africa, and of the Peel Conner Telephone Works. As a result, their investments, which stood at the same figure as a year ago, yielded £7,000 more. At present the works are fully occupied and extensions are being carried out.

Greenwood & Batley.—At the annual meeting last week it was stated that whilst the year's work had been unsatisfactory owing to a very poor first six months, the electrical and turbine department had turned out a fair amount of work. The Company have now acquired the complete control of the English De Laval Steam Turbine Company.

Bournemouth & Poole Electricity Supply Co.—Interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax.

The Sales Managers' Association.—A meeting of this Association will be held on Thursday evening, July 20th, at 6.45 p.m., at the Holborn Restaurant. This will be the first of a series of discussions on selecting and engaging Salesmen, methods of training Salesmen, and Managing Salesmen. Any Business Manager or Sales Manager who desires to attend, or who desires further particulars as to the aims and scope of the Association, is invited to communicate with the Hon. Secretary, Mr. F. R. Jones, Audrey House, Ely Place, E.C. The object of the Association is to discuss at each meeting a topic so broad that every business man present, no matter what his business, will find that it touches at least one point in his work.

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ELECTRICAL ENGINEERING

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SUMMARY

A satisfactory statement as to the progress of the Company was made at the annual meeting of Marconi's Wireless Telegraph Co., Ltd., on Thursday. Arrangements are being made for the erection of stations in many parts of the world, and the Company look forward to developing the Imperial wireless scheme introduced by Sir Joseph Ward at the recent Imperial Conference. (Page 429.)

An article by Mr. W. G. Turner contains a number of practical hints regarding important details in the laying of mains on the solid system. (Page 423.)

Some particulars are given of the electrical undertakings in the Potteries district which are now being amalgamated under the new County Borough of Stoke-on-Trent. (Page 425.)

Several books are reviewed on page 426.

The Newcastle & District Electric Lighting Company has been fined for contravention of the Home Office electrical rules under the Factory Acts. The case arose out of the fatal accident to Mr. Middleton in April. (Page 427.)

Mr. Justice Swinfen Eady has refused to vary an order that the Electrical Co. is to deliver up, without the option of destruction, all "Sunshine" arc lamps and parts which are infringements of the Bremer patent. (Page 427.)

In the electric installation of Messrs. Swears & Wells' new drapery establishment in Regent-street, novel arrangements have been made for electric ironing. (Page 427.)

The Works Committee of the Holborn Council, having considered the report of the whole Council sitting as a Special Committee, recommend that the joint-tender of the Metropolitan Electric Supply Co. and the Gas Light & Coke Co. be accepted. (Page 427.)

An interesting Paper on "Electric Traction in Switzerland," devoted particularly to normal gauge main lines, was read by Mr. Huber Stockar at the Zurich meeting of the Institution of Mechanical Engineers this week.—Arrangements have been made for the conversion of the East London Railway to electric traction at an estimated cost of £65,000.—The City and South London Railway locomotives are to be remodelled with a view to greater speed.—The Court of Appeal has held that the purchase money for the Hartlepool tramways shall be paid to the Company.—Trolley omnibuses are being considered with a view to their installation at Edinburgh, Mirfield, Bingley, and Oldbury.—A number of other interesting notes on traction matters will be found on page 428.

Amongst the specifications published by the Patent Office on Thursday last was one by C. H. Redrup describing a magneto-ignition device. The automatic lowering of trolley poles to clear the overhead equipment when the pole is off the wire is covered by A. R. Christian, and Körting and Mathieson have protected a patent in connection with enclosed arc lamps. H. Hirst and C. H. Archer have introduced an improved electric heater, and G. Massip deals with an electric furnace. Opposition has been entered to the grant of a patent to F. Harrison relating to incandescent lamps. (Page 430.)

The L.C.C. have drawn the attention of the Islington Borough Council to the fact that they have no reserve fund, but that yet the Council is transferring sums to the relief of rates.—Action is being taken against the Islington Council for failing to instal five testing stations as requested by the L.C.C.—A proposal to use overhead wires in connection with street lighting at Attercliffe (Sheffield) has been rejected.—There was a loss of £768 upon the working of the Bristol Electricity undertaking last year. (Page 431.)

Generating plant, switchgear, transformers, meters, &c., are required at Penticton (B.C.); mains at Hammersmith; generating plant with Diesel engines at Farnham; storage battery at Pontypridd; cable at Rochdale; and electric lighting mains and switchgear

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at Tonyrefail; the Swedish Postal Authorities require a large supply of metal filament lamps. (Page 431.)

DIVIDENDS are announced by a number of London Electric Supply Companies. Messrs. Crompton & Co. last year incurred a loss of £14,195. (Page 433.)

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The statement made at the annual meeting of Marconi's Wireless Telegraph Co., on Thursday, shows that there has been a material improvement in the position of the company. Mr. Marconi, who presided, said that a number of important contracts have been entered into for the erection of stations in Italy, Turkey, Greece, Spain, and the Canary Islands. The Italian station at Coltano, which will enable communication between Italy and North America is expected to be opened in the autumn, and the first of a series of coast stations extending from the Cocos Island to Hong Kong, Singapore, Malta, and Gibraltar will also shortly be opened. A working agreement has been entered into between the French Government and the Marconi Co. The Argentine Co. is to proceed with the erection of a long-distance station which will put South America into commercial wireless communication with Europe. Other long-distance stations will shortly be erected by the company in countries outside the British Empire. Further particulars are not yet available. During the early part of the year the company submitted to the Government a scheme to put all British possessions into wireless communication with each other, and applied for a concession for this purpose. This proposal, said Mr. Marconi, appears to have developed into the imperial wireless scheme introduced by Sir Joseph Ward at the recent Imperial Conference, but the company would be equally satisfied if they erected the stations on behalf of the Government.

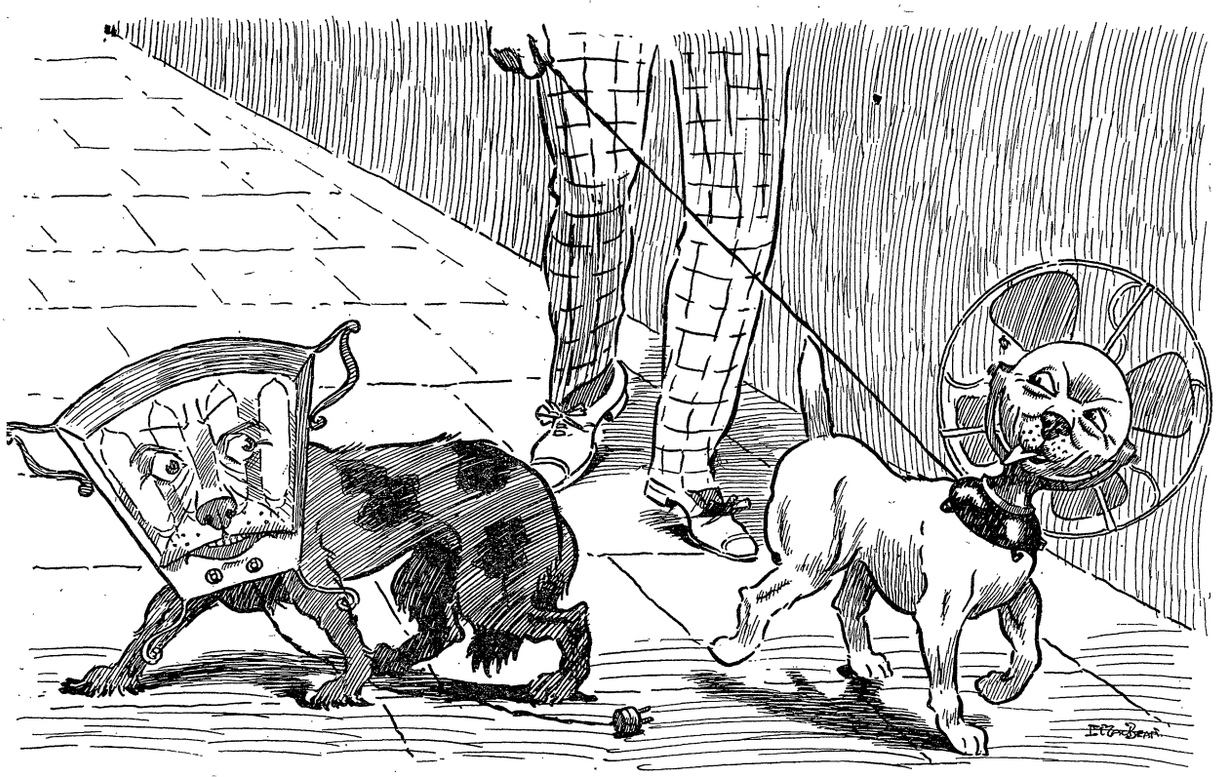
A conference of municipal representatives in the London telephone area is to be held at the Guildhall in October. The Lord Mayor of London will preside, and the main object is to decide whether the Postmaster-General shall be asked to have a flat rate system of charging. It is also expected that the desirability of appointing an Advisory Board will be discussed.

It may be remembered that some little time back the Bell Telephone Co., of Antwerp, charged a number of its employees, who were leaving its employ, with stealing plans and information belonging to the company. The action failed, and the electrical engineers in question, who were imprisoned for some time, have now instituted proceedings for damages against the company.

A profit of £500 for the past year is shown by the Portsmouth municipal telephone accounts.

Telegraphic communication between Rome and Constantinople was down on the 17th inst. for a short while, and telegrams to Rabat, Casablanca, and specially Mogador, are subject to long delay. Telegrams for the latter place can only be accepted at sender's risk.—The Eastern Telegraph Co. suffered through a break in the Malta-Tripoli cable on the 18th inst., when also the Bagdad-Bassorah line ceased working. The Egyptian Administration state that telegrams for Uganda, &c., can be sent *via* Alexandria-Gondokoro with five hours' delay. It may prove of service while the Zanzibar-Mombasa cable is down. Telegrams between these two places are sent about five times per week by post, taking anything between twelve to twenty-four hours in transit.—On the 22nd inst. the Bathurst-Bissao cable was restored. The West India & Panama Telegraph Co. has been giving some attention to the West Indian cables to Puerto Rico.

Machine Tool and Engineering Association.—This association, which was formed in 1910 with the primary object of exercising control over the organisation of exhibitions, has made arrangements whereby one engineering exhibition will be held under its own auspices in 1912 instead of the two proposed for 1912 and 1913 respectively. The association is in favour of one exhibition in London every three years, and possibly one in the provinces alternately with those in London. The association is in touch with the Board of Trade as to engineering sections of foreign exhibitions, and is in a position generally to afford its members information regarding trade openings and conditions abroad. The following form the board of directors:—Chairman, Mr. J. T. Peddie (Vickers, Ltd.); Vice-Chairman, Mr. W. Deakin (H. W. Ward & Co.); Mr. J. W. S. Asquith (William Asquith, Ltd.), Mr. A. Drummond (Drummond Bros., Ltd.), Mr. E. M. Griffiths (C. W. Burton, Griffiths & Co.), Mr. A. Herbert (Alfred Herbert, Ltd.), Mr. W. D. Ford Smith (Smith & Coventry, Ltd.), Mr. Charles Wicksteed (Charles Wicksteed & Co., Ltd.). Communications should be addressed to the Secretary, Mr. H. G. Williams, 104 High Holborn, W.C.



Every dog has his day.

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THE LAYING OF MAINS ON THE SOLID SYSTEM

By W. G. Turner.

A GREAT deal of trouble usually experienced on underground networks laid on the solid system is caused not so much by faulty construction and design of cable as by carelessness in laying, and a few points as to the precautions to be taken in this respect may be of interest. With the more extensive use of vulcanised bitumen cables the necessity for careful laying becomes a matter of the greatest importance, and a good and permanent job should always be made in the first instance, so that any relaying or even opening of the main may be rendered unnecessary in the future.

The careless laying of cables is often caused through work having to be rushed, generally in order to satisfy the hasty demands of some prospective consumer or by the late delivery of cable or other necessary materials. Another factor which is often the cause of defective laying and a contributory cause to the unfulfilment of sound workmanship is the necessity of deviation of cables owing to the presence of such obstacles as gas, water, or telephone pipes, drains, cellars, tramway posts, gas lamps, &c., in the line of route. A great mistake usually made is that the future requirements of a main are overlooked; and although the main may be sufficiently large to meet all immediate demands, it may be totally inadequate for the future. The necessity for careful initial laying cannot be too strongly emphasised with an eye to future requirements, as thereby the main is assisted in the event of an overload.

The hints and precautions outlined below, although referring particularly to rubber or bitumen insulated cables, apply generally to lead-covered and other forms of cable laid on this system.

In commencing work the trench should be cut sufficiently wide to allow the men ample room to work when laying the troughs and cables, otherwise there is a tendency for some of the subsoil to be swept into the trough by the men's clothes. A width of from 4 in. to 6 in. on each side of the trough is generally sufficient, and this enables a man to stand with one foot on each side of the trough. The usual depth of the cutting is from 1 ft. 6 in. to 2 ft. under pathways, and more under roadways, depending upon the nature of the road and whether tram-lines are present. A depth of 4 ft., however, is generally adopted in the latter case. A good labourer is able to dig about one cubic yard of trench in one hour in ordinary ground, and half this amount in hard, rocky ground. For the final filling in and ramming, 50 per cent. of the excavating costs is a good average figure. It is as well to sweep away the excavated material from the edge of the cutting for a distance of at least a foot on each side, so that it is not raked into the trench by the feet of the workmen, or blown in if the day be windy. If the bottom of the cutting is not sandy, it is necessary to riddle the soil on which to bed the troughs, and in any case it is advisable to excavate underneath the place where the spigot and socket of the troughs will lie, to make sure that they will have a firm bed.

The most general materials from which troughs are made are cast-iron, asphalt, earthenware, and wood, the latter either tarred or creosoted. Cast-iron makes a sound mechanical job, but is not used so much nowadays, when everything has to be done in the cheapest possible manner compatible with safety because of its heavy expense, and also from the fact that it is a conductor of electricity, and thus helps a path to earth for leakage currents. It also generally has to be bonded electrically throughout its whole length, although this precaution has been neglected on many systems.

Asphalt troughs are laid by a special process, and make a thoroughly sound job. They are of great service where it has been found necessary to utilise some old cable. The trough, which is manufactured from natural rock asphalt, is made continuous in laying by welded joints, and is protected on its outside by a thin steel casing. This casing is to prevent damage in transit, and after laying eventually rusts away. The cables are laid in the trough with asphalt separators between, and after filling in with compound in the usual manner, a cover is made by pouring hot asphalt concrete over the top of the trough, welding the whole into a solid homogeneous mass. This form of trough is not so expensive as cast-iron.

Earthenware and wood are the cheapest forms of troughing, each costing about the same, and have the advantage over iron in that they are both non-conductors; earthenware, however, has an advantage over wood in that it has an indefinite life, but it is more liable to be damaged by picks or through not being laid on a firm bed, or in ground where there may be a subsidence, as may be encountered in colliery districts.

The following table gives the relative prices per yard for the above troughs of standard sizes complete with covers.

Size.	Cast Iron	Asphalt.	Earthenware.	Wood.
3″ × 2″	2/0	1/7	-/9½	-/10½
6″ × 3″	3/6	2/7	1/-	1/1½

Cast-iron troughs can be from $\frac{3}{16}$ in. to $\frac{3}{8}$ in. thick, but not less than $\frac{3}{16}$ in., and should be coated with Dr. Angus Smith's composition. Earthenware troughing should be glazed all over, but some engineers prefer to leave it unglazed on the inside; as then the bitumen is enabled to get a firmer hold of the surface. Wood troughing should either be prepared with tar or creosoted. When tarred, the usual method is to boil the length of trough in Stockholm tar for at least two hours, ordinary painting or soaking not being sufficient. If creosoted, the only way is to impregnate the trough thoroughly with creosote under pressure or by the vacuum method. It should be specified that wood creosote is not used, but only the best, obtained by coal tar distillation. The former and also cheap creosote having an injurious effect on lead or iron, if the cables are protected in this manner, owing to the free acetic acid contained therein. Wood troughing lasts the longest time when laid in wet clay and the shortest in sand, the air being able to get to it in the latter case.

Cast-iron and earthenware troughs are usually made with spigot and socket joints. The former troughs can be made in various lengths, usually about 3-ft., and the latter in 2-ft. lengths. Asphalt troughs are generally about 4 ft. long, and wood about 9 ft. long. As stated previously, asphalt troughs are joined by a welding process; wood troughs, however, are joined by junction or saddle pieces, into which the ends of the troughs are placed. These saddles, besides preventing the ingress of moisture, also prevent the ends of the trough from sinking out of place and so straining the cables. With wood troughs it is best to make them with the bottoms the full width of the outside, *i.e.*, the sides nailed to the top face of the bottom of the trough, and the grain of all should run lengthways. Fig. 1 will make this quite clear.

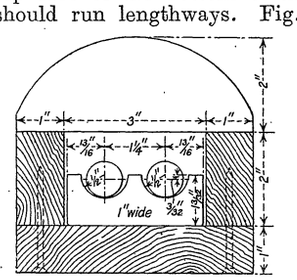


FIG. 1.—WOODEN TROUGH WITH DOME-SHAPED BRICK COVER.

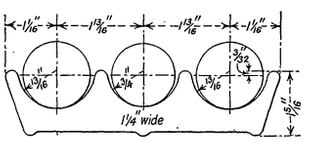


FIG. 2.—EARTHENWARE BRIDGE SUITABLE FOR 6 IN. BY 3 IN. TROUGH.

The wood should not be less than 1 in. thick for sides and bottoms of even the smallest troughs. The saddles are usually about 12 in. long, and the grain of the bottom should be at right angles to the length of the saddle, otherwise they are liable to crack when the trough-ends are placed in them should they be a tight fit.

Covers for cast-iron, wood, or earthenware troughs, if not of the same material as the troughs, which is not usual in these cases, can be either tiles or bricks, and the latter, made with a curved or what is generally known as a dome-shaped top, are the most satisfactory, as they will deflect picks in the event of the ground being opened in the future. They are also generally stamped "Electricity," which serves as a warning should they ever be uncovered. It is as well not to make these tiles very thick, as they become too heavy for easy handling. A dome-shaped tile is shown in Fig. 1, and is shown covering a 3 in. by 2 in. wood trough.

Bends are generally a source of trouble. For cast-iron and earthenware these are usually made in two standard shapes for the horizontal plane, *i.e.*, $\frac{1}{8}$ and $\frac{1}{4}$ bends, and these are again made either right or left handed. Also swan-neck bends are made for a rapid ascent or descent. With asphalt trough the bending process is very easy, as it is only necessary to detach the metal sheath of a special trough so arranged that this can be done, and by warming the trough it can be bent to any curve or shape desired. Wood trough is the most troublesome, as it necessitates the employment of a carpenter to shape it properly for curves and bends. The troughs should have their spigot ends dipped in hot compound before being

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placed in position, as this makes them bed together better at the joints and prevents water entering them from below, due to rain or a wet cutting.

If the cable is of small sectional area, the bridges should be next placed in position. These are made of numerous insulating materials, the most usual being earthenware, wood, and asphalt. They are best when made of a waterproof as well as insulating material. Earthenware is undoubtedly the best material, as it conforms with these chief qualities required for a bridge. Wood bridges, if not thoroughly covered with compound, when placed in a damp position, will eventually absorb water, and so form a path to earth for stray currents. In any case, wood bridges first should be creosoted or boiled in tar, and when used should be kept in buckets on top of the pitch-boiler until wanted, and be dipped in hot compound before being placed in position. They should, however, never be used to support a lead-covered cable, as they are bound eventually to have an injurious effect on the lead due to the organic acids which are produced in the process of decay.

Asphalt is waterproof, and the advantage of it being non-hygroscopic entirely overcomes one of the troubles experienced with wood and improperly glazed earthenware bridges. It also partly melts on its outside surface when in contact with the hot compound used to fill the troughs, and so joins up solid in one homogeneous mass with the compound. The first opinion of many critics was that asphalt bridges would melt away entirely and allow the cable to sag down and touch the trough-bottom, but it has been practically demonstrated that only the surfaces of the bridges become plastic in the interval between pouring in and setting of the compound. These bridges, or generally asphalt separators, when used with asphalt troughs and covers, form a true solid system from every standpoint. An asphalt bridge of standard shape is shown in the trough in Fig. 1.

The radius of the curve of all bridges should be slightly more than that of the cable they have to support, so as to enable the compound to flow round the cable to the maximum possible amount. Fig. 2 shows an earthenware bridge of standard shape suitable for three cables and a 6 in. by 3 in. trough.

Bridges should be placed from 12 in. to 24 in. apart, much depending on the stiffness of the cable, but in the majority of cases a distance of about 15 in. is not exceeded. The dust and dirt are first brushed out of the troughs, and the position of the bridges is then marked on the bottom, a piece of stick being used as a gauge. It is best to prepare such a gauge beforehand, as otherwise if the work of placing the bridges is left to a labourer not possessing a trained eye, a distance of 12 in. or 15 in. often becomes 18 in. A patch of compound is next placed on each of the marks, and the bridges are fixed in these positions. After the trough has been cleared of dirt or other foreign matter, the cable is handed along and dropped into position, care being taken that it is free from kinks or bends, and that it rests properly on its bridges.

Should the cable be very heavy, say one of 1 sq. in. sectional area, the easiest way of handling it is to draw it along the trough on special temporary saddle pieces before the bridges are fixed. These saddle pieces are made of hard wood with rounded tops, in order to avoid damage to the cable, and are placed across the bottoms of the trough and held in by compound at distances of about 6 ft. apart. The advantage of drawing the cable along the trough in the manner described is that there is a great saving in the number of men required in handling the cable. When the cable is in the trough it is lifted up piece by piece and supported on stout pieces of wood laid across the top of the trough, the temporary saddle pieces are then knocked out, and bridges are placed in position, and work proceeded with as described previously.

The most important point to be considered in the laying of cable on the solid system is the filling up of the trough with compound. To get the compound free from blow-holes or air-bubbles, and also dirt, necessitates great care. The first operation is to coat the cables across the bridges, thus helping to keep them in their places. The whole trough is then filled up to one-third or one-half its depth with compound, the former being the best amount when the trough is large. The first application of compound should be hotter than is necessary for successive coats, as the cooling action of the troughs and cables will be very rapid. The compound, however, as it leaves the boiler, may be too hot, it generally being at a temperature of about 450° Fahr.; it will then have to be stirred and cooled by pouring into other buckets until it has fallen to a temperature of about 350° Fahr. The compound in the troughs is then allowed to cool, and at the same time a careful inspection is made to see that there are no air-bubbles under the cables or elsewhere in the trough. Any air-bubbles there may be should be burst with a stick. The trough is then filled up to two-thirds its depth, the same time for cooling being allowed to take place and inspection for air-bubbles, and it is finally filled up flush with the top, either two or three operations having been gone through, depending on the size of the trough. By this method the shrinkage is reduced to a minimum. The air-bubbles which may be present when the compound is drawn from the boiler may be removed by stirring it when in the "pouring-out bucket" with a stick; this also frees all other gas which may be present. Bubbles may also be caused by a shower of rain; therefore full buckets, if left to cool, should be covered up, and buckets standing empty be turned upside down. As each coat of compound is put on to the cables, the trough should be covered up during the time of cooling with a narrow waterproof sheet, supported at intervals by tiles or other means, so that the sheet does not touch the compound and thus adhere to it. This covering is necessary to prevent dust or other material getting into the trough, and also protects it in the event of a shower of rain. A last thin coat of fairly hot compound is applied to the top of the filled trough for fixing the tiles or other form of covers, and care is taken to push the compound in front of each tile as it is laid so as to form a good joint between the edges, and a coating on top of the joint.

Refined Trinidad bitumen is the best filling compound to use, but some engineers use a mixture of pitch and pitch oil, which has, after years of experience, been found to be quite satisfactory. It is also much cheaper than bitumen, but, of course, is not such a good insulator. The minimum distance between the outside of the cable and the trough should not be less than $\frac{1}{2}$ in. The gradual filling of the trough also gives the cable time to cool after each operation, which not only prevents buckling, as would occur if the trough was filled too rapidly, but also saves the consequent expansion in the length of the cable.

The process outlined above renders it possible to ascertain with certainty that the cable has not jumped off any of the bridges or become kinked so as to touch the bottom or sides of the trough. The ground is then filled in except at places of joints in cables, which latter should not be made for at least twenty-four hours after the cable has been laid. This gives plenty of time for the cable to cool and contract to its normal length. The section tests also should not be made until the cable and compound have thoroughly cooled.

A solid system of cables should never be laid in wet weather, and it is essential that the cable, trough, and bridges should be perfectly dry. All material ought, therefore, to be stored in a weatherproof place until immediately before it is required, and troughing when stacked should be inverted to protect the interior from damp. Bitumen-insulated cables should at all times be handled most carefully; in cold weather they are liable to crack if bent too acutely.

In the event of having to make the joints at once, the cable should be kept longer than necessary where it has to be jointed, say, from $\frac{3}{4}$ in. to 1 in. for each hundred yards, and no compound put into the trough for at least three yards on each side of the joint; then, if the cable is found to be a little too long after cooling, it can be shifted either sideways or up or down to take up the slack, or even a piece can be sawn off.

When laying mains round corners the radius should not be less than about 4 ft. 6 in. for a 0·5 sq. in. bitumen-insulated cable, 6 ft. for a 0·75 sq. in. cable, and 7 ft. for a 1 sq. in. cable. Precautions should also be taken when laying cables round bends to see that they are not laid too near the inside curve, as they will be drawn closer to the inside curve during the process of cooling; there is also always a danger of a like thing happening when the cable is heavy and is laid down a hill. The best plan in the event of a bend coming in a long length of cable is to avoid putting any compound into the bend for at least three yards on each side of it until the cable has had twenty-four hours for contraction, after which the troughs can be shifted to suit the length of cable available.

Sometimes for some unforeseen reason a main has to be laid in hot ground, *i.e.*, in the vicinity of buried pipes carrying hot fluids or under ash-heaps. It is necessary in such cases to surround the main with some non-conductive heat-resisting composition.

Before concluding, a few words about the means of disconnecting mains may be of interest. There are two general systems, viz., by means of underground boxes or by pillars. Pillars have a distinct advantage over underground boxes, but it is not always convenient to adopt them. In the first place, they are considerably cheaper; they also involve less disturbance to the ground; are more readily operated, and are much dryer than underground boxes.

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THE ELECTRICITY UNDERTAKINGS IN THE POTTERIES

THE first Paper read at the Municipal Electrical Convention at Brighton referred to the effect of combination between the six different local authorities in the Potteries which has enabled a new scheme to be put forward for the supply to that district. For the benefit of our readers not acquainted with Staffordshire, we may say that this is not the Black Country—a name sometimes given to the chain-making and ironworking district in South Staffordshire. The

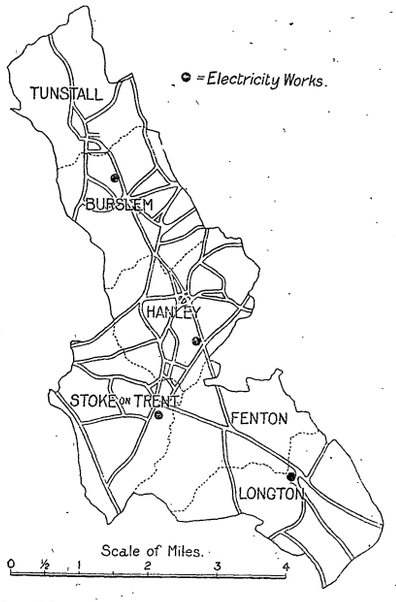


FIG. 1.—MAP OF POTTERIES, SHOWING POSITIONS OF GENERATING STATIONS.

Potteries lie almost equidistant from Crewe, Macclesfield, Stafford, and Derby in North Staffordshire, and between the main lines of the Midland and North Western Railways, in the valley of the River Trent.

The whole area has already been supplied more or less effectively with electricity from independent stations owned by the local authorities which controlled local administration under the old conditions. These works, it is claimed by the founders, were, and even still are, quite efficient and com-

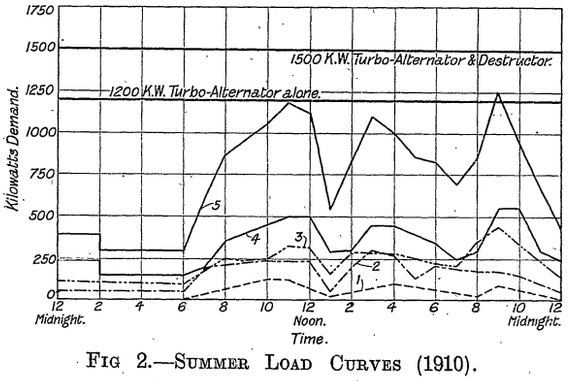


FIG 2.—SUMMER LOAD CURVES (1910).

1. Longton.
2. Stoke.
3. Burslem.
4. Hanley.
5. Total.

petent to supply the needs of the several areas in which they were put down. But although the districts are contiguous, no attempt up to the present had been made to obtain the benefit of a combined undertaking.

A map of the district is given in Fig. 1, showing the positions of the generating stations. Particulars of the electrical undertakings of the constituents which have gone to make up the new county borough of Stoke-on-Trent are as follows:—The supply of Burslem, which was formerly a separate borough, was commenced in 1905, and the station contained plant aggregating 1,250 kw., and consisting of Howden-Dick, Kerr 100, 200 and 350 kw. sets and a Belliss-Siemens mixed-pressure 600 kw. turbo-alternator. The peak load is 746 kw., and a three-wire 2 × 220-volt distribution is given throughout Burslem, Tunstall, and Walstanton. The Hanley station is older, dating from 1894, and gives a single-phase supply. The generating plant is made up of Howden-Westinghouse and Ferranti steam alternators, aggregating 1,900 kw., and dealing with a peak load of 1,304 kw. The Longton station, started in 1901, is smaller, with 600-kw. plant capacity, meeting a peak load of 250 kw., and consisting of three Belliss-E.C.C. sets distribution in three-wire 2 × 230 volts. The remaining station at Stoke, which also supplies part of Fenton at 2 × 240 volts, is equipped with Willans-Dick, Kerr sets totalling 600 kw. Supply was commenced in 1904, and a peak of 624 kw. has been reached.

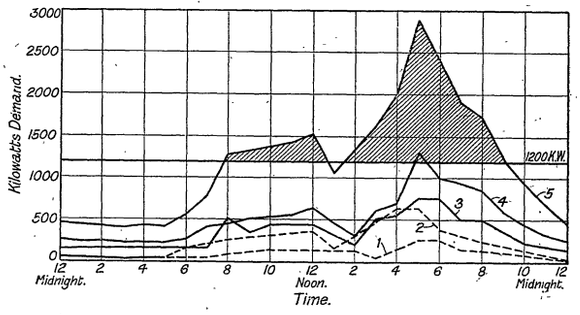


FIG. 3.—WINTER LOAD CURVES (1910).

1. Longton.
2. Stoke.
3. Burslem.
4. Hanley.
5. Total.

The total area is 11,154 acres, population 245,000, and rateable value £788,461. It has been estimated that the total horse-power of electric, steam, and gas plants engaged in the staple industry of the district, the manufacture of pottery and china, and in other minor industries, is 10,000 h.p., and of this approximately one-third is already electric. We are

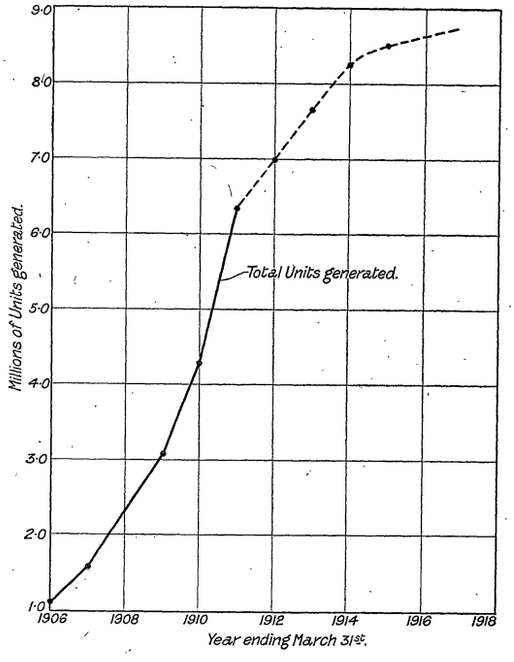


FIG. 4.—CURVE SHOWING INCREASE IN UNITS GENERATED PER ANNUM.

indebted for all these particulars to Mr. C. H. Yeaman, Chief Electrical Engineer to the County Borough of Stoke-on-Trent.

The remaining figures give some interesting curves showing the character and increase of the load. Summer and winter load curves are shown for the four stations separately, and as a total in Figs. 2 and 3 respectively, which are from curves prepared for Mr. J. F. C. Snell's evidence at the recent Local Government Board inquiry. Fig. 4 is also interesting, as it shows the increase in units generated for the last few years,

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and the further estimated growth of the undertaking. The maximum loads each year since the undertakings commenced supply are shown in Fig. 5.

As has already been stated in Mr. Leese's Paper, the policy for the future is not to make additions to the small

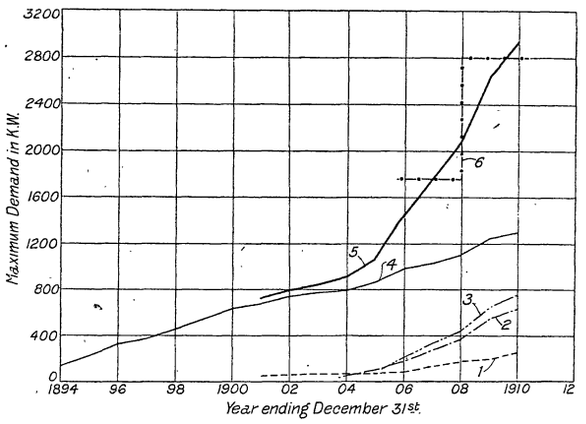


FIG. 5.—CURVES SHOWING MAXIMUM LOADS EACH YEAR SINCE THE UNDERTAKINGS COMMENCED SUPPLY.

1. Longton.
2. Stoke.
3. Burslem.
4. Hanley.
5. Total.
6. Plant capacity excluding stand by.

plant in the existing stations, but to build and equip a new power station, as nearly as possible in the centre of the area of supply. This will be connected with the four existing stations by trunk mains, and will contain two 1,500 kw. turbo-alternators with the necessary equipment of boilers, switch-boards, &c. The D.C. plant at Burslem and Stoke and the A.C. single phase at the Hanley Works will be retained for peak loads so long as it is economical to do so.

REVIEWS OF BOOKS

A Handbook of Wireless Telegraphy, by Dr. J. Erskine-Murray. Third edition. 386 pp., 8¾ in. by 5¾ in., about 192 figures. (London: Crosby Lockwood & Son.) 10s. 6d. net; abroad 11s. 4d.

THE third edition of Dr. Murray's book on wireless telegraphy has followed soon after the second, but the rapid progress of the subject has necessitated considerable revision in the directions both of adding new matter and removing that which relates to paths other than those now leading to progress. The additions include interesting information as to recent developments of the Marconi system, but other modern systems, such as the Lepel, are also dealt with, and, indeed, the balance between the work of different pioneers is on the whole well kept. Although, as in former editions, the final chapters contain quantitative treatment of certain parts of the subject, this is perhaps hardly in the form required by the practical wireless telegraph engineer. The reader with only a general knowledge of the subject will find most stimulating reading to direct his thoughts to ways in which the fundamental phenomena are utilised in the different systems, but we would again suggest, as has been done in reviews of former editions, that, as a handbook for the actual designer, there is not quite enough to give a concrete idea of the actual dimensions of the apparatus employed.

The Propagation of Electric Currents in Telephone and Telegraph Conductors. By Prof. J. A. Fleming, F.R.S. 316 pp. 8¼ in. by 5⅞ in. 80 figures. (London: Constable & Co.) 8s. 6d. net; abroad, 9s. 2d.

THIS book is a reproduction of two courses of lectures recently given by the author. Although a good deal of mathematics, with a fair knowledge of the calculus, is required, the operations and processes have been simplified and rendered easy of application in practice. The opening chapter is a mathematical introduction, wherein the simple periodic currents are represented by complex quantities, and on account of the usefulness of hyperbolic functions for representing the flow of alternating currents, hyperbolic trigonometry is discussed, a table of these functions being given in the appendix. The chapter concludes with useful tables of hyperbolic functions of complex angles. Chapters II. and III. relate to the propagation of electromagnetic waves along wires and simple periodic currents in cables; and Chapter IV. deals with the principles of telephony, introducing the excellent work of Mr. Oliver Heaviside, also Prof. Pupin's application thereof to telephone cables, as well as investigations of Prof. Silvanus Thompson on submarine cables. The transmission of high and very low frequency currents comes next, followed by the electrical measurements and determination of cable constants dealt with at some length. In the next chapter, on cable calculations, useful tables and data are given. In conclusion, an illustrated description is given of the new Anglo-French telephone cable. The whole forms a very complete and comprehensive text-book.

Principles of Electrical Engineering. By H. Pender. 340 pp. 9½ in. by 6¼ in. 125 figures. (New York: McGraw Hill Book Co.) 17s. net; abroad, 17s. 9d.

THIS work is confined exclusively to the principles of electricity and magnetism and their applications in practice. It opens with the usual definitions of the fundamental and derived units, in which the quantities are measured. The next two chapters deal with the principles of the magnet and magnetic lines of force; electric currents in wires and their effects on the surrounding medium; electrical resistance, electromotive force, and the means of measuring them, and Kirchhoff's Laws are clearly defined and applied. We note that the magnetic field intensity is expressed in Gilberts per centimeter, and the unit of flux density is called the Gauss. Under the title of electromagnetism, the continuous current dynamo is introduced with the method of calculating the electromotive force induced in the armature, and expressions for magnetomotive force, reluctance, and inductance are deduced. Following this, electrostatics is fully and clearly explained, and then comes an important chapter on variable currents, in which the charge and discharge of the condenser are calculated. Alternating currents and the symbolic method of treating them is next dealt with, and finally, in connection with polyphase currents, the problem of the star and mesh connected combinations of the three-phase generator and load, and the two wattmeter method of measuring power applied to a balanced three-phase system are very well described. We do not like the abbreviation ln for natural log, nor do we think it necessary to use the prefix "ab," such as abampere, in the C.G.S. system of units. The use of the calculus throughout has, of course, considerably shortened the mathematics, which is unavoidable in this subject. This book contains much that is dealt with in a college course of electrical engineering, and should be well received by the student as well as the practical man.

Whittaker's Electrical Engineer's Pocket Book. Edited by K. Edgcumbe. Third edition. 597 pp. 6½ in. by 4 in. 181 figures. (London: Whittaker & Co.) 5s. net; abroad, 5s. 4d.

THE fact that the Electrical Pocket Book edited by Mr. K. Edgecumbe has already reached a third edition shows that the character of the information contained therein is such as is required in a work of this sort. The names of several well-known technical writers appear at the heads of some of the sections, but this does not prevent a homogeneity of treatment throughout. The work is principally devoted to the heavier branches of electrical engineering, as telegraphy and telephony are not dealt with. There is, however, a short chapter on electric clocks. A large proportion of the matter has been re-written in preparing the new edition, and the revision partakes more of the nature of a thorough bringing up to date of detail than the adding of new sections.

Associated Municipal Electrical Engineers (Greater London).—The Associated Municipal Electrical Engineers (Greater London) held their annual general meeting at the Institution of Electrical Engineers on July 5th, and the following executive officers were appointed for the session 1911-1912:—*President:* W. C. P. Tapper (Stepney). *Vice-Presidents:* F. A. Bond (Battersea), L. L. Robinson (Hackney), and A. H. Shaw (Ilford). *Hon Treasurer:* G. G. Bell (Hammersmith). *Hon. Auditors:* J. G. Bruce (Willesden) and E. Calvert (Finchley). *Hon. Secretary:* Norman Staniland (Hornsey). *Council:* S. W. Baynes (St. Pancras), A. J. Fuller (Fulham), P. E. Rycroft (Heston), J. H. Bowden (Poplar), F. Hill (Hammersmith), E. Sayer (Hampstead), H. H. Couzens (West Ham), W. Innes (Poplar), A. H. Seabrook (St. Marylebone), C. S. Davidson (Barnes), C. Newton Russell (Shoreditch), and W. C. Ullmann (East Ham).

Electric Lighting Provisional Orders.—The Board of Trade received 28 applications for electric lighting provisional orders in 1910, of which 11 were by local authorities, and 17 by companies or persons. In 19 cases the orders as applied for were granted; in two cases the promoters decided not to proceed with their applications, in one case the Board refused to grant the order, and in another dispensed with the consent of the local authority and granted the order, and in the remaining five cases, modified orders were granted. The Board have issued six certificates during the year, under Section 2 of the Electric Lighting Act of 1909, legalising the construction of generating stations upon land which had not been specified in an Act of Parliament, and under Section 6 of the same Act supply outside the area of the supply authority was authorised in 23 instances. The full report can be obtained from Messrs. Wyman & Sons, Fetter Lane, London, price 3d.

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A SUPPLY COMPANY FINED UNDER THE FACTORY ACT

A CASE of some importance to those in charge of central station switchboards was heard at the Newcastle Police Court on Friday last, when the Newcastle and District Electric Lighting Co. were fined for neglecting to comply with certain of the Home Office regulations for the use of electricity in factories and workshops. The case arose out of the accident which occurred on April 6th last, at the switchboard of Close power station of the company, when Mr. W. Middleton, assistant station superintendent, received injuries from which he died.

The board in question is arranged for a 500 volt D.C. three-wire supply, with the neutral earthed, and with a battery and boosters. It appears that two men named Cox and Greenwood were at work on the board, and a spanner, with which a connection on the negative side was being tightened up, accidentally came in contact with a positive bar, and struck an arc by which the two men were somewhat burnt. This put 500 volts across the booster. The current was then broken, and a surge was produced which caused a flash over at a point on the board where there was about one inch between the positive and negative, but it would appear from the statements made in court that a further and more complete flash over, caused possibly by metallic dust left by the first arc, occurred later while Mr. Middleton was examining the connections. Mr. Middleton was badly burnt, and subsequently died from his injuries.

The actual charges were five in number. First, neglect to observe Regulation 14, in that the base conductors at the point where Mr. Middleton was injured were not placed so as to prevent danger from short circuit; and, secondly, that they were not so protected as to prevent danger. The third and fourth informations related to the cases of Cox and Greenwood respectively, and also alleged lack of proper protection. Lastly, the company were charged with general contravention of Regulation No. 1.

Mr. H. Mundahl appeared for the prosecution, and Mr. E. Meynell for the defence said he would plead guilty to the second charge, but not to the remainder. It was pointed out that Mr. Middleton was known to have a weak heart, and may have died from general shock, and the fact was elicited that before the accident the local factory inspector had never found fault with the board. The board had been subsequently tested by Prof. W. M. Thornton with 14,000 volts, without any flash over being produced.

No technical evidence was called, and while recognising that the neglect was not wilful, the Bench imposed a fine of £50 and costs on the second charge, and nominal fines of 20s. in respect of the third and fourth charges. The first and fifth indictments were withdrawn.

The accident was a very peculiar one, and difficult to foresee or reproduce. The board had given no trouble since it was installed in 1907, and had always been regarded as perfectly safe. It is only right to point out that as soon as any question of danger was raised, the company went considerably further than the requirements of the factory inspector, and put in new panels, doing away with the change over switches where the flash over occurred entirely. The severity of the judgment and summary way the case was dealt with may cause some consternation to owners of L.T. switchboards, as we are sure there must be many odd corners where conductors of opposite potential an inch or so apart are without insulating partitions.

THE BREMER FLAME ARC LAMP PATENT

AN interesting echo of the recent action by the British Westinghouse Co., Ltd., against the Electrical Co., Ltd., for infringement of the Bremer flame arc lamp patent was heard in Mr. Swinfen Eady's Chancery Court on Monday. As the result of the action in question (ELECTRICAL ENGINEERING, May 4th, page 235, and June 22nd, page 348), judgment was given to the effect that the Electrical Co.'s "Sunshine" arc lamp was an infringement of the Bremer specification, and an order was made for the delivery up of all lamps or parts of lamps in existence.

Before Mr. Justice Swinfen Eady on Monday, Mr. Bousfield, K.C., on behalf of the Electrical Co., argued that this order should be varied to give the Electrical Co. the option of having the lamps and parts of lamps destroyed in the presence of representatives of the British Westinghouse Co. He claimed that this was the usual interpretation of an order to deliver up, but that the British Westinghouse Co. took the opposite view. He also mentioned the fact that in the previous action by the British Westinghouse Co. against Mr. G. Braulik, lamps had been delivered up which the Westinghouse Co. had actually sold, and he argued that this was not the intention of the order, and he wished to prevent that happening in this case.

Mr. A. J. Walter, K.C., for the British Westinghouse Co., asked his lordship to maintain the terms of the order made at the time judgment was delivered, namely, that the goods should be delivered up.

Mr. Justice Swinfen Eady gave judgment in favour of the British Westinghouse Co., pointing out that the alternative asked for by the Electrical Co. was not suggested when judgment was delivered and the order made.

ELECTRICAL EQUIPMENT OF A LARGE DRAPERY ESTABLISHMENT

THE electrical equipment of Messrs. Swears & Wells, of Regent Street, whose enlarged premises are now nearing completion, has been carried out by Messrs. Rashleigh Phipps & Co. (147 Oxford Street, W.). Two separate services from the supply mains of the St. James & Pall Mall Electric Light Co. enter the building at the back and front respectively through Tucker switches, of the ironclad type, and fuses, and all connections here are finished off with a teak covering. The premises are wired throughout with Henley's 19/14 cable, which is drawn into heavy screwed steel earthed conduits with draw boxes throughout. The distribution boards are all provided with earth metal backings to the cases. All the tumbler switches are semi-sunk, and look much less cumbersome than the ordinary type. A feature of the building is the extensive provision made for electric ironing, which is always in great demand. For this purpose small teak benches 1 in. thick, insulated with uralite slabs ¾ in. thick, are erected at the wall on two or three floors. The electric irons are of the British Prometheus Co.'s manufacture, and are connected to plugs in the wall, each through a tumbler switch and a ruby lamp, which glows while the iron is in circuit, and acts as a warning to that effect. The large irons, made especially for tailoring work, take 3 amperes, and the smaller ones take 1·15 amperes. The window lighting consists entirely of 32-c.p. Osram lamps, placed in glass-lined metal troughings of Messrs. Rashleigh Phipps & Co.'s special design, arranged behind the flouncing at the top of the windows. The troughing is made in sections swivelled at the top, so that they can be tilted to any angle to produce the best effects for various methods of window-dressing. Power is supplied at 220 volts for the irons and the lifts, which were installed by Messrs. R. Waygood & Co., but the lighting circuits are entirely at 110 volts.

A very complete intercommunication telephone system, including 20 instruments in various departments, has been installed on the latest intercommunication system by the **Sterling Telephone & Electric Co., Ltd.**

STREET LIGHTING IN THE BORO' OF HOLBORN

THE much debated contract for the street lighting of the Borough of Holborn will again come up for consideration at the Council meeting to-morrow. The Works Committee having considered the report of the Council sitting as a special Committee (ELECTRICAL ENGINEERING, June 22nd, page 348), now express the opinion that the joint tender of the electric lighting and gas companies to give 425,000 c.p. at an annual cost of £7,645 is a favourable one to the Council. They point out that the capital cost of providing the new fittings, columns, lamps, &c., will amount to about £9,000, which sum will have to be provided by the Council, the fittings, &c., of course, remaining their property. This amount will be repaid over a period of ten years, making an addition of £900 per annum to the contract price. The proposal of the companies involves 20,000 more c.p. than is required by the specification, but this is brought about by the higher c.p. lamps required in certain thoroughfares in order to make them uniform with existing lamps in other parts of these thoroughfares which are in adjoining boroughs.

The Works Committee make the following recommendation that, "Subject to the consent of the London County Council being first obtained to the form and principle of the contract, the joint and several tenders of the Gas Light & Coke Co. and the Metropolitan Electric Supply Co., Ltd., dated 11th April, 1911, for lighting the streets of the Borough for ten years for the sum of £7,645 per annum, subject to the deletion of Clause 35 of the specification (ELECTRICAL ENGINEERING, June 15th, page 335) and the amendment of the schedule of lighting as proposed by them, be accepted, and that the seal of the Council be affixed to the necessary contract to be prepared by the Town Clerk."

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ELECTRIC TRACTION NOTES

In ELECTRICAL ENGINEERING of May 18th (page 265) some notes were given of the intentions of the French Midi Railway as regards the adoption of electric traction, and particulars were given of one of the locomotives to be used. Another locomotive to be experimented with on the Villefranche section is described in *La Revue Electrique*. This had been built by Les Atelier de Construction électriques du Nord et de l'Est of Jeumont, and has a continuous rating of 1,200 b.h.p., or 1,500 h.p. on the one-hour rating. It will take current at 1,200 volts at 16⅔ cycles, single phase. Like the other, it is a ten-wheeled locomotive, with six driving wheels in the centre, but no coupling rods are used, as a separate 500-h.p. motor is provided for each driving axle. The motors are mounted rigidly on the chassis, and drive sleeves surrounding the driving axles through helical gearing. These sleeves are connected by spring couplings to the driving wheels, allowing considerable freedom of movement. The motors are of the compensated series type, weighing six tons, complete with gearing, and run at 450 r.p.m. They are fed from transformers in conjunction with induction regulators, and regenerative braking is arranged for. The locomotive is designed to start a train of 400 tons, and to attain a speed of 25 miles per hour with a 280-ton train, and 38 miles per hour with a 100-ton train.

For the supply of power for electric traction in the Hoosac Tunnel, in America, an account of which appeared in a recent issue of *Power*, an up-to-date generating plant has been installed by the Westinghouse Co. This consists of two 3,750-kw. turbines of the double flow type, which drive single-phase 25-cycle generators at 1,500 r.p.m., and supply current to the lines, which run from the station on flexible steel towers to switching stations at each end of the tunnel, at 11,000 volts. The auxiliary units comprise two 100-kw. direct-current exciters driven by an induction motor and turbine respectively, an air-compressor driven also by an induction motor, which supplies air at 50 cubic ft. per minute for cleaning purposes. The voltage is transformed down on the train, each locomotive being provided with a transformer, which is tapped so that any voltage can be obtained. The locomotives are each equipped with four 320-h.p. 300-volt single-phase motors bolted direct to the frames and connected to the driving wheels by gearing and a spring drive, and controlled by the multiple-unit system, so that it is possible for one controller to operate more than one locomotive. The locomotives for freight service have a maximum speed of 30 miles per hour, and those for passenger service are geared for a maximum speed of 50 miles per hour.

The most interesting Paper from an electrical engineering point of view of those read at the Zurich meeting of the Institution of Mechanical Engineers was that of Mr. E. Huber Stockar, of Zurich, on "Electric Traction in Switzerland." The author pointed out that in Switzerland, where railways are, on the whole, not making profits because of cost of construction, heavy grades, rather irregular traffic, short average distance of travel, high wages, low fares, and so on, the problem of railway electrification is in every case a problem mainly of general economics of railway operation, since the technical problem has admittedly been satisfactorily solved so far. Some statistics as to the Swiss railways in general were given in the form of tables, and it was mentioned that the percentage of normal gauge railways worked electrically had risen from 2·9 in 1909 to 5·4 at the present time. A description was then given of the Burgdorf-Thun line, which, it will be remembered, was the first normal gauge railway to be run on the three-phase system, although this form of traction has already been applied to a tramway system in Lugano and to certain narrow gauge and mountain lines. The trains were originally hauled by 30-ton two-axle locomotives, with two 150-h.p. motors, wound for one economical speed only, and provided with a mechanical change speed gear. The latest locomotives, however, are of the double bogie type, weighing 42 tons, and propelled by two 400 induction motors without slip-ring for variable voltage control, and giving four economical speeds by changing the effective number of poles. They were equipped by Messrs. Brown, Boveri & Co.; motor coaches, each equipped with four 60-h.p. motors, are also used. The Burgdorf-Thun railway was built for electric traction, but the first Swiss normal gauge steam railway to be converted was the Freiburg-Murten-Sus line, completed as far as Murten in 1903, and extended to Ins quite recently. This is the only example of a continuous-current normal gauge railway in the country, and makes use of a third rail at a pressure of 800 volts. The Paper then describes the traction arrangements in the Simplon Tunnel, which is entirely by three-phase locomotives, the most recent of which, by Messrs. Brown, Boveri & Co., have four driving axles driven by cranks and side-rods by two motors aggregating 1,700 h.p., with four economical speeds and variable voltage control. The first single-phase normal gauge railway in Switzerland was the Seebach-Wettingen experimental line, where tests have been made of various locomotives working with a contact line pressure of 15,000 volts 15 cycles. The locomotives were constructed by the Oerlikon and Siemens-Schuckert firms.

Another single-phase normal gauge line is the Seethalbahn, where motor cars each with four 100-h.p. motors are run from a 5,000-volt 25-cycle circuit. The Martigny-Orsières line, however, employs 8,000 volts at 15 cycles, this frequency conforming with the standard now accepted for future electrification. This line is interesting as employing the Deri motor, in which speed regulation is obtained by shifting the brushes. The Paper then describes the equipment for the Loetchberg tunnel. The Spiez-Frutigen line leading to the tunnel approaches is already run electrically on the now standard 15,000-volt 15-cycle single-phase system, first experimented with on the Seebach-Wettingen line. The rolling stock to be used for the tunnel comprise a 1,600-h.p. A.E.G. locomotive, a 2,000-h.p. Oerlikon locomotive, and three passenger motor cars of 450-900 h.p., each ordered jointly from the Siemens-Schuckert and Oerlikon companies. Single-phase current at 10,000 volts 15 cycles has been decided upon for the Rhätische Bahn, the new lines of which, in the Upper Engadine, are all to be worked electrically. Three 600-h.p. and eight 300-h.p. locomotives are already on order. These lines, although quite of the character of main lines, are of narrow gauge. Progress in electric traction has been facilitated in Switzerland by the Commission for the Study of Electrical Railway Working appointed by the Government, whose investigations led to the standardisation of system, voltage, and frequency, and who have prepared a complete scheme for the forthcoming electrification of the Gothard Railway.

On Friday, an Appeal Court, consisting of Lords Justices Vaughan-Williams, Fletcher-Moulton, and Buckley, disposed of the dispute between the West Hartlepool Corporation and the Hartlepool Electric Tramways Co., with regard to the purchase of the company's lines. We gave the facts of the case on page 353 of our issue for June 22nd. Briefly, they are that Messrs. Sellon & Ashby obtained the Hartlepool Tramways Order in 1895, and transferred it to the Hartlepool Tramways Co. This transfer, however, did not receive the sanction of the Board of Trade, but the company continued to work the lines until the period arrived when the Corporation were entitled to purchase. Arbitration proceedings took place a short time ago, and the sum of £12,963 was agreed upon as the price to be paid, but the Corporation raised the point that neither Messrs. Sellon & Ashby nor the Hartlepool Electric Tramways Co. were entitled in law to be paid. The matter was argued before Mr. Justice Bray, who held that Messrs. Sellon & Ashby still remained "promoters" under the Tramways Act, and that the Corporation must pay the purchase money to them, leaving it to these two gentlemen and the Tramways Company to make the necessary arrangements for giving the Corporation a good title to the tramways. The Appeal Court decided, however, that as the Board of Trade were fully cognisant of the position, as proved by certain documents, and had not objected, their consent had in fact been given, and that the company were in the position to give a good title to the tramways to the Corporation. They, therefore, upheld the decision of Mr. Justice Bray that the Corporation must pay somebody, but their decision has simplified the matter in holding that the Tramways Company can itself give a good title to the tramways.

The provision of trolley omnibus systems is under consideration in Mirfield, Bingley, and Oldbury. A deputation from the Dewsbury Council is to visit the installations at Leeds and Bradford.

Some further evidence was heard at Stalybridge last week concerning the cause of the tramway accident on Whit Monday. The witnesses consisted of the driver and conductor of a car coming in the opposite direction. The former stated that he saw the driver of the runaway car endeavour to apply first the hand brake and then the magnetic brake, but in neither case was the speed of the car checked. Col. Von Donop will report in due course.

In their annual report the directors of the Metropolitan Railway Co. state that the installation of automatic signalling between Willesden Green and Neasden has now been completed. The replacement of the existing turbo-generators at Neasden by machines of larger capacity and improved

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economy is proceeding satisfactorily. The report also states that arrangements for the electrification of the East London Railway Co. are engaging the special attention of the lessee companies, and the work is expected to be put in hand shortly. Its completion will permit of the company's train service to New Cross being resumed.

A dividend at the rate of 5½ per cent. per annum for the June half-year is recommended by the Lanarkshire Tramways Co., carrying forward £7,073. Four additional cars will shortly be put into service.

The London, Tilbury & Southend Railway Bill was passed by a House of Lords Committee last week. The Bill gives the company powers to work the whole of their lines by electric traction, and authorises the raising of £750,000 new capital for the purpose of generating machinery and rolling stock.

The Llanelly electric tramway system was formally opened last week. The system is the property of the Llanelly & District Electric Lighting & Traction Co., Ltd.

In connection with the scheme mentioned in our last issue for the purchasing of the whole of the British Electric Traction Co.'s lines in Birmingham, the Tramways Committee recommend a large number of extensions.

The June half-year's report of the London, Brighton & South Coast Railway states that the cost of equipping the L.B. & S.C. Railway and Crystal Palace lines for electric traction, and providing rolling stock and repair shops, are the principal items of the capital expenditure of £449,715.

The concession for the extension of the subways in New York City has been awarded to the Brooklyn Rapid Transit Co. The estimated cost is about £45,000,000.

The Hastings Tramways Committee have refused to assent to a proposal by the Hastings Tramways Co. to substitute the overhead system for the Dolter surface contact system along the sea-front.

The Highways Committee of the L.C.C. recommend application being made to Parliament next session for seven new lines of tramways having an aggregate length of eleven miles of single track. The estimated cost of construction and equipment, including cables, cars, and a proportion of the cost of car-sheds and sub-stations, is £274,820, and the total net cost of street widenings £88,750.

Some details of the proposed conversion of the East London Railway to electric traction have at last been made public. At the half-yearly meeting on Tuesday, Lord Claud Hamilton stated that the estimated expenditure was £65,000, and it was hoped that the Great Eastern Railway Co. would incorporate clauses in one of its own Bills authorising the raising of this sum of money. The extra working expenses are put at £3,000 per annum, which the lessee companies are willing to bear. With regard to the interest upon the £65,000, which at 4 per cent. amounts to £2,600 per annum, the East London Co. will pay this after they have received the minimum rent of £30,000 per annum, and also the extra sum to which they are entitled when the gross receipts exceed £53,000 per annum. The District Railway Co. will supply the current from Lot's Road, and the Metropolitan Co. will supply the rolling stock.

At the City and South London half-yearly meeting, on Tuesday, it was stated that experiments are to be carried out with a view to so improving the existing locomotives that the time taken on each journey will be reduced by five or six minutes.

An Appeal Court, consisting of the Master of the Rolls and Lords Justices Farwell and Kennedy, decided on Monday (Lord Justice Farwell dissenting) that the Central London Railway Co. is not liable to pay land tax in respect of the portion of their tubes which are beneath certain streets in the City of London. It is agreed that land tax is not payable where the tubes are underneath houses.

The conversion to electric traction of the Vienna Stadttahn and the construction of a considerable length of new underground electric lines connected therewith, is being considered by the Vienna Traffic Commission. Probably a concession will be granted to a company to carry out the work, which will involve the expenditure of about five million pounds.

Parliamentary.—The East Kent Electric Power Bill was read a third time and passed in the House of Lords last week.

The Newcastle-upon-Tyne, the Chiswick, and St. Helens Corporations Bills were read a second time, and the Luton Corporation Bill a third time, in the House of Lords on Monday.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ONEWATT LAMPS.—Several new sizes of onewatt lamps are included in a new list just issued by Siemens Brothers' Dynamo Works, Ltd. (Tyssen Street, Dalston, N.E.). The range now comprises low voltage lamps in various sizes, from 9 to 14·5 c.p. for voltages from 20 to 50, a special 45 c.p. (55 watt) lamp for street and shop lighting, made for 100–130 and 200–250 volts, and the high candle-power lamps, which are now produced for 90, 180, 270, and 360 British candle-power. As is well known, the drawn tungsten filament of these lamps is wound in one length, and is supported by tantalum hooks, the elasticity of which greatly reduces risk of breakage.

A further pamphlet from Siemens Brothers' Dynamo Works deals particularly with the 200 watt "onewatt" lamp, pointing out its advantages for shop, hotel, and street lighting, and illustrating one or two designs of outside lantern specially suited for use with this size of lamp.

METAL FILAMENT LAMPS.—The Corona Lamp Works Co. (Ascham Street, N.W.), with which is incorporated the lamp business formerly carried on by Mr. S. Horvath, have issued a full list of their Corona lamps. This lamp was previously known as the "Mascot," and its special distinguishing feature is the method of supporting the filament, which in the higher voltage lamps is mounted on a double frame, giving, so to speak, two layers. Great flexibility and freedom from the effects of shock are also obtained by the use of a loose ring instead of a rigid hook through which the loops of the filament are threaded.

CRANE MOTORS.—A pamphlet relating to crane-rated motors is before us from the Union Electric Co. (Park Street, Southwark, S.E.). It deals with motors of the open protected, enclosed ventilated, and totally enclosed types, and comprises the rating of and the general specification of d.c. and three-phase motors, with a full list of dimensions in each case. Prices for the whole machine and spare parts are also given.

WIRES AND CABLES.—The Piggott Electrical Company (24 New Bridge Street, E.C.) have issued a leaflet containing the prices of cables of the 600 megohms grade, and illustrating their china cable connectors.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

METALLIC DIMMERS.—The Adams Manufacturing Co. (106 New Bond Street) have sent us two pamphlets dealing with stage lighting which is now an important branch in electrical engineering. One of the pamphlets compares the liquid and the metallic dimmers from the point of view of size, safety, construction, upkeep, and results, and the second deals with stage lighting in general, giving a full illustrated description of the company's metallic dimmer. In these days, when so much money is spent in scenic displays, the question of illumination is of the utmost importance. In order to render these effects as real as possible, it is necessary to be able to obtain any degree of brilliancy. When the carbon filament lamp was used, this was comparatively easy, but now that the metallic filament lamp is so extensively adopted, a much greater range of resistance is required than can be provided conveniently by a dimmer of the liquid type. It is largely for this purpose that the metallic dimmer has been developed. This is constructed on the unit principle, each consisting of a resistance divided up into a number of small steps for graduating the brilliancy of the light. They are worked by means of a lever actuating a rigid rod drive, and by an interlocking arrangement any combination of lamps can be worked. A more complete description of these dimmers appeared in an article on "Stage Lighting at the Little Theatre," where they are extensively used, in ELECTRICAL ENGINEERING of October 27th, 1910, page 680.

FANS.—Messrs. Matthews & Yates, Ltd. (84 Gray's Inn Road, W.C.), have sent us a leaflet of the cyclone fans, the special feature of which is the blade. This is of simple and open construction, and does not obstruct ventilation when the fan is at rest. The motors are supplied for constant and variable speeds, and can be enclosed or open protected. We understand that these fans have been installed in the Houses of Parliament, Buckingham Palace, the Natural History Museum, Birmingham University, and also to H.M. Office of Works, the Admiralty, and the various Post Offices throughout the country.

THE VULCAN REDUCING VALVE.—A leaflet, which has just been issued by W. Geipel & Co. (Vulcan Works, St. Thomas' Street, London, S.E.), describes their new reducing valve. This is attached to a piston, the weight of which keeps it on its seat. The piston is a loose fit, so that steam can pass into a space provided underneath. This space is connected through a pilot valve to the reduced pressure side by means of a passage. When the pilot valve, which is actuated by a steel diaphragm, is open, the steam escapes through the passage, and the valve is closed by the greater pressure on top of the piston, but when it is closed the pressure on each side of the piston is equal, and the valve is free to open. The diaphragm is controlled by a spring on one side, and the reduced pressure on the other. These are also made for medium pressure, high pressure, or superheat.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published July 20, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

15,134/10. **Magneto Ignition.** C. H. REDRUP. A magneto-ignition device for a multi-cylinder engine consists of a distributor rotatable with the cylinders, and carrying a series of contacts, in conjunction with a brush that travels round with the magneto armature at a different speed to the cylinders. The interruption of the primary circuit of the armature is effected by a make and break plunger co-operating with cam surfaces on the distributor. Three figures.

15,414/10. **Trolley Poles.** A. R. CHRISTIAN. A bridge, slideable on two connecting rods, and also on a central core on which is threaded a helical spring, is provided with pivoted pawls which engage with notches in the rods, and maintains the trolley pole in contact with the wire. Should the pole leave the wire, a stationary bridge with cams for disengaging the pawls from the notches allows the rod to slide through the bridge and release the spring, when the pole drops and clears all overhead equipment, until it is stopped by a buffer spring. Flexible connections are provided for restoring the pole to its running position, which draw the sliding bridge forward and free the pawls from the cams ready to engage the notches again. Nineteen figures.

22,777/10. **Electric Furnace.** G. MASSIP. An electric furnace, comprising an upper movable electrode, and a refractory and normally non-conducting hearth, which is heated to the point of conductivity by an electric current, which passes through metallic resistances embedded in the hearth, and which constitute the other electrode. Six figures.

24,238/10. **Electric Heater.** H. HIRST and C. H. ARCHER. The heating conductors are supported on a fireproof insulating support made of fireclay, porcelain, quartz, or asbestos, and provided with conveniently spaced holes for cottar pins, which are first placed over the conductors, and then either cemented into the holes, or allowed to project through them beyond the back support, and then opened out. Two figures.

15,619/10. **Electric Recorders.** A. LAMBOT. An automatic electric measuring and recording device, in which the transmitter carries a needle controlled by the measuring device, and periodically moves a loose needle controlled by one or more electromagnets, and makes or breaks the circuits. The receiver is provided with a resistance, which, when short circuited, reinforces the live current and operates the transmission device after the recording of each indication. A self-polarising selective relay is also used. Six figures.

15,789/10. **Arc Lamp Couplings.** J. E. F. C. RECHIN. An improved cup insulator for arc lamps, with concentric contact rings composed of two parts, arranged in such a way that two rings are provided in each of the cup parts, serving to establish the current, the upper cup part being fixed and the lower part movable, in a manner permitting easy access to the lamp and ensuring perfect contact between the two parts. Five figures.

19,182/10. **Electrical Switches.** THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., and N. COLLINS. An electric switch in which the contact arm and slotted bracket are provided with a series of coincident holes in which the balls are located, the balls being normally forced inwards by springs to engage with recesses in the controlling part of the handle, and also engage partly with the bracket and partly with the contact arm, which is locked in its "on" or "off" position until the handle causes the recesses to engage and force the balls against the springs to unlock the switch arm. Six figures.

28,724/10. **Electric Lighting.** FRANKENBURG & SONS and E. FLEMING. A method of supplying current to charge an accumulator for feeding a low-voltage circuit, consists of introducing a change-over switch into a high-voltage circuit, and connecting the accumulator to the terminals on the switch, so that the accumulator can be cut out when charged, but continues to feed the low-voltage circuit. One figure.

3,891/11. **Enclosed Arc Lamps.** KORTING and MATHIESON AKT.-GES. Relates to enclosed arc lamps, in which a depositing chamber is provided above the combustion chamber, and consists in cooling the gases flowing back from the former chamber to a low temperature, and at the same time keeping the globe surrounding the arc as hot as possible, by jacketing it with a second globe, so that the air, enclosed between the two, serves as a heat insulator. Two figures.

Opposition to Grant of Patent

10,869/10. **Incandescent Lamps.** J. HARRISON. Opposition has been entered to the grant of this patent. The specification describes a method of attaching metallic lamp filaments to the conducting wires by means of a paste containing phosphorous and powdered platinum.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: STEVENSON and WILLIAMS [Automatic raising and lowering of] 18,217/10; SCHMID [Self-regulating, for projection] 25,634/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: WOLFF [Automatic distributor for electricity] 29,810/10.

Dynamos, Motors, and Transformers: MILCH [Speed-regulation of induction motors] 22,717/10; SIEMENS BROS. DYNAMO WORKS, LTD., and KOETTGEN [Ventilation of machines] 8,392/11; SCHULZ and EVERYMANN [Homopolar dynamos] 2,369/11.

Electric Ignition: MAZELLIER [Electric sparking-plug] 3,859/11.

Heating and Cooking: VERITY'S, LTD. and PIPKIN [Electric heaters] 18,136/10; FIELD and FERRANTI, LTD. [Electric heaters] 26,836/10; SUMNER [Resistances] 5,521/11.

Switchgear, Fuses, and Fittings: HAMILTON and FERRANTI, LTD. [Time switches] 13,704/10; CROMPTON & Co., MACFARLANE, BURGE, and WILLIAMS [Control of electric driving systems] 29,727/10; SIEMENS BROS. DYNAMO WORKS, LTD. (*Siemens-Schuckertwerke Ges.*) [Non-interchangeable fuses] 10,113/11.

Telephony and Telegraphy: RAY [Guide-sheaves for ships' telegraphs] 28,320/10.

Traction: ASHWORTH [Trolley poles] 17,690/10; DUDGEON [Device for protecting the ears and trolley wire] 23,536/10; HULTMAN [Conduit manufacturing apparatus] 5,813/11; KNECHT [Railway-signalling devices] 6,166/11.

Miscellaneous: CEREBOTANI [Wireless-operated signalling] 16,360/10; BILLÉ [Conduits joints] 21,313/10; REISZ and STRAUSS [Relay for undulatory currents] 2,111/11; PRITCHETT [Electric accumulator boxes] 4,524/11; BRITISH THOMSON-HOUSTON Co. (General Electric Co.) [Manufacture of tungsten] 8,031/10.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution: GES. FÜR ELEKTROTECHNISCHE INDUSTRIE [Electric conductors] 5,569/11.

Electric Ignition: OFFICINE DI VILLAR PEROSA, AGNELLI & Co. [Sparking plug] 1,562/11.

Storage Batteries: SOC. DES ETABLISSEMENTS SAGE, BINE ET CIE. [Multitubular positive for electric batteries] 19,600/10.

Incandescent Lamps: SOC. DES ETABLISSEMENTS PAZ and SILVA [Sockets for fixing bulbs] 20,040/10.

Telephony: CLIMENT [Telephones] 29,685/10.

Expiring and Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: H. S. HATFIELD and F. M. LEWIS, 7,926/07; H. BEVIS and A. E. ANGOLD, 7,941A/07.

Dynamos, &c.: SIEMENS BROS. DYNAMO WORKS (*Siemens-Schuckertwerke Ges.*) [Dynamos] 7,695/07.

Electrometallurgy, &c.: A. J. BOULT (*J. B. Du. Faur*) [Electrolysis] 7,698/07; S. O. COWPER COLES [Electric furnaces] 7,742/07; E. A. A. GRÖNWALL, A. R. LINDBLAD, and O. STALHANE [Electric furnaces] 7,791/07.

Incandescent Lamps: W. J. GREENWOOD, 7,444/05; R. T. SMITH and A. G. BEAVER [Lamps] 7,789/07; J. J. RAWLINGS and R. T. SMITH [Lamps] 8,151/07.

Switchgear, &c.: BRITISH THOMSON-HOUSTON Co. (*General Electric Co.*) [Motor control] 8,020/07; H. W. LEONARD [Controllers] 8,079/07; H. H. BERRY, E. SKINNER, and W. J. MARKHAM [Cut-outs] 8,138/07.

Telephony, &c.: G. ANGELINI [Telephones] 8,168/06; T. D. TAYLOR [Telegraphs] 7,663/07; P. CHRISTOF [Recording telephone signals] 8,095/07.

Traction: A. NEELEMANS [Railway points and signals] 8,020/02; S. R. THOMPSON [Electric tramways] 8,077/04; T. MCMORRAN [Electric tramways] 7,758/07.

Miscellaneous: R. P. JACKSON [Electromagnets] 7,491/06; J. B. D'HOMERGUE [Electric resistances] 7,711/07; R. WAYGOOD & Co. and D. BONE [Lifts] 7,737/07; W. G. T. GOODMAN and E. W. AUCKLAND [Electric conduits] 7,800/07; W. P. THOMPSON (*Ges. für Drathlose Telegraphie*) [Electric oscillations] 7,815/07; C. and F. C. NAUJOKS [Lifts] 7,883/07; J. and G. J. SUTTON and G. MUNDY [Fire alarms] 7,895/07; W. BLACKMOXL [Magnetic separators] 7,982/07; FELTEN and GUILLEAUME-LAHMEYERWERKE AKT.-GES. [Electromagnets] 15,009/07.

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LOCAL NOTES

Bootle: *Electricity Accounts.*—After meeting capital charges and transferring £2,300 towards depreciation and renewals, a sum of £1,500 is handed over to relief of rates from the profits on the electricity undertaking last year.

Bristol: *Electric Lighting Accounts.*—After meeting capital charges, there is a deficiency for the past year of £768 16s. upon the working of the electricity undertaking. The balance in hand amounts to £4,041 15s., and against this is to be charged the deficiency for the year, and a number of other items not chargeable against revenue, but for which loans have not been obtained, leaving a balance of £2,628 to be carried forward. The number of 30-watt lamps connected with the mains increased from 521,124 to 551,991 during the year.

Edinburgh: *Electricity Surplus.*—There has been considerable controversy as to the best method of disposing of the profits upon the working of the electricity undertaking, the reserve fund having reached the limit allowed by statute. Last year there was a surplus of £8,000, and it is now proposed to hand this over to the College of Art Building Fund to complete the necessary sum required for that purpose.

London: *Hammersmith: Condition of Tramway Track.*—The Council have a deposit of £1,000 from the London United Tramways Co. in respect of maintenance of the company's tramways in that district. Complaints have been made as to the condition of the lines in Goldhawk Road, and the question of spending a portion of this deposit in repairing them has been referred to the Works Committee for report.

Advertising Electricity.—Having regard to the active methods pursued by the gas company, the Electricity Committee recommend that an annual sum of £300, which shall include the salary of the canvasser, shall be set aside for the purposes of general advertising in connection with the Electricity Department.

Islington: Testing Stations.—The London County Council are taking action against the Borough Council, calling upon them to show cause why they should not instal five testing stations for recording the pressure upon their electric supply system as provided for in their Electric Lighting Orders. The Council was called upon to instal these stations in July, 1907, but have since done nothing.

Reserve Fund.—In recommending sanction to a loan of £24,175 for extensions in connection with the electricity undertaking, the Finance Committee of the L.C.C. call attention to the absence of a reserve fund, and the fact that the Borough Council propose to transfer the estimated net surplus of £3,360 for 1910-11 to relief of rates. As a consequence, the Borough Council have decided to give consideration to the question of establishing a reserve fund.

Poplar: Showrooms.—The Electricity Department opened a showroom of electrical appliances at 121 East India Dock Road last week.

Maidstone: *Electricity Accounts.*—There was a deficit of £158 15s. upon the working of the electricity undertaking last year after meeting capital charges amounting to £5,976. The deficit is explained by a considerable increase in capital charges.

Portsmouth: *Electric Lighting Profits.*—The accounts of the electric lighting department for the past year show that the reserve fund has now reached the limit of 10 per cent. on the capital expenditure allowed by Parliament.

Sheffield: *Overhead Wires.*—A proposal to use overhead wires in connection with the proposed extension of street electric lighting to Attercliffe was negatived at the last meeting of the Council. Those councillors who were instrumental in bringing about this decision based their argument on danger, a rather surprising one, having in view the large mileage of overhead tramway wires which Sheffield possesses.

Electricity Extensions.—A report by Mr. S. E. Fedden dealing with the general position of electricity supply in Sheffield in connection with the proposed extensions at Neepsend has been referred back in order that the Finance Committee may consider it first. Incidentally, it may be mentioned that some of the councillors object to some rather outspoken remarks by Mr. Fedden as to the protracted proceedings in obtaining the approval of the various committees of the Council. One member suggested that the engineer should confine his reports to matters which come under his jurisdiction.

Swinton: *Death from Electric Shock.*—An assistant mains engineer of the Lancashire Electric Power Co., named Sidney Douglas, was investigating a fault in the high-tension plant at the Pendlebury sub-station on Saturday when he came into contact with the 10,000-volt mains, and received a fatal shock.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Canada.—According to the *Board of Trade Journal*, the Penticton (British Columbia) Council require two 100-k.v.a. three-phase 4,600-volt 900-r.p.m. alternators, with switchboards, transformers, meters, distribution and street lighting system. Tenders to Mr. F. H. Latimer, Consulting Engineer, Penticton, British Columbia, by August 10th. It will be noticed that this date is only of use to those having agents on the spot, as specification forms are to be obtained at the office of the *Canadian Engineer*, Toronto.

Farnham.—Tenders are invited, by August 16th, for two 90 k.w. Diesel engines and dynamos, exciters, cranes, &c.; also high tension switchboard. Consulting engineers, Messrs. Handcock and Dykes, 11, Victoria Street, S.W. Specifications, &c., from Farnham Gas and Electricity Co.

Glamorgan.—The Tonyrefail and Gilfach Goch Electric Lighting Company require tenders for the supply and erection of electric light mains, switchgear, and street lighting fittings. Applications to D. R. Morgan, 48, High Street, Tonyrefail.

Hartlepool.—The Local Government Board inquiry into the application of the Corporation for sanction to borrow £35,417 for a new electric power station was resumed last week. It will be remembered that the scheme is to erect plant at the works of the Seaton Carew Iron Works Co., in order to make use of the exhaust steam there. Mr. J. F. C. Snell is advising the Corporation, for whom Captain Sankey gave evidence. There is opposition to the scheme by the Cleveland & Durham Electric Power Co. and others, the point between the power company and the Corporation being that power can be purchased in bulk more cheaply than it will be generated under the new scheme. A provisional agreement has been entered into between the Iron Works Co. and the Corporation for the supply of 30,000 lbs. of steam per annum for thirty years. The Corporation guarantee to give the company a free supply of electrical energy up to a certain amount.

London: *Hammersmith.*—An extension of mains to Oilmill Lane at £162 12s. is recommended.

An additional transformer and accessories is required at an estimated cost of £131 9s.

Pontypridd.—A 1,700 ampere-hour storage battery with motor-driven booster, also switchgear, is required. Particulars from Borough Electrical Engineer, and tenders by August 1st.

Rawtenstall.—A Local Government Board enquiry will be held shortly with regard to a loan of £2,000 for street lighting.

Rochdale.—Tenders are invited, by August 2nd, for a twelve months' supply of paper insulated cable. Particulars from Borough Electrical Engineer.

WIRING

Ashford.—Considerable extensions to the South Eastern & Chatham Railway Co.'s locomotive works.

Bradford.—Re-building of Albion Dye Works. Architect, W. T. Holroyd, 55, Tyrrel Street.

Bridlington.—Alterations and additions to the Corn Exchange. Architect, J. Earnshaw, Carlton House.

Bristol.—Reconstruction of Royal Theatre.

Cardiff.—Drill hall for Territorial Forces Association. Architect, J. W. Roger, 14 High Street.

New buildings for National Museum of Wales.

Chadderton.—Town Hall and Public Offices in Middleton Road. Architects, Messrs. Taylor Simister, Oldham.



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Dundee.—Church and hall in Blackness Avenue.

Edinburgh.—Schools at Fountainbridge and Viewforth. Architect, C. R. Carfrae, 3, Queen Street. Three-story tenement in Gorgie Road, for Hillside Printing Works.

Greenock.—Extensive alterations to W. Kirk.

Greenwich.—Extensions to Miller General Hospital.

Kendal.—Swimming bath, pavilion, and gymnasium for the Council.

London.—Melville Theatre, Shaftesbury Avenue.—Cinematograph theatre at Gaisford Street, Kentish Town.

Tenders are invited, by August 1st, for the installation of 250 lamps at the Great College Street Elementary School, N.W. Particulars from Chief Engineer to L.C.C.

Wakefield.—Extensions to workhouse infirmary.

Ystradgynlais.—Tenders are invited for the electric lighting of Cwmgiedd Chapel. Apply, Cwmgiedd House.

MISCELLANEOUS

Australia.—The Melbourne City Council require 530 A.C. meters, 495 D.C. meters, 133 maximum demand indicators. Particulars from Messrs. McIlwraith, McEacharn and Co., Billiter Square Buildings, London, E.C.

Portsmouth.—The Light Railways Commissioners have extended the time for construction of the Portsmouth and Hayling Island light electric railway. A transporter bridge will be constructed joining the island with Portsmouth and linking up the tramways on the Portsmouth system.

Sweden.—The Swedish Postal Authorities require a supply of 4,000 to 6,000 metal filament lamps, 16-50 c.p. 110-250 volts. Tenders by August 1st to "Generalpoststyrelsens Registratorskontor, Vasagatan," Stockholm.

TENDERS RECEIVED AND ACCEPTED

Dover.—The tenders of the Brush Electrical Engineering Co. for three car-bodies, trucks, and brakes at £303 each, and the British Thomson-Houston Co. for electrical equipments at £272 each, have been accepted.

Huddersfield.—The tenders of Messrs. Dick, Kerr & Co. and the United Car Co. for ten tramcars have been accepted.

London: *L.C.C.*—The following have been received for electric lighting at the Kennington Fire Station, and the Fire Brigade Committee recommend the acceptance of Messrs. Hawkins & Sons' offer:—A. Hawkins & Sons, £229; W. J. Fryer & Co., £248 18s.; G. E. Taylor & Co., £269 15s.; Tilley Bros., £269 15s.; Pinching & Walton, £287; John Bryden & Sons, £314.

The following tenders have been received for electric lighting at the Shadwell Fire Station, the tender of Messrs. Malcolm & Allan, Ltd., being recommended for acceptance:—Malcolm and Allan, Ltd., £202 15s.; Tilley Bros., £206 9s.; E. Newbald & Co., £236; G. Harland Bowden & Co., £280; Tredegar & Co., £280 4s.

The following tenders have been received for electric lighting at the Stoke Newington Fire Station, the tender of Messrs. W. J. Fryer & Co. being recommended:—W. J. Fryer & Co., £168 15s.; Foote & Milne, £176 17s.; E. Lawrance & Sons, £185; G. Weston & Sons, £185; Waring & Withers, £214 10s.; Lund Bros. & Co., £230.

Hammersmith.—The tender of Messrs. Nichols Bros., Gateshead, for the supply of a feed pump at £190 15s. is recommended for acceptance.

Tenders have been received from the Reason Manufacturing Co., Haydn Harrison & Co., Lucy & Co., Wardle Engineering Co., General Electric Co., W. Edgar, Pontifex & Co., and Falk, Stadelman & Co., for the supply of lanterns for side-street lighting. The tenders of Messrs. Lucy & Co. for the supply of brackets and switches at 8s. 10d. each, and of the General Electric Co. for hoods at 8s. 3d. each for street lighting, are recommended for acceptance.

Tenders have been received from Messrs. Venner & Co., Laing, Wharton & Co., Reid & Co., Engineering & Arc Lamps, Ltd., General Electric Co., and Ferranti, Ltd., for the supply of time switches for public electric lamps. In reporting upon the tenders, the Electricity Committee recommend that in view of the cost involved, viz., £1,085, no further action shall be taken in the matter at present.

London & North Western Railway.—Messrs. Wm. Geipel & Co. have again secured a contract for the annual supply of Henrion arc lamp carbons, open, enclosed, and flame type, amounting to nearly 1,150,000 carbons. This is the third year that they have secured this important contract.

Margate.—The Electric and Street Lighting Committee have accepted the tender of the Isle of Thanet Tramways & Lighting Co. for lighting the promenade and approaches with twenty-four 300-c.p. Osram lamps at a total cost of £101 10s. per annum. A tender was also sent in by the gas company, but the Council have preferred electric light.

Swansea.—The tender of the Electric and Ordnance Accessories Co. for a two years' supply of electric motors has been accepted.

The Lea Recorder Co. have recently received orders for their recorders for the following electric power stations:—Dublin, Aberdeen, Stretford, East Ham, Sheffield, Torquay, Cape Town, Walthamstow, Walsall, Eastbourne, Burnley, and Blackburn Municipalities, Dublin United Tramways Co., City & South London Railway, Midland Electric Corporation, County of London Electric Supply Co., and Melbourne Electric Supply Co.

APPOINTMENTS AND PERSONAL NOTES

A well-known central station engineer can thoroughly recommend a first-class Boiler House and Steam Plant Superintendent, whom we shall be glad to put in communication with any Supply Engineer seeking a reliable man for this position.

The Highways Committee of the London County Council received 149 applications for the position of Charge Engineer at the Greenwich power-house. Mr. R. E. Armstrong, at present in charge of the Philadelphia power station of the Newcastle Electric Supply Co., Ltd., is recommended for the post at a salary of £250 rising to £300 per annum.

There were 250 applications for the appointment of fourth Engineer-in-Charge at the Hammersmith Electricity Works, and the Electricity Committee recommend the appointment of Mr. H. Love, at present in the employ of the Great Western Railway Co.

The salary of Mr. H. Bartlett, the Exeter Tramways Manager, has been increased from £160 to £170 per annum.

The salary of Mr. J. W. Turner, Chief Assistant Electrical Engineer to the Huddersfield Corporation, has been increased from £185 to £200 per annum.

We are asked to state that Mr. Harry Guest is not now connected with the Reason Manufacturing Co.

Mr. H. B. Tilley, well-known as the Manchester manager of Messrs. Bruce Peebles, has just left this country for an extended business tour in Canada, on behalf of his firm. He will visit all places of importance in the Dominion, and expects to be away for fully a year.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 10s. (last week, £58 15s. to £59 5s.).

Athletic Club.—Electrical Installations, Ltd. (27 Martin's Lane, Cannon Street, E.C.), have recently organised an athletic club for cricket, football, tennis, &c., and have taken grounds at Edmonton. The Secretary would be glad to hear from other firms in the allied trades with reference to arranging for matches.

Galsworthy, Ltd.—Considerable extensions have just been opened to Messrs. Galworthy's fittings show-rooms at 15 and 16 Newman Street, Oxford Street, which have been redecorated and re-arranged throughout, and contain an excellent selection of examples of fittings in every style.

Patents for Sale.—Two patents relating to electro-mechanical transmission systems of motor road vehicles. (See an advertisement on another page.)

The Benjamin Electric, Ltd.—The telephone number of this firm's new offices and show rooms, at 117, Victoria Street, is Victoria 1297.

Liquidations.—The Batley Electric Carbonising Co., Ltd., is to be wound up voluntarily. Mr. H. Appleyard, Prudential Buildings, Market Place, Dewsbury, is liquidator.



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Bankruptcies.—W. H. Ridpath, electrical engineer, 20 Bath Street, Ilkestone, has been adjudicated bankrupt.

The first meeting of creditors will be held at 5 Victoria Buildings, London Road, Derby, on July 31st, at 11 a.m., and the public examination will take place at the Court House 20, St. Peter's Church, Derby, August 2nd, at 11 a.m.

The last day for receiving proofs in the bankruptcy of W. H. Illingworth, electrical engineer, 30 Pellon Lane, Halifax, is August 2nd, 1911. The trustee is Mr. W. Durrance, 12 Duke Street, Bradford.

The public examination of T. C. Francis, electrical engineer, 66 Liverpool Road, Stoke-on-Trent, took place last week. The liabilities amount to £513 and the assets to £11. The examination was adjourned.

Canadian Agents Wanted.—A London firm wishes to get into communication with Canadian importers of metal filament lamps and metal filaments for lamp-making, electrical accessories, and bell wiring. Further particulars from Board of Trade, 73 Basinghall Street, London, E.C.

A Toronto firm desire the representation of British manufacturers of electrical supplies.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Melbourne Electric Supply Co.—Resolutions have been passed authorising the raising of £100,000 additional capital.

Electric Construction Co.—The annual meeting was held in London on Thursday. Mr. W. S. B. McLaren, chairman, stated that this year had been commenced with a larger amount of work than in the previous twelve months, and that the directors viewed the future with confidence. The Board looked for a larger output of machinery for use in mines when the apprehensions as to the use of electricity in mines were removed, as there was every reason to believe would be the case before long.

Crompton & Co.—After making the usual provision for depreciation, the accounts for the year to March 31st show a loss of £14,195 10s., bringing the debit balance to £48,272.

Electric and General Investment Co.—A scheme for the reconstruction of this company will be laid before the shareholders at the meeting to-day.

Companies Struck off Register.—The names of the Macclesfield Electric Light and Power Co., and the Phœnix Electric Heating Co., Ltd., will be struck off the register of joint stock companies within three months, unless cause is shown to the contrary.

Vickers.—Interim dividend for the June half-year of 2½ per cent. on the preferred stock, and 1s. per share on the ordinary shares.

Dividends of London Supply Companies.—Interim dividends for the June half-year at the rate of 10 per cent. per annum are recommended on the ordinary shares of the St. James and Pall Mall Electric Supply Co., and 4 per cent. by the Chelsea Electricity Supply Co., and the County of London Electric Supply Co.

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RECORD ELECTRICAL CO.—Capital, £20,000. Manufacturers of electrical machinery and apparatus. To adopt agreement between C. W. von Roemer, J. W. Record, and T. J. Boorne. Managing director, J .W. Record.

F. G. EDEY & CO., 25 Warwick Lane, London. Capital, £3,000. Electrical engineers.

DICKS, 149 High Street, Winchester. Capital £5,000. Electrical and general engineers.

BRITISH ARC WELDING CO. (North-east coast). Capital £20,000. To take over a process for electrical welding under a license granted by the British Arc Welding Co., Ltd.

LAUNCESTON & DISTRICT ELECTRIC SUPPLY CO., Westgate, Launceston. Capital £10,000.

NATIONAL GAS ENGINE CO., Wellington Works, Wellington Road, Ashton-under-Lyne. Capital £1,000,000 (400,000 5 per cent. cumulative preference shares). Manufacturers of gas and oil engines, electric plant, &c. The subscribers include Messrs. H. M. and R. Bickerton.

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WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

No. 240 [Vol. VII., No. 31] THURSDAY, AUGUST 3, 1911. [Price One Penny.
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SUMMARY

Our monthly supplement on Electrical Engineering in Mines is included in this issue. It opens with an illustrated description of the electrical equipment of the Sneyd Colliery, Burslem, and contains an account of an electrical mining power scheme in the north of France. An illustrated description is given of a new mining telephone, and an abstract of a Paper read recently on high tension mining switchgear. Notes on various matters concerning electricity in mines are also included.

The question of the rating of telephone property after the State acquire the National Telephone Co.'s undertaking, is causing some uneasiness in local circles. A new submarine cable is to be laid between New Zealand and Australia. Some successful wireless experiments from an aeroplane have been carried out in France. (Page 438.)

A letter from Mr. C. Beaver comments on a number of points raised in Mr. W. G. Turner's article last week, on the laying of mains on the solid system. (Page 437.)

Some notes on the variation of flame photometric standards with atmospheric conditions, &c., are given in a Paper by Messrs. W. J. A. Butterfield, J. S. Haldane, and A. P. Trotter, read at the Zürich meeting of the International Photometric Commission. (Page 437.)

The Holborn Council have finally decided to accept the joint tender of the Electric Lighting and Gas Companies for street lighting. (Page 437.)

The Thomas petrol electric system has been applied in a modified form to a railway coach for the Central South African Railways. The Board of the British Electric Traction Co. have prepared a scheme for the rearrangement of the company's capital. The Aberdare and Rotherham Comporation Bills, which provide for the installation of trolley omnibuses, have been passed. There was a loss of £1,110 upon the working of the Great Northern & City Railway Co. for the June half-year. A scheme for the electrification of the Melbourne suburban railways is to be prepared. There was a profit of £232,727 upon the L.C.C. tramways last year after meeting capital charges. (Page 439.)

Amongst the specifications published by the Patent Office on Thursday last was one by H. M. Dudgeon for the protection of the ears and trolley wire on overhead systems. A self-regulating arc lamp, in which both carbons are adjusted by a solenoid, is covered by A. Schmidt. Siemens Brothers' Dynamo Works and C. A. B. D. Koettgen deal with the ventilation of machinery, and the same firm have protected a system of non-interchangeable fuses. Opposition has been entered to the grant of a patent for an insulating material to A. R. Muller and the R. M. D. Syndicate, Ltd. (Page 438.)

A Sub-Committee has been formed to consider the formation of an independent electricity meter testing department at Manchester.—A new scheme of electric supply is nearly completed at Walsall.—There was a net balance of £12,089 upon the working of the Marylebone electricity undertaking last year. Bonuses to the officials amounted to £788.—Stoke Newington Council propose to terminate their agreement with the North Metropolitan Electric Power Supply Co.—A deputation from the Glasgow tramway power house is to visit the works of various makers of turbo-generators. (Page 440.)

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The Finance Committee of the L.C.C. recommend considerable loans, for electrical extensions, to a number of London Borough Councils.—Bolton Corporation are to apply for £20,000 and Belfast for £40,000.—Loans have been sanctioned at Loughborough, £2,200, and Haslingden, £8,188.—A 5,000-kw. generator and other plant is required at West Ham; generating plant at Whalley Asylum; a high-tension feeder at Stoke-on-Trent, and an induced draught fan at Warrington. (Page 441.)

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

It is stated that the Dundee Town Council are proposing to urge the Government to make provision in the Telephone Transfer Bill with regard to the rating of telephone property in local areas after the transfer of the National Telephone Co.'s business to the State. In Dundee the valuation of the National Telephone Co.'s property is £5,682, but Crown property is exempt from rating, and it is this matter which is exercising some uneasiness in various local quarters.

At the half-yearly meeting of the National Telephone Co. on Thursday, Mr. George Franklin stated that during the past six months more than £200,000 had been expended on constructional work, the Board being assured that all capital now being spent would produce an added sum when the system was taken over by the State. It was anticipated, he said, that by the end of the present year the inventory of the plant would be completed, and that it would then be possible, if necessary, to obtain the decision of the arbitrators as to the price to be paid. Reference was made to the decision of the Post Office to take over practically all the company's plant subject to its valuation later. With regard to the staff, the Board felt that the Postmaster-General had met them in a fair, full, and frank manner, and that the company had now no cause for complaint. He hoped that the same spirit would be applied to the principal officers and others whose claims were now under consideration.

In addition to installing some 700 miles of telephone lines between a number of important centres in the interior of Italy, provision has been made in the Budget for the establishment of the following international lines:—Rome-Milan-Simplon, Turin-Milan, and Genoa-Milan, for communication with Germany; Milan-Swiss Frontier (Chiasso) and Milan-Swiss Frontier-Simplon for direct communication with Bale and Zurich.

The Pacific Cable (Extensions) Bill, which has just been published, authorises the laying of a submarine cable between Australia and New Zealand, and any other extensions that may be agreed between the contributing Governments.

A wireless telegraph station has been established at Fez, in Morocco. Experiments are being carried on with a view to establishing communication with Paris.

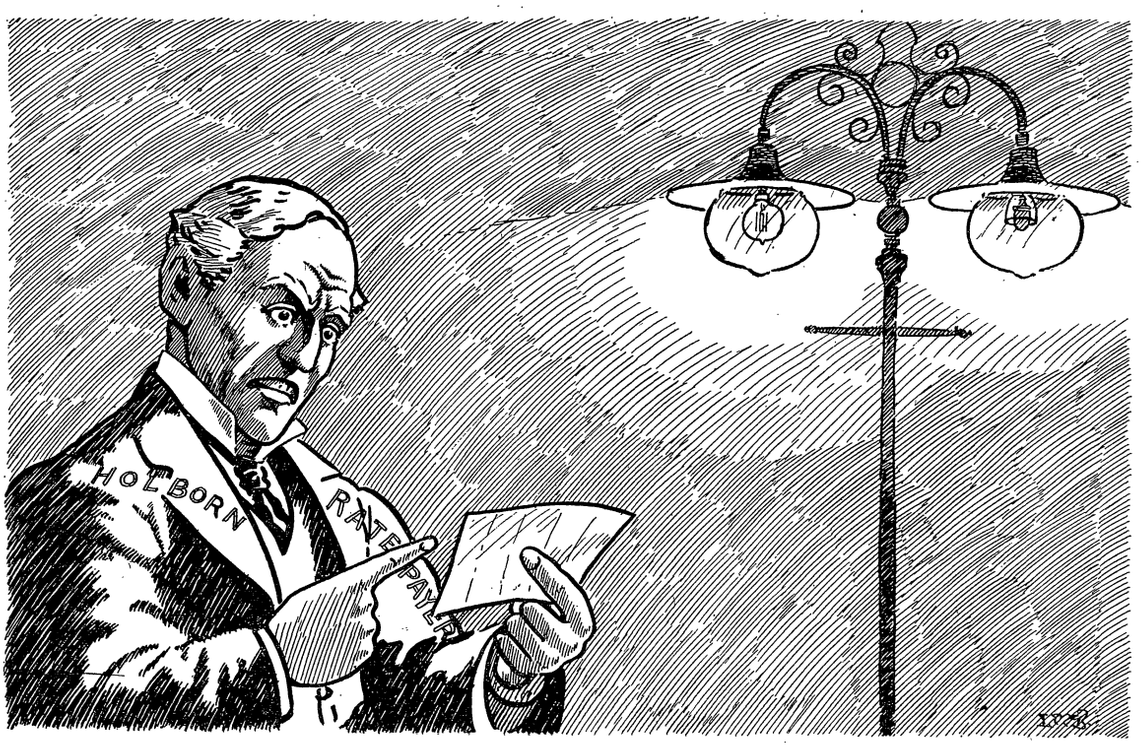
A successful experiment with wireless transmission from an aeroplane was carried out on Saturday in France, when two engineer officers sent a message from a biplane flying at about 31 miles from Paris, which was received at the Eiffel Tower station. Thence it was delivered to the Minister of War. The apparatus on the aeroplane weighed about 46 lbs.

The Bristol Corporation Docks Committee have been in correspondence with the Postmaster-General with a view to having a wireless telegraph station erected at Avonmouth. The Secretary of the General Post Office has written, however, stating that it is the intention to establish wireless telegraph stations at Land's End and Fishguard, and these stations, it is considered, will be sufficient without it being necessary to erect an additional station at Avonmouth.

Mr. Remnant asked the First Lord of the Admiralty in the House of Commons on Monday whether wireless telegraphists in the Navy were being prohibited from purchasing their discharges in the ordinary way. Mr. McKenna said that this was not so, although any such application was carefully scrutinised. With the growing requirements of wireless telegraphy in the Fleet, it was desirable that the expansion of this new branch of the service should not be checked more than was necessary.

There are now 141 private owners of overhead wires in the City of London, in addition to 26 companies. The National Telephone Co. has 735,136 spans, compared with 733,956 last year.

In connection with telegraphs there is little to report this week. Communication has been restored with Casablanca, Mogador, and Rabat, while the Cayenne-Salinas cable of the Compagnie Française des Cables Télégraphiques was once more interrupted on July 29th, and this breakdown is likely to last some time, judging by past experience. The line between Rome and Constantinople was down on July 31st.



THE DISSATISFIED CONSUMER—"My street lighting bill raised."
[The Holborn Borough Council has finally accepted the combined tender of the Gas and Electric Lighting Co.s for street lighting at £7,645 per annum. The Electric Lighting Co.s had previously offered to do the work for £6,602.] (*With apologies to a well-known poster.*)

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ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

ELECTRICAL EQUIPMENT OF THE SNEYD COLLIERY, BURSLEM

TWENTY years ago the owners of the Sneyd Colliery, Burslem, laid down a small lighting set to light their offices. Eight years later they put down a 50-kw. three-phase Westinghouse engine generator set for power purposes, operating two haulage systems (a 20-h.p. main and tail and a 20-h.p. endless rope) and a 30-h.p. pump. This was something in the nature of an innovation, being one of the very earliest applications of the three-phase system to collieries in this country, but it proved so successful that the Company decided to convert all the haulages in their mines, and for this purpose built their present power station. The plant next installed consisted of two 250-kw. Howden high-speed engine sets, running at 375 r.p.m. direct coupled to three-phase 25-cycle 440-volt alternators, with exciters separately driven by small steam sets, plenty of space being left for extensions.

In its two years of service this plant showed so many economies and advantages that it was further enlarged by the installation of a 500-kw. turbo-alternator set. The turbine is of the Rateau type, run on exhaust steam from the winding engines, with a thermo-accumulator interposed, and drives a British Westinghouse three-phase 25-cycle 440/500-volt turbo-type alternator, with coupled exciter, the set running at 1,500 r.p.m. Steam is supplied to the engine sets by three Babcock & Wilcox and six Lancashire boilers working at 120 lbs. and 90 lbs. pressure respectively, the Babcock & Wilcox grates being designed to burn the fine slack from the screening plant.

The switchboard is mounted on a platform at one end of the station, and comprises three generator and four feeder panels, fitted with the usual meters, overload circuit-breakers, &c., the rheostats for voltage regulation being placed at the back of the board and operated from pillars in front. The supply is led to the various motors installed on the surface and to the top of the pit shafts by underground cables, and thence down the pit to sub-stations.

There are three pits, known as No. 2, No. 3, and No. 4, the electrical machinery in No. 2 pit comprising eleven motors, totalling about 380 h.p., all engaged either in haulage or pumping work. The main haulage to the pit-bottom is a single drum set, capable of dealing with six tubs per wind, each tub carrying approximately 12 cwt. of coal. These are hauled up a gradient of 1 in 3 for a distance of 160 yards, the motive power being furnished by 100-h.p. 440-volt Westinghouse slip-ring motor, running at 475 r.p.m., driving by ropes to the haulage pulley, which transmits the power through a friction clutch and helical gearing to the drum, the haulage ropes being ¾ in. steel wire. The control for this unit is effected by means of an oil-immersed reversible controller. There are also the following haulage gears in this pit :—One 75-h.p. single-drum gear drawing nine waggons up an incline of 1 in 4½; one 75-h.p. endless-rope plant; and three 20-h.p. single-drum haulage sets. These are semi-portable, the gears, motor, controller, and resistance all being fixed in the same bed-plate. The sump at the pit-bottom is dealt with by two three-throw pumps, each having a lift of 750 ft., driven by a 50-h.p. squirrel-cage motor running at 710 r.p.m. through an 8-in. canvas belt, one being kept as a spare whilst the other is in use. One of these sets is shown in Fig. 1. Three small pumps, each driven by a 3-h.p. motor, act as an auxiliary plant.

The distribution switchgear supplying these motors is situated at the pit-bottom, and current is led by three single-

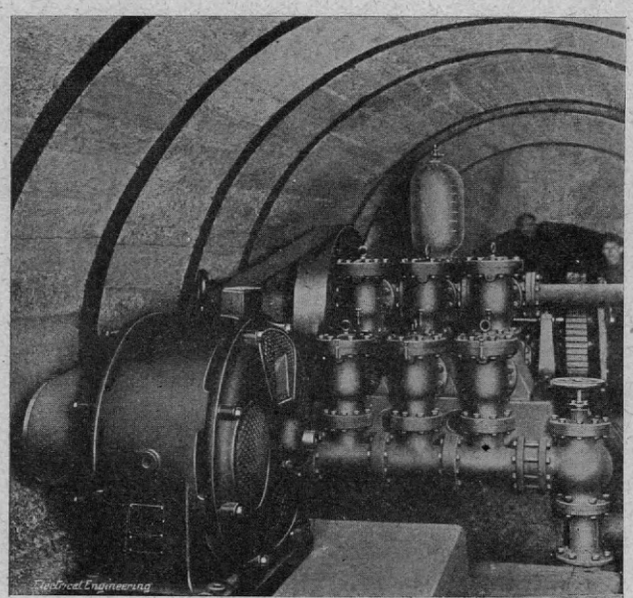


FIG. 1.—30-H.P. WESTINGHOUSE MOTOR DRIVING 3-THROW SCOTT & MOUNTAIN PUMP.

core cables to busbars at the back of the distribution board. The feeder switches are of the totally enclosed, automatic, oil-immersed type, specially designed for mining work, the necessary meters being fitted within the casing of the switch. The gear is mounted on two iron pillars, and forms a complete dust-proof, water-proof, and, more important still in colliery work, gas-tight, iron-clad distribution board, from which the current is led to the various motors by feeders made up of three-core armoured cables.

In No. 3 pit six motors are installed, the aggregate h.p. amounting to 333. A three-throw ram pump, having a duty of 200 gallons per minute against a head of 1,200 ft., is driven by means of ropes from a 100-h.p. slip-ring motor. A Riedler pump to which a motor of 75 h.p. is attached is provided as a stand-by. Two other pumps act as auxiliaries, viz., a centrifugal pump driven by a 5-h.p. motor, and a small portable three-throw ram pump connected by gearing to a 3-h.p. motor. There are two single drum-haulage gears drawing waggons up inclines of 1 in 3 and 1 in 4½ respectively, and both operated by 75-h.p. slip-ring motors.

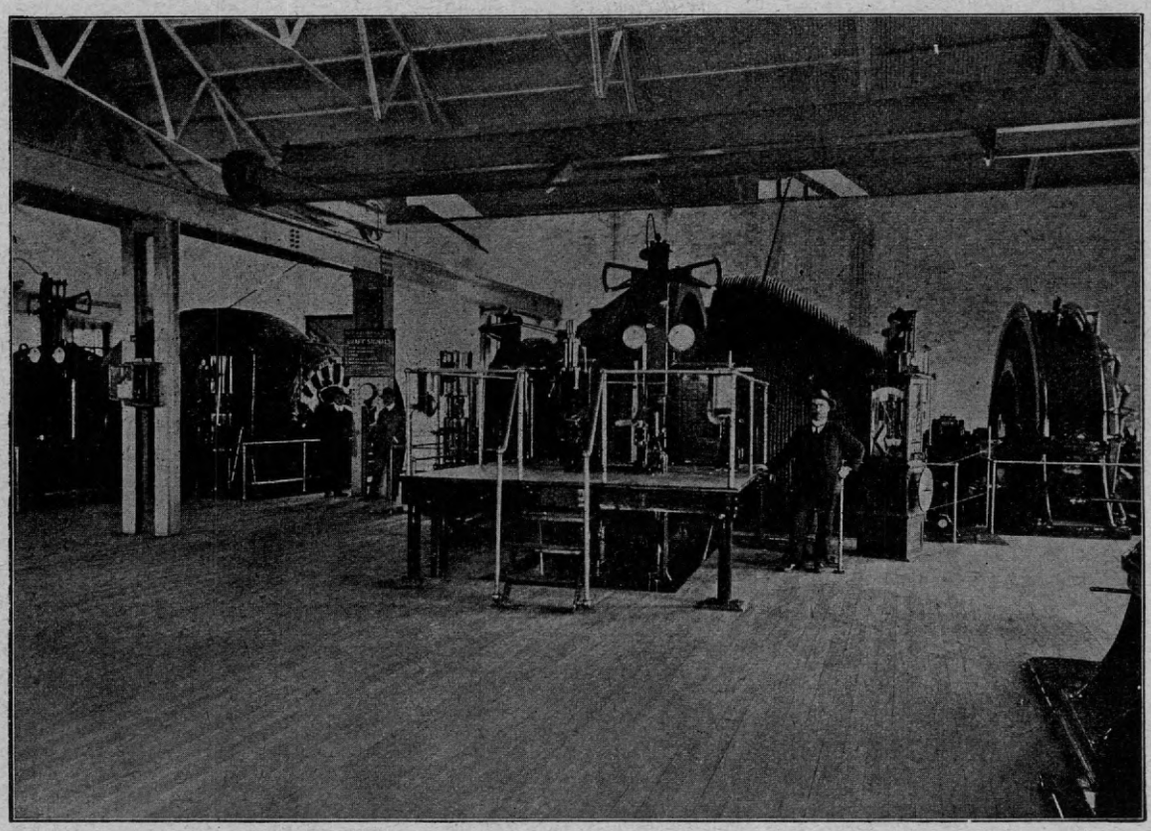
In No. 4 pit there are two types of haulage, namely, main and tail and endless rope, which differ from the single-drum

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type employed in No. 2 and No. 3. The single drum, as its name implies, consists of a single drum winding a single rope, and, therefore, the gradient must be steep enough to allow the tubs to draw the rope back by gravity; in the main and tail type, however, the main rope hauls the full tubs, and the tail rope takes back the empties. In No. 4 pit there are two of these haulages, both driven by 75-h.p. motors, each capable of dealing with 30 trucks at an average speed of five miles per hour. In the endless-rope type of haulage the rope is passed two or three times round a "C" pulley, and then round a guide wheel at each end of the road, the tubs being affixed to the rope by clips. It will be seen that to allow of the use of this type the road must be wide enough to allow two tubs to pass each other at any point on the route. In this particular case, illustrated in Fig. 2, a 20-h.p. squirrel-cage Westinghouse motor drives the haulage pulley by ropes, thence by pinion and spur wheel to the "C" pulley. The switchgear operating the motor consists of a totally enclosed oil switch, similar to those used on the distributing board, and an oil-immersed controller. All the haulages in the mine are fitted with strong brakes of the band type. There are also two single-drum haulages in this pit, driven by 20-h.p. slip-ring Westinghouse motors, and controlled by tramway-type controllers dealing with four tubs on a 1 in 4½ gradient. Two 5-h.p. squirrel-cage motors are used to operate creepers,

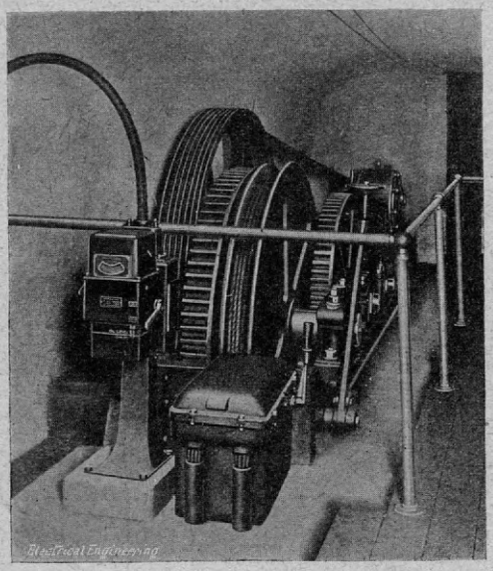


FIG. 2.—20-H.P. WESTINGHOUSE MOTOR DRIVING ENDLESS ROPE HAULAGE GEAR.

one for raising loaded tubs, and the other empty tubs, both working at the pit-bottom. One motor of 50 h.p. drives by means of a belt a two-stage air compressor, the air being used for percussive drills, and two small haulage winches.

Hydraulic rams are used to push the full tubs into the cage, and at the same time push the empties off, a three-throw pump driven by a 10-h.p. motor supplying the water pressure. This is a most useful device, and saves a great amount of time and labour in getting the coal to the surface. The total h.p. of the ten motors working in this pit is 300. The cages are of the four-deck type, capable of carrying eight tubs of coal per wind, and are operated by 2,000-h.p. steam winding engines working at 90 lbs. steam pressure.

On arriving at the surface electricity is again requisitioned to convey the coal to the screens, and also in the actual operation of screening. At the pit-brow there is a 20-h.p. motor driving a creeper by pinion and spur wheel, which is capable of pulling the loaded waggons up the incline to the screen, into which the coal is tipped by power-driven tipplers. The screens are large rectangular sieves, placed on a slant, and shaken by eccentrics, the latter being driven by a 150-h.p. motor. As the coal drops through the screens it is conveyed on belts to the chutes, the dirt being picked out by boys, and carried away by a small conveyor belt, known as the dirt belt. There are altogether five 5-h.p. Westinghouse motors operating these belts, and a 10-h.p. motor controlling the hoisting gear for raising the jib ends of the belt, and so minimising the breakage of coal falling from the belts. An interesting feature of the screens is the installation of Westinghouse-Cooper Hewitt mercury-vapour lamps, the light from which is admirably suited for coal picking. A fan driven by a 20-h.p. motor extracts most of the dust and delivers it in a "Maxaner" apparatus, when it is mixed with water and allowed to settle, the sediment being afterwards dried and burnt in the boiler fires.

In the fitting shops a 3-h.p. squirrel-cage Westinghouse motor is doing splendid work, driving line shafting from which three lathes, a radial drill and drilling machines, and a 6 ft. by 2 ft. planer are operated; whilst in the next shed a 20-h.p. motor drives a 4 ft. circular saw. Electric motors are also used to operate the blacksmith's shop and the crane, the latter being worked by two motors, a 20-h.p. British Westinghouse slip-ring motor for hoistiing, and a 6-h.p. 110-volt D.C. motor for slewing the crane. There are at present 53 motors installed, totalling 1,440 h.p., varying in size from a small 3-h.p. pump motor to a 150-h.p. motor driving the screens, all at work saving time, labour, and, therefore, money for the Company.

We have to express our indebtedness to Mr. J. Gregory, the Manager of the Sneyd Collieries, Ltd., Burslem, for permission to publish the foregoing interesting details, and to the British Westinghouse Co. for the photographs from which the illustrations are reproduced.

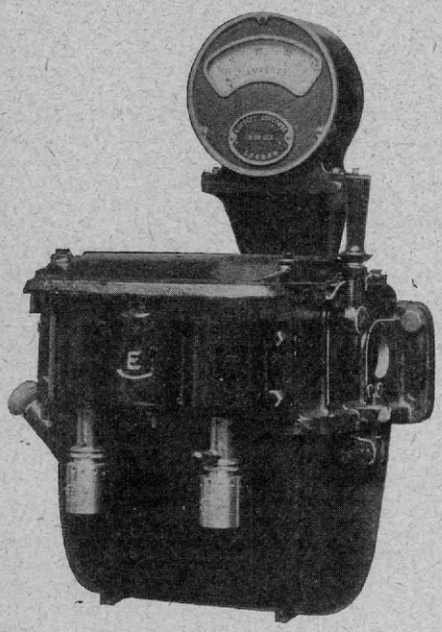
Electric Safety Lamps.—At an inquest on Saturday at Bryncethin, on two men who lost their lives owing to an escape of gas, it transpired that electric safety lamps were in use at the time. Colonel Pearson, inspector of mines, adopted the view that electric lamps were not "safety" lamps within the meaning of the Act, although, when questioned, he admitted that had ordinary safety lamps been in use there would have been more likelihood of explosion. The jury found that the deceased had died through suffocation, but added that if they had been using safety lamps the deaths would not have occurred.

A Primary Battery Lamp.—In the proceedings of the South Wales Institute of Engineers, an electric safety lamp for miners is described, in a Paper read by Mr. A. Leighton Stevens. This compares favourably with some of the requirements set down in connection with the prize of £1,000 which has been offered. (See ELECTRICAL ENGINEERING of June 1st, 1911, Supp. XLI.) Its main feature is that it is worked by a primary battery. This consists of a carefully packed glass pot and a carbon cylinder, arranged in an aluminium case. The liquid in the cylinder is prevented from spilling by means of a rubber plug, which seals the cylinder, and at the same time holds the zinc. There are no switching arrangements, the amount of fluid being so arranged that inverting the battery puts it out of operation. The lamp, which weighs about 3¼ lbs., will give a full light for eight hours, at a cost of a little more than 1d. per unit, and the life of the bulb would be about 800 hours.

The Home Office Rules.—We referred in a recent issue to the announcement by the Home Office that an arbitrator had been appointed to consider objections to the new electrical mining order. The following is the text of the circular in question, which is signed by Sir Henry Cunynghame, Permanent Assistant Under Secretary: "I am directed by the Secretary of State to say that he has received a number of objections from owners of mines under the Coal Mines Regulation Acts to the new special rules relating to the installation and use of electricity which have been proposed to them. It has consequently been necessary for the inspector of mines in charge of each district to appoint an arbitrator in the matter, in pursuance of the provisions of Section 47 of the Coal Mines Regulation Act, 1887, and each of the inspectors has accordingly appointed Mr. James Swinburne, of Victoria Street, London, S.W., as arbitrator in the matter of objections to the rules received in respect of mines in his district. The Secretary of State trusts that it may be possible to settle the matter without arbitration, but as objection has been formally made to the rules, it is necessary, under the Act, that an arbitrator should be appointed."

The Coal Mines Bill.—When the new Mines Bill was under consideration of the Standing Committee of the House of Commons, of which Mr. E. Wason is Chairman, on July 19th, discussion was resumed on Clause 20, which seeks to limit the use of electricity in mines. The amendment proposed by Mr. S. Walsh that electricity should not be used in any part of a mine where safety lamps are in use, was rejected by 26 votes to 13, and Sir A. Markham then moved to add the following words to the clause:—"If in any place of a mine, or part of a ventilating district of a mine, the amount of inflammable gas in the air current exceeds one-half per cent. or upwards, the use of electricity shall at once be discontinued in such place or part of such ventilating district where the inflammable gas exists till the air current is clear of the same, or shall not exceed one-half per cent." The amendment was opposed by Mr. Hunter, who said that not only would electricity be then prohibited at the place where safety lamps were used, but also in mines where naked lamps were used. The presence of a half per cent. of gas was not necessarily dangerous. The amendment was, however, carried by 15 votes to 12. A new sub-section proposed by Mr. Hunter was also agreed to, reading as follows: "When any question under this section is to be settled by arbitration, the owner, pending the settlement of the question, shall comply with the requirements of the inspector, subject to an appeal to the chief inspector."

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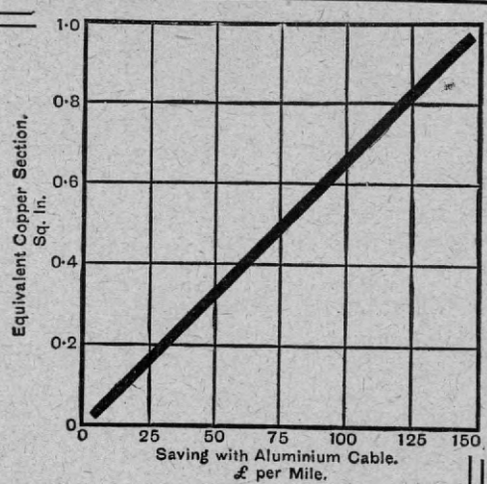
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AN ELECTRICAL MINING POWER SCHEME IN THE NORTH OF FRANCE

A PAPER by M. Besson recently published in the *Bulletin* of the Société Internationale des Electriciens, describes the electrical equipment of a group of mines at Lens, in the north of France, which is a fine example of the utilisation of waste power from both coke oven gas and exhaust steam, and of electric power supply on a large scale. The electrical energy produced is used for ventilation, pumping, coal screening, and workshop driving and lighting, and in the case of two of the newest pits for main shaft winding. In addition to this, surplus power is sold to a neighbouring power company (Compagnie électrique du Nord), to whose 15,000- and 45,000-volt transmission lines the colliery station is connected through a step-up sub-station.

There are, in addition to the coke oven gas and exhaust steam plants referred to below, four high-pressure steam generating stations at different points about the group of mines. Three of these adjoin the riverside chemical works at Vendin-le-Vieil, some distance from Lens, and one is at pit No. 3, the other side of Lens. The first three contain generating sets supplied with steam from boilers fired by coke oven gas, with a few coal-fired boilers in case of shortage of gas. One of these contains a slow-speed horizontal engine driving an 800 k.v.a. flywheel alternator installed in 1902, and a 1,250 k.v.a. Brown, Boveri-Parsons type turbo-alternator manufactured by the Compagnie Electromécanique du Bourget, exhausting into a Westinghouse-Leblanc condenser, and running at 3,000 r.p.m. The second station, dating also from 1902, contains three 850-kw. sets driven by Corliss type engines. The third station was only recently completed and contains only turbo-generators. These are three in number, also of the Brown, Boveri-Parsons pattern, each for 1,750 kw. running at 1,500 r.p.m. The boilers at this station, which are of the Belleville water-tube type, are arranged to be fired either by coke oven gas or by coal burned in "Underfeed" automatic stokers. The equipment is thoroughly up to date, with economiser and superheaters, and a steam consumption at full load of 17·9 lbs. of steam per kw. hour is obtained. The generating plant referred to above at pit No. 3 is only of very small size, consisting of one 180-kw. Brown-Boveri turbo set, taking steam from boilers supplying the winding engines, &c.

Passing now to the gas-driven stations, we have one (at pit No. 8) containing a single 360-kw. alternator direct driven by an engine with two double-acting tandem cylinders taking the waste gas from a battery of coke ovens. The other gas-engine station by the riverside is much larger, and is designed for three 800-kw. sets and two 1,600-kw. The first three engines, which are of the Augsburg-Nurnberg type, with two tandem double-acting cylinders each, are already in place. The large sets will be similar, with two lines of cylinders. The engines have cylinders 34 ins. diameter by about 42 ins. stroke, and run at 107 r.p.m.; each carries a 25-ton flywheel and drives a Westinghouse alternator. There are four exhaust steam turbo-generator installations (at pits Nos. 5, 8, 13, and 11), the last of which is not yet completed. That at pit No. 5 is solely an exhaust steam plant, but in the other three, mixed pressure turbines are used. All these equipments are provided with Rateau heat accumulators of varying sizes, designed to keep the steam pressure reasonably constant during a stoppage of the steam winding engines of 50 seconds. In the case of pit No. 5 provision is made, in case of long stops of the winding engine, for admitting live steam to the turbine through a reducing valve, but in the other three cases true mixed pressure turbines are employed, in which separate wheels are provided for the high-pressure steam. Westinghouse-Leblanc condensers are used in all these installations; condensing water in one case is taken from a canal, but in the other three instances cooling towers are employed. The turbo-alternator at No. 5 pit is of 550-k.v.a. capacity, and was made by Sautter Harlé and Co., of Paris. The steam consumption obtained has been 37·5 lbs. per kw. hour on full load with steam at 15·7 lbs. per sq. in. absolute, and 1·4 lbs. per sq. in. back pressure. At pit No. 8 a 1,000-kw. Curtiss vertical shaft mixed pressure turbo-generator by the French Thomson-Houston Co. is installed, taking exhaust steam from two winding engines, two air compressors, two fans, and the coal washing and screening plant. At full load with high-pressure steam alone the consumption is 22·8 lbs. per kw. hour, and with low-pressure steam alone, 36·9 lbs. per kw. hour. The set at pit No. 13 was supplied by the Société d'exploitation des Appareils Rateau; the turbine was manufactured by Messrs. Brosse et Fouché, of Nantes, and drives a 550-kw. Brown-Boveri alternator, and a similar set of 630-kw. is being erected at pit No. 11. The current from these generators, which have been put down from time to time at convenient points, and all generate at 5,000 volts three-phase 50 cycles, is distributed by a network of underground cables aggregating some 56·3 miles, running all through the group of mines. This network springs from a principal distributing station near the river, to which the feeders from the four generating stations in its immediate neighbourhood are taken. The other stations are connected up to the main network at convenient points. In the riverside district some 3,900 kw. is utilised, and the next largest receiving point is pit No. 15, where plant is being installed that will absorb 1,300 kw., and will include two electric winders, two large ventilating fans, a pair of turbo air compressors, and a number of motors for general purposes.

The winders were equipped by the French Thomson-Houston Co. Both employ Koepe pulleys, driven in one case by a pair of direct coupled motors, one on either side, and in the other case by a single motor. These winding motors are for continuous current, and are supplied with current from Ilgner equalising sets with 18-ton flywheels. The motor of each flywheel set absorbs about 270 kw. continuously, and by the aid of the flywheel, peaks at 434 kw. are supplied to the winding motors, which work at voltages varying up to 300. The load is 4·4 tons including cage, the shaft is 2,300 ft. deep, and a maximum rope speed of 1,970 ft. per min. is attained. The ventilating fans are driven by 225 h.p. motors direct off the 5,000-volt three-phase circuit. Electrically driven ventilating fans have also been installed at five other pits, where electric power is also used for pumping, driving the washing and screening plant, and general workshops. The total plant capacity of the generating plant now at work is 18,220 kw., and as the aggregate motor connections only amount to 11,520 kw., there is a fair margin of power available for supply to the Compagnie électrique du Nord.

Electrical Mining Accidents.—A coroner's jury at Trimdon Grange on July 5th returned a verdict that a screensman named M. Vickers met his death on June 26th by electric shock through coming in contact with a pipe containing a cable. The medical evidence was to the effect that it was impossible to say whether current had passed through the man's body. He had a diseased heart, and the actual cause of death was cardiac failure.

A coal cutter accident, in which a man was killed by the starting of the cutter before he was ready, occurred at Emley last month. It appears that when the trailing cable plug was inserted in the switchbox eighty yards away, the cutter started owing to the switch on the machine having been accidentally left on or knocked on.

An electrician named R. Craggs received a fatal shock on July 8th while examining a switch pillar at Swalwell Colliery, owing, probably, to the switch cover having become live. Although he had rubber gloves with him, he had only one on at the time. The pressure was 440 volt alternating.

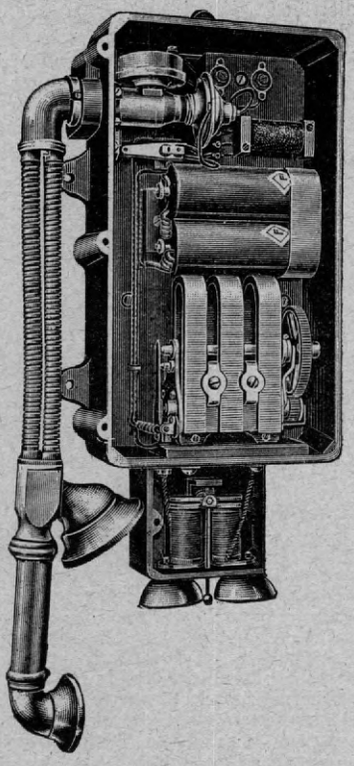




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MINING TELEPHONES

THE accompanying illustration shows one of a special series of magneto and battery call telephones particularly suited for mines, steel works, and use on board ship, which Messrs. Haslam & Schontheil, Ltd. (11, Windsor Place, Cardiff), are putting on the market. The particular instrument depicted is a magneto instrument, and is shown with the cover removed. The cases are of cast-iron, fully water-



MINING MAGNETO CALL TELEPHONE, WITH COVER REMOVED.

tight, and the transmitter and receiver are so connected by flexible tubes to aluminium mouth- and ear-pieces that they only require one hand for use. There is an automatic switch, so that there is no need to hold down a speaking key as in ordinary hand combination sets, and there are no exposed cords to break or wear. Loud and clear speaking is obtained, and there should be considerable field for apparatus of this type.

HIGH TENSION MINING SWITCHGEAR

A PAPER on this subject by Mr. F. B. Clark was read last month before the South Staffordshire and Warwickshire Institute of Mining Engineers. The author emphasised the advantage of oil-immersed switches for all underground work, even for low pressure, and the necessity for making them capable of dealing with the full short-circuit current which can arise in the particular circuit. Overload trips should be used in preference to fuses, especially underground. Where the neutral point is insulated, it is sufficient to have these on two phases, but otherwise there must be used one on each phase.

Speaking of motor starters, he recommended the use of squirrel-cage motors wherever possible started by the auto-transformer or the star-delta method. Where slip-ring motors must be employed, liquid starters were often used, but for frequent starting and stopping, as in main and tail haulage, metallic starters were preferable. The resistances should be well protected, and in wet and very dusty places oil-immersed resistances were preferable. For underground use controllers should be oil-immersed, even for circuits of low pressure, and the horizontal type, with the drum fixed to the cover, was preferable to the vertical type, as the latter, when oil-immersed, did not lend itself so readily to inspection.

On large systems automatic leakage protective devices were advisable as well as overload trips, and the Merz-Price system had given good results. Although these leakage protective devices undoubtedly prevented severe arcing, it had not been proved that any of them would prevent arcing altogether, quick as their action might be when a high-tension cable suddenly developed a fault. It might therefore be argued that protective devices would not inevitably prevent the ignition of gas should it be present where a cable is damaged; but, by preventing severe arcing, they lessened to a certain extent the risk of ignition of either gas or coal dust.

Generally speaking, underground switchgear should be compact and simple, with a minimum of instruments, absolute protection being more desirable than immediate accessibility. It should be interlocked, so that no part can be got at unless "dead." It is not desirable to enclose more space than is absolutely necessary, but ample clearance between the internal parts and earthed outer casing should be provided. In order to make the gear more compact, makers have on the whole erred on the side of too little clearance.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during July.

July 6th.—Monthly supplement on Electrical Engineering in Mines, containing an article on Prof. Redmayne's report on the Hulton colliery disaster, and some notes on electric power in the Kent colliery works.

July 13th.—Illustrated description of the large new power-house of the Newcastle-upon-Tyne Electric Supply Co. Details of a new automatic voltage regulator.

July 20th.—Report of a Paper on magnetic separator for the concentration of tin ores. Description of an automatic clutch for use with alternating current motors.

July 27th.—A practical article on the laying of mains on the solid system.

Electric Haulage Gears.—We have received from Messrs. H. Mackay and Co. (4 Southampton Row, W.C.), who are now sole selling agents of the Falcon Iron Works, Ltd., Oldham, some particulars of electric and other haulage gears manufactured by the latter firm. The electric-driven gears include a standard single-drum haulage made in sizes from 5 to 500 h.p., and suitable for either surface work or underground work. It is built upon a strong steel girder framework requiring little or no foundation. The first motion gearing is machine-cut, with a raw hide pinion and cast-iron spur-wheel. The second motion gear is machine-moulded. The drum is fitted with claw clutch and very powerful foot brake. Rope-driven endless rope haulages are also listed.

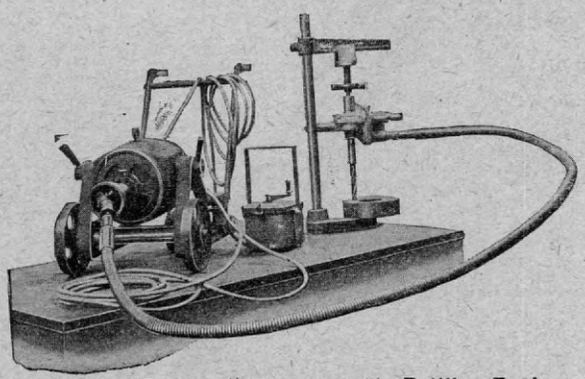
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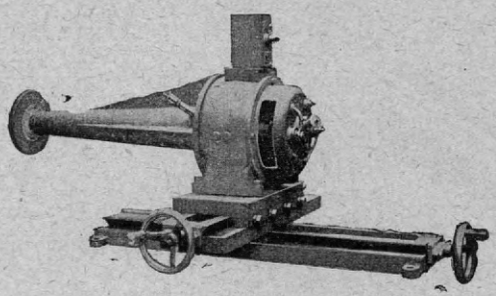
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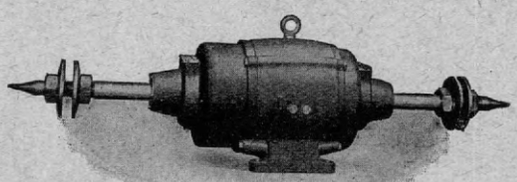


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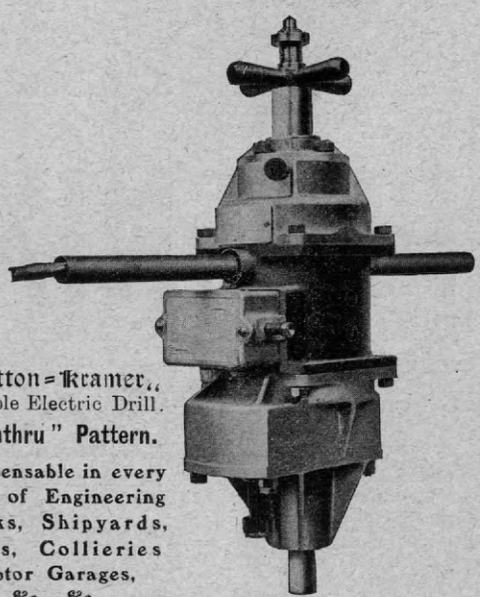
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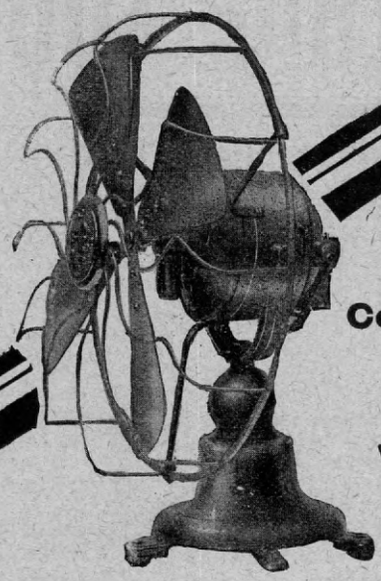
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CORRESPONDENCE

THE LAYING OF MAINS ON THE SOLID SYSTEM.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—The article by Mr. W. G. Turner in your issue of the 27th inst., is excellent both as regards scope and detail, and I should like to be allowed to supplement it with a few brief remarks on the subject of materials.

With regard to the troughs, cast-iron has been largely used in this country for E.H.T. cables, because of its "earth shield" facilities. The bolting together of the sections, and the clipping down of the cable to iron bridges in the trough, constitute all the bonding that is required in connection with it. In tropical countries it is also said to shield the cables from lightning effects. Incidentally, it also shields the cables from electrolytic effects arising from external sources. These features, together with the mechanical soundness pointed out by Mr. Turner, probably render it the most permanent method. There are, however, few jobs which justify the expense entailed by its use.

Asphalt troughs properly jointed and filled are ideal as regards the permanency of the materials and the protection afforded to the cables. They have given excellent results in all climates. In a discussion on Mr. C. Vernier's Paper at the Institution in London, Mr. F. J. C. Snell and Mr. Roger Smith spoke very highly of the Howard asphalt troughing, the former as to its efficiency in protecting cables under sub-tropical conditions, and the latter as to electrical tests between cable sheaths and earth, the values obtained being, it was stated, quite sufficient to prevent electrolysis.

Unlikely as it may appear at first sight to those unfamiliar with the Howard asphalt troughing system, it has been conclusively proved that as regards heat dissipation this system is very considerably superior to either the earthenware or wood troughing systems. Ordinarily, these more usual solid systems constitute the worst methods of laying from this point of view, whereas the Howard system is closely comparable with the best system for heat dissipation, *i.e.*, armoured cable laid direct in the ground. The asphalt is non-absorbent, and there is therefore no chance of a general leakage through it from cable sheaths in course of time, as there is in the case of wood and the grade of earthenware usually used for troughing.

The well-known instances of cable failures at wood bridges in wood troughing have had exact parallels in the case of earthenware troughs in which the bridges are moulded on the inner surface of the trough. Generally speaking, it should be remembered that porous earthenware can no more be protected from the percolation of moisture by capillarity by a thin glazing, than fibrous material such as wood can be prevented from absorbing water by tarring, creosoting, or compounding. Asphalt bridges have come to the rescue of these two forms of troughing, and should, in my opinion, be invariably used in conjunction with them. The criticisms as to their softening under the heat of the compound and the mechanical pressure of the cables referred to by Mr. Turner, are, as he also states, quite erroneous. Such criticisms have been made in ignorance of the physical properties of the material, which, although softened by heat, does not liquefy, or even lose its shape, unless mechanical pressure is applied considerably in excess of anything met with in cable-laying conditions. Porcelain bridges which are quite non-absorbent are now easily obtainable. They should preferably be unglazed and finished with a matt surface to assist the adhesion of the trough compound. It is good practice to expel surface moisture, and form a prepared surface by immersing them in the hot trough compound before placing them in the trough.

With regard to trough-filling compound, I quite agree with Mr. Turner that refined Trinidad bitumen is the best material for the purpose, and would point out that this is especially so where cables in the trough are liable to become heated through overload, because for a given temperature rise pitch mixtures are much more liable to flow. In this connection, it is well to remember that the solid system of laying, so far as wood and earthenware troughs are concerned, is the worst system as regards dissipation of heat. For ordinary conditions of load, such as obtain with lighting feeders, pitch compounds are very satisfactory. The usual abstract statements as to "weathering" effects on pitch as compared with refined Trinidad bitumen do not apply, because the practical comparison is not between surfaces but between solid masses.

In conclusion, I would emphasise Mr. Turner's remarks as to the necessity for dry and clean conditions in all solid systems of cable laying.

C. BEAVER.

Trafford Park, Manchester.
July 31st, 1911.

PHOTOMETRIC FLAME STANDARDS

A PAPER by Messrs. W. J. A. Butterfield, J. S. Haldane, and A. P. Trotter, read at the meeting of the International Photometric Commission at Zürich, in July, contained a record of a research on the corrections for the effects of atmospheric conditions on Photometric flame standards. The effects of the pressure, degree of humidity and vitiation of the atmosphere on the Harcourt pentane and Hefner amyl-acetate lamps were investigated by the aid of a steel chamber, sufficiently commodious to accommodate two observers (placed at the disposal of the authors by the Lister Institute of Preventive Medicine), in which any variation of conditions could be made and recorded. The lamps were placed below a hood directly connected with the outlet airway. A small metal filament lamp fed by accumulators and considerably underrun to obtain a suitable colour, was at first used as a standard, but subsequently a Fleming-Ediswan carbon standard was used. The methods employed and the results are detailed in the Paper. The principal results may be summarised as follows:—The curve connecting air pressure and correction factor is for the Harcourt lamp nearly a straight line for the range of 700 to 850 mm., and shows that within these limits the light increases or decreases by 1 per cent., with an increase or decrease respectively in pressure of 12·5 mm., or that a variation of 10 mm. in pressure is attended by a variation in the same sense of 0·8 per cent. in the light afforded by the lamp. The curve for the Hefner lamp is likewise nearly a straight line for the range of 700 to 850 mm., and shows that within these limits the light increases or decreases by 1 per cent. with an increase or decrease respectively in pressure of 25 mm., or that a variation of 10 mm. in pressure is attended by a variation in the same sense of 0·4 per cent. in the light afforded by the lamp. Sets of observations on the Harcourt lamp showed that a change in the temperature *per se* of the air from 8° C. to over 20° C. had no definite effect on the light afforded, but the light of both the Harcourt and Hefner lamps decreases by 1 per cent. for an increase of 0·16 per cent. in the aqueous vapour in the air, so that an increase of 1 per cent. in the aqueous vapour in the air is attended by a decrease of 6·25 per cent. in the light of the lamps. It was also found that 1 per cent. decrease in the light of the Harcourt lamp was caused when approximately 0·035 per cent. of carbon dioxide was present in the air, and in the light of the Hefner lamp with 0·045 per cent.

STREET LIGHTING IN THE BORO' OF HOLBORN

AT the meeting of the Holborn Borough Council on Wednesday last week, the report of the Works Committee recommending the Council to adopt the joint tender of the Electric Light and Gas Companies for street lighting at an annual cost of £7,645 (ELECTRICAL ENGINEERING, July 27th, page 427), was agreed to without the recommendation being put to the vote. The only speaker on the report was Alderman Green, whose argument seemed to be that the 425,000 c.p. provided for in the agreement was excessive for the needs of the Borough, and he incidentally complained that the Works Committee in their last consideration of the matter had treated it in a somewhat cursory manner, "as if they had had enough of it," to which remark several councillors added, "Hear, hear." Thus the Holborn street lighting problem is at last disposed of, although the ratepayers have the doubtful satisfaction of having to pay the £7,645 per annum for the combined scheme of electric and gas lighting against £6,602, for which the electric lighting company offered to carry out the work.

Crystal Palace School of Engineering.—The annual ceremony of the award of certificates was held yesterday, Sir Almeric W. Fitzroy, Clerk of the Privy Council, in the chair.

University College.—In the Faculty of Engineering at University College, London, an Entrance Scholarship of the value of 120 guineas, instituted by a Fellow of the College, will be competed for in September next. Candidates must have passed the University of London Matriculation, or an examination accepted in lieu thereof. The post-graduate courses for next session will include a course by Mr. F. Bacon on "The Photomicrographic Study of Metals"; a course by Mr. A. R. Low on "The Design and Calculation of Aeroplanes"; a course by Mr. W. J. Goudie on "Steam Turbines"; and a course by Mr. H. P. Philpot on "Some Modern Methods in the Design of Structures."

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published July 27, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

23,536/10. **Protection of Trolley Wire and Ears.** H. M. DUDGEON. To reduce the rapid wear of the ears and trolley wire due to arcing, the contact area between the conductor and collector is increased by suspending a supplementary conductor of flexible wire or strip in bow-shape fashion alongside the ear, so that contact is made between it and the collector in addition to the original contact with the trolley wire. The supplementary conductor is held in position by clips fixed on the wire near the ears. Three figures.

25,634/10. **Arc Lamps.** A. SCHMIDT. A self-regulating arc lamp, in which both carbons are adjusted by a solenoid. An arm, pin-jointed to a toothed lever, is connected to the solenoid, and by means of a spring joining the lever and core, the lever is pressed against a toothed wheel attached to a grooved roller. A chain, passing round this roller, is connected to the carbons, which are drawn apart. When the solenoid core is at its bottom position, the toothed lever is released and the carbons fall together. Two figures.

26,836/10. **Electric Heaters.** M. B. FIELD and FERRANTI, LTD. This invention relates to an electrical heater with a slotted hot plate, and a resistance winding, insulated therefrom, for generating heat in contact with the plate. Two figures.

4,524/11. **Accumulator Boxes.** G. E. B. PRITCHETT (*Pritchett's and Gold, Ltd.*). In the author's patent 15,425/10, which was abstracted in ELECTRICAL ENGINEERING of April 27th, 1911, page 226, instead of having a deep space between the plate and the top of the box, he supplies a second plate, which forms the lid of the box, and the space is much reduced. Two figures.

8,392/11. **Ventilation of Machinery.** SIEMENS BROTHERS DYNAMO WORKS, LTD., and C. A. B. D. KOETTGEN. In a dynamo of the turbo type, an arrangement for ventilation consists of the combination of three fans on the rotor for forcing air through the stator air ducts, drawing air through the rotor air ducts, and also through the air gap. A partition within the dynamo separates the air discharged from the stator ducts from that discharged from the rotor ducts and the air gap. One figure.

10,113/11. **Non-Interchangeable Fuses.** SIEMENS BROTHERS DYNAMO WORKS, LTD. To avoid using low-voltage screw plugs in high-voltage sockets, the depth of the fuse socket, and the length of the screw plug, are altered. In this way, sockets of considerable depth with long screw plugs can be used for high voltages, and of less depth with shorter screw plugs for low voltages, the graduation for consecutive voltages being at least equal to the length of the screw-threaded part of the screw plug. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Dynamos, Motors, and Transformers: ROSENBERG and PECK [Braking induction motors] 17,010/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Control systems for electric motors] 17,107/10; BRITISH THOMSON-HOUSTON CO. (*General Electric Co.*) [Systems of motor control] 177/11; ALLGEMEINE ELEKTRICITÄTS-GES. [Systems of motor control] 12,921/11.

Electric Ignition: ANDERSON [Manufacture of spark plugs] 18,295/10; SMITH and MUIRHEAD & Co. [Ignition apparatus] 18,794/10.

Electrometallurgy and Electrochemistry: RUTHENBURG [Extraction of antimony from ores] 28,030/10; SOCIÉTÉ ANONYME ELECTROMETALLURGIQUE (*Procédés Paul Girod*) [Method of supplying electric furnaces with three-phase currents] 13,731/11.

Heating and Cooking: CUNNINGTON [Electrical heating apparatus] 21,848/10.

Incandescent Lamps: WILSON, 1,251/11.

Instruments and Meters: COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATERIEL D'USINES À GAZ [Electricity motor-meters] 30,297/10.

Switchgear, Fuses, and Fittings: JOHNSON and LOXLEY & Co. [Electrical ceiling-roses, junction boxes and fuses] 14,042/10; KALLMANN [Electric safety fuses] 16,258/10; PRESSER, and GES. FÜR ELEKTROTECHNISCHE INDUSTRIE [Automatic regulators for electric circuits] 22,198/10; WESTINGHOUSE BRAKE CO. (*Taylor*) [Electric relay apparatus] 28,588/10; HATHORNE, DAVEY & Co. and TOWLER [Control gear for electric driven pumps] 8,890/11.

Telephony and Telegraghy: GRAHAM [Water-tight telephonic apparatus] 2,501/11; SIEMENS BROS. & Co. (*Siemens and Halske Akt.-Ges.*) [Automatic telephone instruments] 10,341/11.

Traction: SAMAIA [Conduits and ploughs] 24,489/10; COMPAGNIE DE SIGNAUX ELECTRIQUES POUR CHEMINS DE FER [Warning apparatus on railways] 3,978/11; SIEMENS BROS. & Co. and SCOURFIELD [Automatic signal control] 8,511/11.

Miscellaneous: CRAWFORD and SCOTT [Means for driving tools electrically] 13,716/10; HOLDEN [Electric clocks] 14,126/10; VICKERS, SONS & MAXIM, LTD., and WILLIAMSON [Rotating commutators] 22,507/10; READING [Centrifugal fans] 1,326/11; KELLY [Metallic railway ties] 2,994/10; CARDWELL [Mechanism for transmitting electric impulses] 3,086/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: GEBR. SIEMENS & Co. [Electrodes for] 13,817/11; GENERAL COMPOSING CO. GES. [Arc lights] 15,474/11; GES. FÜR MASCHINEN- UND METALL-INDUSTRIE M.B.H., 15,730/11.

Switchgear, &c.: BERDON [Electric-current controlling device] 15,149/11.

Telephony, &c.: TELEPHON APPARAT FABRIK E. ZWIETUSCH & Co. GES. [Automatic telephone sending mechanism] 15,569/11.

Miscellaneous: NEU [Feeding low-voltage lamps on a high-voltage circuit] 10,965/11; ELEKTROCHEMISCHE WERKE-GES. and ROTHE [Production of disc-like flaming arcs] 13,335/11; REBSAMEN [Electric sewing-machines] 15,690/11; SCHWAGER [Pocket-lamps] 15,818/11.

Opposition to Grant of Patent

11,908/10. **Insulating Material.** A. R. MULLER and the R. M. D. SYNDICATE, LTD. Opposition has been entered to the grant of this patent, which relates to an improved insulating material, comprising a mixture of asbestos and tar, consisting of two parts of asbestos to one of tar, compressed to the required shape, and heated to a temperature of 400° to 500° C.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

18,259 of August 5th, 1897. **Traffic Control.** F. W. WEBB, G. EDWARDS, and A. M. THOMSON. In the electrical control of traffic on single lines of railway in which staffs are used, the removal of one of them renders the instrument inoperative until it has been returned or inserted in the instrument at the other end of the section. This patent provides a number of staffs for despatching several trains if required, and the electrical arrangements for working the instruments are also used for transmitting telephonic messages.

18,337 of August 6th, 1897. **Electrical Cut-outs.** H. HIRST. This patent provides means for enclosing the fusible wire or strip in an isolating box, so that when the fuse is blown, the vapour is prevented from causing an arc between the terminals.

18,556 of August 10th, 1897. **Lightning Arresters.** THE BRITISH THOMSON-HOUSTON CO. (*E. M. Hewlett, America*). A lightning arrester for protecting electrical apparatus comprises the combination of arcing electrodes, a non-inductive resistance in circuit with one of them, and a blow-out magnet with its coil ends connected to the resistance at points between which there is a difference of potential, these being suitably enclosed in a box of insulating material.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: BRITISH THOMSON-HOUSTON CO. (*General Electric Co.*) [Transformers] 8,539/06; SIEMENS BROS. & Co. and F. TURNER [Transmission] 8,367/07.

Dynamos, &c.: BRITISH THOMSON-HOUSTON (*General Electric Co.*) [Dynamos] 7,919/05; H. J. MCMAHON [Dynamos] 7,891/06; BRITISH THOMSON-HOUSTON CO. and W. F PAWSON [Dynamos] 8,286/07.

Electrometallurgy, &c.: S. Z. DE FERRANTI [Furnaces] 8,255/07; H. PAWECK [Electrolysis] 8,562/07.

Incandescent Lamps: R. J. B. M. DAMSEAUX, 8,240/07.

Switchgear, &c.: L. NEU [Electric Protective Systems] 9,026/06; P. S. BROOK and J. A. HIRST [Switches] 8,504/07; C. SCHMIDT [Switches] 8,706/07; C. T. J. OPPERMANN [Controllers] 8,742/07.

Telephony, &c.: W. BENICKE and H. WESTERBECK [Typewriters, Telegraphs, &c.] 8,575/04; C. BRUNNSCHWEILER [Telephones] 8,611/07.

Traction: B. GRAHAM [Electric railway points and switches] 8,206/07; N. KESSLER and G. JELICH [Crossing gates and barriers] 8,471A/07; S. STONE and L. W. MIGOTTI [Traction control] 8,623/07 and 8,623A/07.

Miscellaneous: C. NEUMANN [Fans] 7,729/05 and 7,730/05; BRITISH THOMSON-HOUSTON CO. (*General Electric Co.*) [Electric relays] 8,936/06; BRITISH THOMSON-HOUSTON (*General Electric Co.*) [Electric lighting] 8,388/07; N. KESSLER and G. JELICH [Electric bells] 8,471/07.

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ELECTRIC TRACTION NOTES

The petrol electric transmission system, designed by Mr. J. G. P. Thomas, and known as the Thomas transmission, which is applied to road vehicles, was described in some detail in ELECTRICAL ENGINEERING, May 4th, page 236, has also been applied in a slightly modified form to a railway coach which is being supplied to the Central South African Railways. The vehicle has been constructed by Leyland Motors, Ltd., in conjunction with the United Electric Car Co., of Preston. The engine, which is of the six-cylinder vertical pattern, rated at 120 h.p., is situated in the centre of the car, and drives, as before, the cage of the planetary gear. The smaller sun-pinion is connected to one of the electrical machines, while the larger one is geared to one of the axles of one bogie, there being also a coupling whereby the sleeve carrying the armature of the motor can be coupled to the same shaft. The other electric machine, instead of being mounted on the back end of the propeller shaft as in the road vehicles, is geared to the driving axle of the other bogie. The general principle of the sharing of the transmission of power by the electrical and mechanical shafts is in no way altered. A battery is provided which can propel the vehicle a short distance in case of emergency, and is used for starting up the engine. The weight of the car, which is 37 ft. over all and accommodates 42 passengers, is 21·25 tons, and of this 7 tons is accounted for by the power equipment, the engine alone weighing 35 cwt. A draw bar pull of 1¾ tons has been obtained. The car can attain a maximum speed of 50 m.p.h., and is capable of reaching 30 m.p.h. in 30 seconds after starting on the level. It is guaranteed to maintain this speed up gradients of 1 in 25.

The net revenue of the Great Northern & City Railway Co. for the June half-year was insufficient to meet the fixed charges by £1,110 12s. This sum, as usual, has been provided from outside sources. The number of passengers carried during the half-year showed an improvement of nearly half a million.

It is announced that the London Brighton & South Coast Railway Co. have decided to extend their electric lines from Balham to Croydon *via* South Norwood.

The directors of the Liverpool Overhead Railway Co. recommend a dividend at the rate of 1 per cent. per annum on the ordinary shares for the June half-year, carrying forward £4,665.

The half-yearly accounts of the Central London Railway Co. show a balance available for distribution of £76,878, against £85,079 in the corresponding period of last year. After meeting the preference interest the directors recommend a dividend at the rate of 3 per cent. per annum on the undivided ordinary stock, and 4 per cent. per annum on the preferred ordinary stock, carrying forward £36,538. The number of passengers carried during the half-year decreased by 658,609, a result which is attributed to the large increase of motor-omnibus competition and the poor attendance at the Shepherd's Bush Exhibition. Against this a material saving has been effected in the working expenses. Arrangements have been made with the contractors for the Liverpool Street extension, whereby the work will be expedited six months.

According to a *Standard* cable from Melbourne, the Hon. W. A. Watt, the Acting Premier, has promised to submit to Parliament a definite scheme for the conversion to electric traction of the Melbourne suburban lines. A few years ago Mr. C. H. Merz was specially engaged by the Victorian Government to investigate the problem of converting the Melbourne railways to electric traction. His proposals to do so, however, were not adopted, but the matter has since continued a much debated one in view of the need for acceleration in the train service between the centre of Melbourne and the suburbs.

The Bill of the Aberdare Urban District Council for the construction of electric tramways was passed last week by a House of Commons Committee. It includes powers to run trolley omnibuses.

The Birmingham Corporation have passed a resolution to purchase the lines of the British Electric Traction Co. in their district at a cost of £151,500. The Tramway Committee's recommendation to apply to Parliament for powers to considerably extend the tramways has been deferred for further consideration in October.

After meeting all charges, the accounts of the Aberdeen Tramways Department for the year to March 31st show a net profit of £17,459, which has been carried to renewal fund, bringing this latter up to £67,402. The net profit in the previous twelve months was £14,654. The use of meters on the tramcars has been extremely beneficial.

Mr. R. Elliott Cooper has been appointed by the Board of Trade to act as arbitrator in connection with the purchase by the L.C.C. of the small portion of the London United Tramway Co.'s undertaking which is in the County of London.

An interim dividend at the rate of 4 per cent. per annum for the June half-year is recommended on the ordinary shares of the Bristol Tramways & Carriage Co.

The accounts of the L.C.C. Tramways for the year to March 31st, 1911, show that there are 126⅓ miles of electric tramways, and 17⅓ miles of horse lines. The total capital expenditure amounts to £11,618,837, and allowing for repayments, the net debt is £9,465,499. There was a surplus on the working for the year of £895,048, which is reduced to £232,727 after providing for capital charges and other payments. From this balance the sum of £129,229 is taken for renewals, bringing this fund to £527,264. The balance on the year's working is £103,498. The working expenses per mile increased from 6·42d. to 6·48d. for the electric lines, and the receipts were 11d. per car mile, against 11·21d. for the previous year, which latter decrease is due to the opening of routes in less populated districts.

A dividend at the rate of 1 per cent. per annum is recommended on the ordinary shares of the London Electric Rly. Co. for the June half-year, placing £7,500 to renewals, and carrying forward £14,500. The full dividend on the 4 per cent. guaranteed stock of the District Rly. Co. for the past six months is recommended, and 4½ per cent. on the first preference stock. Renewals fund is credited with £10,000, and the carry forward is £14,200.

The Paris City authorities have sanctioned a loan of £9,600,000 for completing the Metropolitan Railway.

A House of Lords Committee have passed the Rotherham Corporation Bill, which provides for various tramway extensions, and also the installation of trolley omnibuses.

A scheme for the rearrangement, and not reduction, of the capital of the British Electric Traction Co. has been prepared by the Board. Under the scheme, the preference shareholders obtain an advantage in priority of capital, and waive part of their rights to future distribution of profits. The ordinary shareholders have their prospect of dividend improved, and waive part of their right as to capital. The nominal capital of £4,000,000, divided into £2,000,000 preference and £2,000,000 ordinary, will be divided into £500,000 first preference shares, £500,000 second preference shares, £2,000,000 preference ordinary shares, and £1,000,000 deferred ordinary shares, all of £1 each.

According to the *Journal des Transports* (Paris), considerable progress is being made with the conversion to electric traction of the Mont Cenis line from Modane to Bardonèche, which will increase the carrying capacity and ameliorate the conditions in the Mont Cenis tunnel. Energy will be obtained from the municipal generating station at Chiomonte, where 3,500 kw. will be available at 50,000 volts 50 cycles. The main feeders will follow the course of the railway between Bardonèche and Bussoleno on poles suitable also for carrying the contact line, when this section is converted; special types of glass and porcelain insulators will be employed. At Bardonèche a sub-station will convert the supply to 3,500 volts 16 cycles. The locomotives will be required to haul a 300-ton train up a 3 per cent. gradient at 31 miles per hour, and two such trains will be on the 9½-mile section between Bardonèche and Modane at once.

Another section of the German State railways which is to be converted to electric traction is a group of lines in Silesia, near the frontier of Bohemia, including a line 76 miles in length, from Lauban to Königszelt, and certain branch lines aggregating about 90 miles. Much of this is almost of the nature as a mountain railway, with heavy gradients and sharp curves. The lines will work with a contact-line pressure of 10,000 volts single-phase 15 cycles, which is now the standard for the German main lines. Two types of locomotives will be used, one for passenger traffic capable of speeds up to 68·5 miles per hour, and the other for goods traffic, similar to those described in ELECTRICAL ENGINEERING, July 20th, page 414, for the Dessau-Bitterfeld section. These will be capable of speeds up to 40 miles per hour. For very heavy trains two can be used in tandem.

It is anticipated that considerable increase in traffic and speed, combined with reduction in cost, will follow the adoption of electric traction on the St. Gothard line. The scheme under consideration involves taking power from three stations at Retom, Göschenen, and Amsteg respectively.

A company is being formed for the construction of an electric railway between Jumilla and Cieza, in Spain.

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CATALOGUES AND PAMPHLETS RECEIVED

ARC LAMPS.—A pamphlet from the Globe Electric Co., Ltd. (11 Farringdon Avenue, E.C.) gives notice of further improvements in the "Multax" flame lamp. By an improved method of enclosure the burning hours have been increased by 25 per cent., with a corresponding reduction in carbon and trimming costs, while at the same time the outer globe is kept free of deposit. The lamps can now be provided with a special light distribution reflector.

BRUSH HOLDERS.—Another pamphlet from the Globe Electric Co. deals with the "Supra" brush holder and carbon brushes. This well-known brush holder consists of two independent cast steel parts, one being tightly fixed on the spindle by means of a split ring and tommy screw, the other being allowed free movement round same. To the end of the fixed portion, remote from the spindle, is attached a spiral spring, the downward pull of which is exerted on the moving arm of the holder carrying the brush, resulting in the latter being pressed evenly against the commutator. The brush is carried by two jaws, one of which is cast solid on the main arm, and the other is formed by a freely moving arm, which is held in tension by means of a spring.

HEATING AND COOKING APPARATUS.—The London Electrical Trading Co. (21 Broad Street House, E.C.) send us a list of Bastian patent "Quartzalite" heating and cooking appliances, the principal features of which have been described in Electrical Engineering from time to time. Various patterns of heaters for rooms and offices, toasters, ovens, hot plates, kettles, and water-heaters and irons, are dealt with, including those with the latest pattern of insertion heater.

GOVERNORS AND GOVERNING GEAR.—An interesting catalogue on governors and governing gear has just been issued by W. Hartnell & Co. (Volt Works, Leeds). The Hartnell automatic expansion regulator and various vertical types of governor are illustrated and described, and much valuable information is contained in notes on the governing of engines.

ELECTRIC BELLS AND ACCESSORIES.—We have received from Messrs. G. Braulik (8 Lambeth Hill, Queen Victoria Street, E.C.) a copy of the new edition of Section B of their catalogue. It is divided into five sub-sections, with numerous illustrations and details of bells, buzzers, and relays; indicators; pushes, alarm-contacts and switches; testing instruments, batteries, and line materials, etc., and diagrams of connections for bell and indicator circuits. Separate leaflets are also enclosed relating to fans and small motors, the Eclipse metallic filament lamp, the Eclipse flame arc lamp, and electric auto thermal flashers. This very complete bell list will be sent to all contractors who apply for a copy.

THE "SVP" MOTOR.—A short account of this continuous-current motor appears in a pamphlet from the Electric Construction Co., Ltd. (Dashwood House, 9 New Broad Street, London, E.C.). The principal feature is its vertical commutator, the advantages of which reduce the cost of production, allow of easy access to the brushes, do away with the danger of high bars, require practically no bedding of the brushes, and the overall length of the motor is reduced. Each of the two brushes is held against the commutator by a small spiral spring, adjustable by means of a milled-head vulcanite screw. The temperature rise after a six hours' run does not exceed 70° F., and the overload capacity is 25 per cent. for two hours, and 50 per cent. momentarily. The following outputs are at present offered: ¾, 1, and 1½ B.H.P. at 1,000, 1,400, and 2,000 R.P.M. respectively.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

FLAME ARC LAMPS.—The Union Electric Co., Ltd. (Park Street, Southwark, S.E.), have issued a new complete list of "Excello" arc lamps, introducing the latest form of inner dioptric globe, which is composed of a number of prism rings of different angles to divert the rays and produce the most suitable distribution of light. From the surface illumination curves of lamps placed about 60 yards apart and at a suitable height for street lighting, it is seen that the minimum illumination is almost doubled, whilst the maximum illumination compares more closely with the minimum, when the dioptric globe is used. Various designs of reflectors and covers are illustrated, and among the accessories we find adjustable choking coils and line resistances, transformers, automatic cut-outs, and compensating resistances for D.C. lamps, safety coils, and arc lamp winches. A full list of dimensions appears at the end, and a new feature which is being adopted by the firm consists in cutting the right-hand edge of their catalogues for index purposes.

ALUMINIUM.—Two leaflets are to hand, illustrating the use of aluminium for battery and feeder connections, from the British Aluminium Co., Ltd. (109 Queen Victoria Street, E.C.).

HEATING AND COOKING APPARATUS.—An illustrated catalogue from the Phœnix Electric Heating Co. (17 Morwell Street, Tottenham Court Road, W.C.) contains electric heating and cooking apparatus of every description, including hot cupboards, grills, hot plates, electric irons, utensils and urns for the kitchen; kettles and water jugs for the table; besides radiators, curling-iron heaters, towel rails, immersion heaters, coffee roasters, hot-water tanks, and many other articles, all of which are of British manufacture.

LOCAL NOTES

Baildon: *Electric Lighting.*—The Council has intimated its intention of opposing an application for an electric lighting Provisional Order by the Wharfedale Electric Light and Power Syndicate.

Braunton: *Electric Lighting.*—The final arrangements for the formation of the Braunton Electric Lighting and Power Co. have now been made. It is anticipated that there will be no difficulty in raising the necessary capital locally, and that the plant will be installed within three months from the commencement of erection. Messrs. Crompton & Co. are concerned in the project.

Bristol: *Electricity Accounts.*—In dealing with these accounts in our last issue, we stated that there was a deficiency last year of £768 16s. after meeting capital charges. Closer investigation of the accounts, however, reveals that whilst this in itself is more than a sound position, the result for the past year given above was arrived at after setting aside about £3,000 to the renewals fund. The Bristol auditors do not approve of declaring a net profit until after money has been placed to the reserve fund, a policy which is not in accordance with other people's ideas.

Edgware: *Electric Light.*—An agreement has been signed with the North Metropolitan Electric Power Co. for lighting the Edgware main road by electricity.

Glasgow: *New Turbo-Generators.*—A deputation in connection with the Tramways Department, including the Tramways Manager and the Tramways Electrical Engineer, has been appointed to visit the works of various makers of turbo-generators in England and on the Continent. The object is to make full inquiries before the Tramways Committee make a recommendation with regard to the new turbo-generators which are to be installed at Pinkston Power Station.

Honiton: *Electric Supply.*—The Council have decided to enter into an agreement with Dr. Purves, of Exeter, to install an electric supply plant.

India: *Electric Power Supply.*—The water power scheme of the Tata Hydro Electric Supply Co. is in an advanced state of construction, and the directors have decided to invite applications from prospective consumers.

London: *City of London: Street Lighting.*—At the present time there are 463 street electric lamps in the City of London compared with 447 last year. This number includes 32 centrally-hung lamps; there are 424 open type arc lamps and 90 flame arc lamps.

St. Marylebone: Electricity Accounts.—After meeting interest and repayment of loans, which amounted to no less than £113,789, there was a net balance of £12,089 upon the working of the electricity undertaking last year. Out of this sundry items of capital expenditure amounting to £2,166 have been met, in addition to the full cost of motors, &c., on hire, amounting to £1,192, and a further sum of £1,183 in respect of sundry improvements and minor additions to plant. After meeting these and the bonuses payable to officials, £788, there remains an unappropriated balance of £6,712. The total expenses on the Sales and Publicity Department for the year were £19,171, whilst the amount received from the sale and hiring of apparatus, &c., was £16,959. In their report the Committee emphasised the fact that a great deal of the work of this section is unremunerative to itself, but is considerably beneficial to the undertaking as a whole. The cost per unit sold amounted to 0·901d., including publicity expenditure, against 0·961d. in the previous year and 1·19d. in 1908-9. Whilst the expenditure for the past twelve months increased by 7½ per cent., the output was increased by 14½ per cent.

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Stoke Newington: Electric Lighting.—It is proposed that the Council shall give the necessary six months' notice to the North Metropolitan Electric Power Supply Co. to terminate the agreement for bulk supply. The matter is to be discussed in September.

Oldham: *Hiring of Motors.*—The Electricity Committee have met a deputation from the Electrical Section of the Oldham Chamber of Trade with regard to the hiring out of motors. The Chamber had made the charge that the Committee were infringing the law in hiring out motors, but it was pointed out that the Corporation themselves do not own any motors so hired, but that arrangements were made with two firms of makers. The Committee claimed the moral right to work in this manner, as none of the electrical contractors in the town have been prepared to hire, although they are willing to sell motors. The Committee offered to meet the Chamber of Trade by dropping the arrangements they have at present if the electrical contractors in the town take up the hiring of motors.

Maidstone: *Supply Outside Area.*—The Corporation have decided to apply to the Board of Trade for sanction to supply certain premises outside the area.

Manchester: *Testing Electricity Meters.*—The Justices Committee, which has charge of the Gas Meter Testing Department of the Corporation, have issued a special report in which it is recommended that the testing of electricity meters shall also be placed in their hands. This Committee is in a similar position to the Electrical Department of the London County Council, in that it is not in direct connection with the Gas Department, and the argument is that the testing of electricity meters should also be carried out by an independent authority of this character. At the meeting of the Council on Monday it was decided to appoint a sub-committee to consider the question.

Swansea: *Electric Lighting Profits.*—The Corporation, after a lengthy discussion, have adopted the recommendation of the Tramways and Lighting Committee to transfer the profits on the electric lighting undertaking, viz., £8,062, to the reserve fund.

Wakefield: *Electricity Accounts.*—There was a loss of £213 upon the Corporation's electricity undertaking last year, compared with £802 in the previous twelve months.

Walsall: *New Supply Scheme.*—The large scheme of extensions inaugurated by A. S. Barnard before he was unfortunately compelled to go away for his health, and which has been carried on by Mr. Ashton Bremner, who is acting for Mr. Barnard, is nearing completion.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Austria-Hungary.—According to the *Board of Trade Journal*, the Budapest municipal authorities invite tenders by September 30th for a 10,000-kw. power plant. Particulars from "Dr. János Buzáth, IV. Városhaz utcza 16, II. 1," Budapest.

Belfast.—Application is to be made for sanction to a loan of £40,000 for additional electrical plant and mains.

Blackburn.—Firms desirous of an opportunity to tender for the installation of electricity generating plant at the Whalley Asylum, near Blackburn, should send their names and addresses to the Clerk to the Committee of Visitors, County Offices, Preston, not later than August 7th.

Bolton.—The Electricity Committee recommend application for a loan of £20,000 for electric mains extensions.

Cleethorpes.—The Local Government Board have written to the Council in reference to the recent inquiry concerning a loan of £4,000 for electric light purposes. At that inquiry it was suggested that the scheme put forward could be considerably improved, and the Local Government Board now desire particulars of this new scheme. Mr. C. S. Vesey-Brown, the Council's Consulting Engineer, has been asked to forward the amended estimates.

Guisborough.—The Council have received a petition signed by some 400 residents in favour of electric lighting of the streets.

Haslingden.—The Local Government Board have sanctioned a loan of £8,188, as follows: £6,238 for mains; £850 for sub-station equipment; £350 for services; £250 for meters; £500 for the purchase of motors for hire.

London: *L.C.C.*—Electric charging apparatus is to be erected at four fire stations in connection with the motor escape vans which will shortly be in use, at an estimated cost of £200.

Hampstead.—The Finance Committee of the L.C.C. recommend a loan of £7,550 for mains, transformers, house services, &c.

Islington.—A loan of £5,500 for mains, transformers, house services, &c., is recommended by the Finance Committee of the L.C.C.

Marylebone.—The Finance Committee of the L.C.C. recommend loans of £1,500 for mains, £3,500 for house services, and £2,650 for battery cells.

Poplar.—Sanction to loans amounting to £34,995 for new generating plant is recommended by the Finance Committee of the L.C.C.

Woolwich.—The Finance Committee of the L.C.C. recommend a loan of £4,841 for electrical plant and mains.

Loughborough.—The Local Government Board have sanctioned a loan of £2,200 in connection with the electricity undertaking.

Reigate.—A Local Government Board inquiry was held on Tuesday concerning an application for sanction to borrow £8,400 for the electricity undertaking. The scheme includes the installation of Diesel engines.

Sweden.—The *Board of Trade Journal* states that the Danvik Hospital authorities require an electric power plant. Tenders will be received at the "Kungl Direktionen for Danviks Hospital," Stockholm, up to August 15th.

Stoke-on-Trent.—A new high-tension feeder, at an estimated cost of £425, is to be laid to Howard Place.

Warrington.—The Electricity and Tramways Committee invite tenders by August 9th for a motor-driven induced draught fan.

West Ham.—Tenders are invited for water-tube boilers, coal handling and discharging plant, a 5,000-kw. turbo-alternator and condensing plant, river service pipe-work, 750-kw. converter, and centrifugal pumps. (See an advertisement on another page.)

Worthing.—A Local Government Board inquiry was held last week concerning a loan of £4,950 for new plant and mains. Diesel engines are to be installed.

WIRING

Aberdeen.—Tenders are invited by August 14th for electric lighting on the property of the City District and Lunacy Board.

Birmingham.—New tramway depôt in Whitmore Street for the Corporation.

Dublin.—Additions to Richmond Hospital. Architect, C. H. Ashworth, 12 & 13 William Street, Dublin.

Glasgow.—Alterations to premises of Scotch Automobile Club.—Block of buildings at north-east corner of Gallowgate.—Shops and hall at corner of Pollokshaws Road.

London.—New town hall for the Hampstead Council.

Newport.—Additions to infirmary buildings.

Radcliffe.—Extension to County Hospital. Builders, Wooldridge & Simpson, Oxford.

Swansea.—Additions to hospital.—Eighteen houses in Pantygwydr Road. J. B. Jenkins.—Additions to Salem Chapel, Neath Road.

Walsall.—Catholic School in Glebe Street.

York.—The Board of Guardians are seeking information as to the cost of electric lighting at the workhouse.

MISCELLANEOUS

South Africa.—In his report for 1910 the Postmaster-General of South Rhodesia recommends the installation of two new copper telegraph wires from Salisbury to Bulawayo, and thence to the border of the Cape Province, at an estimated cost of £20,000. He also recommends the introduction of the metallic circuit system at Bulawayo.

Sweden.—The *Board of Trade Journal* states that the Danvik Hospital authorities require a telephone system, and also an electric lift. Tenders to "Kungl, Direktionen for Danviks Hospital," Stockholm.



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TENDERS RECEIVED AND ACCEPTED

Belfast.—The tender of the Rees Roturbo Manufacturing Co., Ltd., has been accepted for a circulating water-pump, and that of the Worthington Pump Co. for a motor-driven air-pump.

Burnley.—The contract for the electrical lighting at Victoria Hospital Extension has been secured by Mr. R. B. Beattie, electrician, of St. James' Street, Burnley.

Copenhagen.—Messrs. W. Geipel & Co. have secured a contract for 68 Geipel steam traps for the new Copenhagen hospital.

Derby.—The following tenders have been accepted:—Cables, Messrs. W. Rickard, £914; transformers, British Electric Transformer Co., £696 10s.; sub-station switchgear, Messrs. Reyrolle, £342.

London: *L.C.C.*—The following tenders have been received for the electric lighting of the North Kensington Fire Station:—E. Lawrence & Son, £157; G. Weston & Sons, £160; Malcolm & Allan, £168 10s.; E. Newbold & Co., £194; Tredegar & Co., £221. The first-named is recommended for acceptance.

Six electrically-driven motor escape vans are to be supplied by the Cedes Electric Traction, Ltd., at £5,291 18s.

The tender of Messrs. John Mowlem & Co. for the tramway and paving works in connection with the reconstruction of the track from Finsbury Park to Manor House, and from Green Lanes to Southgate Road, for the conduit system, at £71,993 is recommended for acceptance.

Luton.—The tender of the Hudson Economiser Co., Ltd., at £637 10s., has been accepted for a cooling tower of 125,000 lbs. per hour capacity, and that of Messrs. Hayward Tyler & Co., at £120, for a motor-driven feed pump.

Stoke-on-Trent.—The Electricity Committee recommend the acceptance of the Stirling Boiler Co.'s tender for three boilers at £5,040.

Mexborough.—The following tenders have been accepted:—Arc lamps, British Westinghouse Co.; brackets, Reason Manufacturing Co.; switch panels, Dorman & Smith.

York.—The tender of Messrs. Callender's Cable Construction Co. at £2,640 has been accepted for the supply of cables in connection with the supply of electricity to Messrs. Rowntree's works.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 10s. (last week, £58 15s. to £59 5s.).

The General Electric Co.—This company's Dublin branch has removed to more commodious premises at 13 Trinity street, the new telephone number being 3300 Dublin.

Plant for Sale.—The Mount Kenneth Ironworks, Dock Road, Limerick, are for sale. (See an advertisement on another page.)

Holidays.—Siemens Brothers Dynamo Works, Ltd. (Incandescent Lamp and Fittings Department), inform us that their Dalston offices and stores will be closed from August 7th to August 12th, but a small staff will be in attendance to deal with urgent matters.

Armorduct Outing.—The sixth annual outing of the head office staff, branch managers and agents of the Armorduct Manufacturing Co., took place on Saturday. A party of over fifty journeyed by river to Staines, and had a very enjoyable time.

Bankruptcies.—The discharge of G. M. Sellick, manufacturer of electrical accessories, 464 Romford Road, Forest Gate, E., has been suspended for two years as from June, 1913.

The last day for receiving proofs in the bankruptcy of J. D. Carlmark, electrical engineer, 402 High Street, West Bromwich, is August 12th. The trustee is A. S. Cully, 191 Corporation Street, Birmingham.

APPOINTMENTS AND PERSONAL NOTES

An Assistant to the Wireless Telegraph Expert on H.M.S. *Vernon*, Portsmouth, is required. (See an advertisement on another page.)

The Bournemouth Corporation require a chief assistant and electrical engineer in the Tramways Department, at a salary of £300, rising to £400, per annum.

The salary of Mr. W. H. Cooke, chief electrical engineer to the Luton Corporation, is to be increased from £400 to £450 per annum, and that of Mr. H. A. Kell, his chief assistant, from £140 to £165 per annum.

Mr. P. A. Spalding, of Galway, has been appointed Resident Electrical Engineer by the Dundalk Urban District Council.

The salary of Mr. G. Dearle, Assistant Mains Superintendent at the Derby Electricity Works, is to be increased from £120 to 130 per annum.

A switchboard attendant is required for the Kilmarnock Council's lighting and traction station. (See an advertisement on another page.)

Dr. M. Kloss, who is well known as one of Messrs. Siemens Brothers Dynamo Works chief designers, has been appointed Professor of Electrical Engineering at the Technical University, Berlin—Charlottenburg.

Mr. I. Bulfin, at present Chief Assistant and Electrical Engineer in the Bournemouth Tramways Department, has been appointed General Manager of the tramways, in succession to Mr. C. W. Hill, at a salary of £500, rising to £700, per annum.

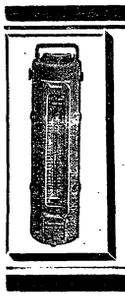
A Chief Assistant Electrical Engineer is required at the Batley Electricity Works. Salary, £130 per annum. Applications to Town Clerk by August 9th.

Parliamentary Intelligence.—The Metropolitan Electric Tramways Bill and the Belfast Bill were read a third time, and passed in the House of Lords on Thursday.

The East Kent Electric Power Bill was read a second time in the House of Commons on Monday.

Electricity in Textile Mills.—We understand that the Institution of Electrical Engineers and the Textile Institute have appointed a joint committee, consisting of twenty-eight members drawn in equal numbers from either institution, to consider the application of electricity in textile mills. Mr. T. Roberts, of Darwen, has been appointed chairman, and Mr. S. L. Pearce, City Electrical Engineer, Manchester, vice-chairman. The following is the full list of members of the committee:—Representatives of Institution of Electrical Engineers: J. F. C. Snell (Messrs. Preece, Cardew & Snell); R. K. Morcom (Messrs. Bellis and Morcom); C. D. Taite (Lancashire Electric Power Co.); S. J. Watson (Borough Electrical Engineer, Bury); H. Wilson (Messrs. Miller, Wilson, & Pegg); Professor Schwartz (Manchester); S. L. Pearce (City Electrical Engineer, Manchester); J. S. Peck (British Westinghouse Co.); H. Dickenson (City Electrical Engineer, Leeds); A. B. Mountain (Borough Electrical Engineer, Huddersfield); W. B. Woodhouse (Yorkshire Electric Power Co., Thornhill, Dewsbury); W. M. Rogerson (Borough Electrical Engineer, Halifax); Dr. Pohl (Phœnix Dynamo Co.); and J. Schofield (Borough Electrical Engineer, Shipley). Representatives of Textile Institute: Messrs. J. R. Denison (Messrs. Denison, Preusner, & Co.), Bradford; B. Palin Dobson (Messrs. Dobson & Barlow), Bolton; E. P. Fry, Shipley, Yorkshire; Oscar Hall (Messrs. Robert Hall & Sons), Bury; Frederick Leeves (Messrs. Platt Bros. & Co.), Oldham; Frederick Lye (Messrs. John Bright & Bros.), Rochdale; F. Nasmith (Messrs. Nasmith & Barraclough), Manchester; W. J. Orr (Messrs. Orr & Sons), Castleton; Thomas Roberts (Messrs. Whipp Brothers & Co.), Darwen; Fletcher Robinson, Manchester; George B. Storie, Rochdale; F. W. Whittaker (Messrs. Whittaker & Pendlebury), Bradford; and T. Rowland Wollaston, Manchester. In addition to taking evidence, the committee will carry out experiments, the results of which will be embodied in their final report.

Fatal Accident.—An inquest was held into the death of H. R. Fisher from shock at Rugby on Tuesday last. The deceased was employed in the Testing Department of the British Thomson-Houston Co.'s works, and was engaged in preparing for testing a motor-generator. Only a preliminary test was to be made, which would not require the use of the bus-bars. It was also understood that connections were to be made as far as possible for the load test, which would require 2,100 volts, and the same connections were to be used as had been used for a turbo-generator test. It was known that the turbo-generator was to be again temporarily connected, and before giving instructions to connect up the cables ready for the load test, it was ascertained that the bus-bars were dead. It appears, though it is unknown how it happened, that the bus-bars were alive when the machine was switched in, and the deceased, who was underneath, got the full pressure, and was killed instantly. The jury returned a verdict of accidental death.


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ELECTRICAL ENGINEERING

No. 241 [Vol. VII., No. 32] THURSDAY, AUGUST 10, 1911. [Price One Penny.
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ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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SUMMARY

An article criticising the general inactivity of the Electrical Contractors' Association in all matters except the opposition to municipal wiring appears on page 444.

Our monthly article on New Electrical Supplies and Accessories contains the description of a complete line of knife switches; some new weather-proof lanterns and screens for interior fitting are described, and illustrated particulars are given of a new re-fillable cartridge fuse; other novelties dealt with include motor-starters and a form of fan which can be fixed in chimney shafts and large pipes. (Page 445.)

We give some details of two reliable types of time switches. (Page 446.)

Several books relating to electrical engineering and allied subjects are reviewed on page 447.

Many interesting details are to be found in the scheme adopted for the erection of the overhead equipment of the Dessau-Bitterfeld section of the Prussian State Railway system. (Page 448.)

The French Government are establishing three wireless stations for the purpose of giving distinctive signals by which ships can identify their position in case of fog.—The Hull Municipal telephone system has given a profit of £1,168. (Page 449.)

The electric lighting and traction scheme at Llanelly has recently been inaugurated; some details of the undertaking are given on page 449.

A Board of Trade inquiry was held last week into the circumstances attending a fatal explosion caused by water-hammer at the Bow Road works of the Charing Cross, West End, & City Electricity Supply Corporation on October 31st. (Page 449.)

Among the specifications published by the Patent Office on Thursday last was one by F. Holden, relating to electric clocks, and another by M. Kallmann describes an electric safety fuse. J. C. Anderson has protected a method of manufacturing sparking plugs. The attachment of commutators is dealt with by Vickers, Sons and Maxim, and A. D. Williamson. A patent has been granted in spite of opposition to P. Marino, in connection with separators for primary batteries. The desired amendments to two patents by Brown, Boveri & Co., Ltd., describing textile machinery, have been allowed. (Page 450.)

An interesting Paper on Rack-Railway Locomotives, including particulars of those worked electrically, was read at the Zurich meeting of the Institution of Mechanical Engineers.—The reports of the various railways in this country upon which electric traction is used show a general improvement in traffic receipts.—Considerable success has attended the opening of the newly electrified lines of the London, Brighton & South Coast Railway. (Page 451.)

Profits on the year's work are reported at St. Pancras (£12,203); Halifax (£4,366); Hull (£8,347);

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Ilford (£1,400). The Marylebone Council has decided that wiring of installations under the three years' hire system shall be sublet to contractors. A reduction in the price of supply for lighting has been made at Llandudno. (Page 452.)

Application is to be made to the Local Government Board for loans at Bacup (£1,250), Southwark (£4,456), and Wednesbury (£238). Inquiries have been held into applications at Birmingham (£934), Wimbledon (£7,459), and Worthing (£4,950). Loans have been sanctioned at Burnley (£8,552), and Wrexham. A rotary converter and switchgear is required at Wolverhampton. (Page 453.)

Dissatisfaction is being expressed by the shareholders of the Welsbach Light Co., and an inquiry is asked for. The report of the Yorkshire Electric Power Co. records a steady growth in the receipts. (Page 454.)

THE ELECTRICAL CONTRACTORS' ASSOCIATION

ALTHOUGH seventy new members have joined the Electrical Contractors' Association during the past year, it appears that the membership of this body does not yet exceed 400, and this can only represent a small fraction of the total number of men engaged in electric light and power wiring all over the country. This is not because the Association is too "exclusive"; in fact, it errs rather in the opposite direction, and admits any electrical contractor, so that membership is not necessarily a mark of high status. The reason of the comparatively small membership, we are convinced, is that the whole aims and objects of the Association are subordinated to, and overshadowed by "the great struggle," to use the words of the Association's own journal, *The Electrical Contractor*. Those who are not taking a direct personal interest in the controversy with regard to municipal wiring have very little inducement to join, yet the number of installations wired by firms who are not members of the Association must be a hundred times as great as the number wired by municipal workmen.

The remedy for this state of affairs is obvious. The Association must make up its mind to pursue a more general policy; it must hold regular meetings at which matters relating to the practice of electric wiring should be discussed, and not merely questions of business, organisation, and opposition to municipal trading. Consulting engineers who specialise in wiring work, and also manufacturers of supplies and accessories, should be invited to take part in the discussions, and the technical press should be encouraged to report the meetings, instead of being excluded from them. In spite of the seventy new members, it is not inconceivable that the roll of the Association has not greatly increased when resignations and the natural falling out of members who are too indifferent either to resign or to pay their subscriptions, are taken account of, and if more life is not infused into the Association it is bound to die a natural death. As it is, we doubt whether the Institution of Electrical Engineers and the Engineering Standards Committee would continue to place delegates of the Association on some of their committees if they knew that for many years past there has been no general meeting of members of the Association to discuss technical matters.

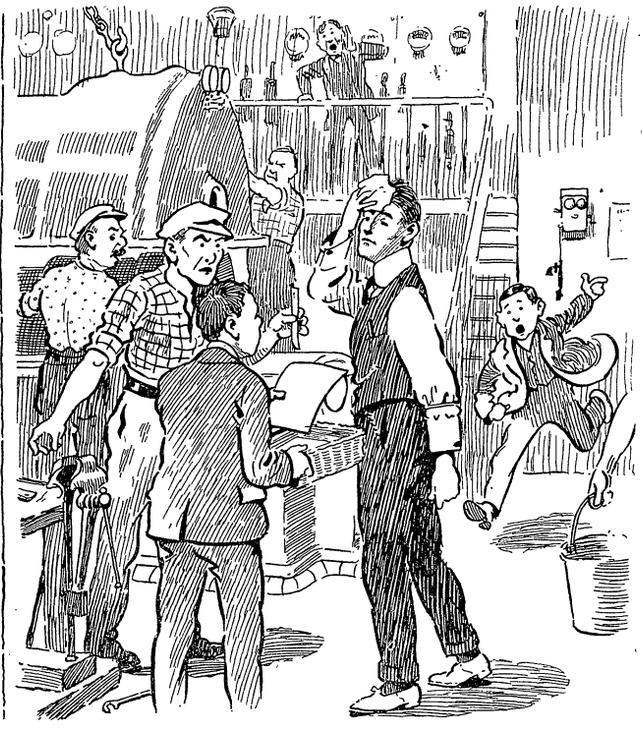
The Electrical Contractors' Association is capable of doing useful work, and we trust that a change of policy may be inaugurated which will make it really representative of the branch of the industry whose name it bears.

Parliamentary Intelligence.—The London County Council (Tramways and Improvements) Bill was read a third time, and passed, in the House of Lords, on Wednesday last week.

Obituary.—We regret to report that Mr. C. W. Pearson, of Messrs. Pearson Bros., electrical engineers, Nottingham, who had been suffering from overwork, threw himself from a train last Monday and died of his injuries.



The Chief.



The Chief Assistant.

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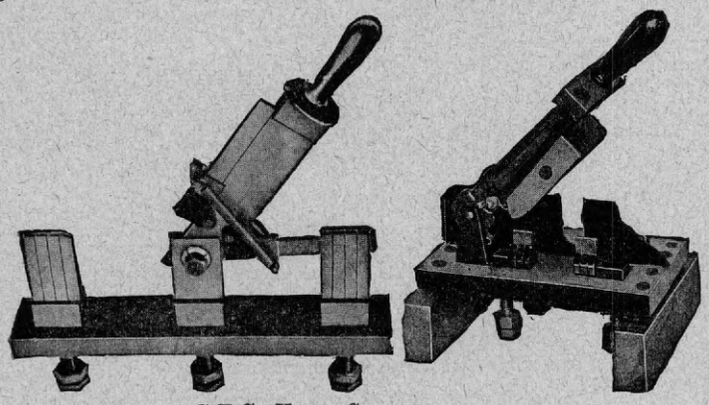
NEW ELECTRICAL SUPPLIES AND ACCESSORIES

Switches, Fittings and Accessories.

The General Electric Co., Ltd., has recently put on the market a complete line of chopper-type switches, which are manufactured at the Witton Works. These are made and stocked in thirteen sizes from 30 to 3,000 amps., and can be be made up to a 10,000 amps. capacity at short notice.

The same general design has been carried through the whole range, and the appearance of the switches of different capacities is therefore quite similar.

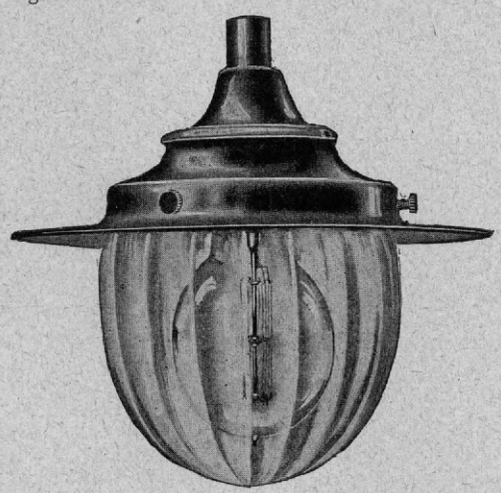
The current density exceeds nowhere 1,000 amps. per sq. in. sectional area for high-conductivity copper, and 60 amps. per sq. inch surface area in the contact clips. They are amply rated with regard to surface density, and therefore keep particularly cool on heavy overloads. The general design can be seen from the illustrations. The



G.E.C. Knife Switches.

flipper blades, which cause the quick break, are fitted with a steel stamping where they are hinged, and the main blade is bushed with a steel bush for the hinge pin, making the actual wearing parts very strong. At the handle end, the main blades are provided with solid square steel blocks, in which the handle is screwed. To hold the blade in the "off" position in change-over switches, or where there should be no room to swing the switch right over, shaped steel springs are provided, which are fixed to the side of the hinge contact and act on the rounded end of the flipper blade pivot pin. The switches are stocked "single," "double," and "triple" pole for front and back connections. A larger number of poles can be made up on short notice. The switches are jig made, and all parts are interchangeable. The finish is copper and black.

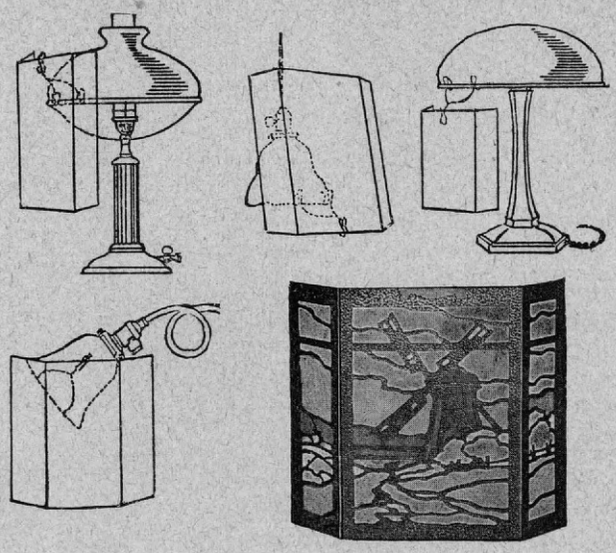
Siemens Brothers Dynamo Works, Ltd. (Incandescent Lamps and Fittings Department, Tyssen Street, Dalston), have brought out several new weather-proof fittings for using



"Bradford" Lantern for 1,200 watt Lamp.
(Siemens Bros. Dynamo Works.)

"Onewatt" lamps to the best advantage for exterior lighting. We illustrate here their "Bradford" design of zinc lantern, complete with special fluted clear globe and white enamelled reflector, suitable for one 200-watt lamp. Other lanterns suitable either for one 200-watt lamp or a group of four 55-watt lamps are also supplied.

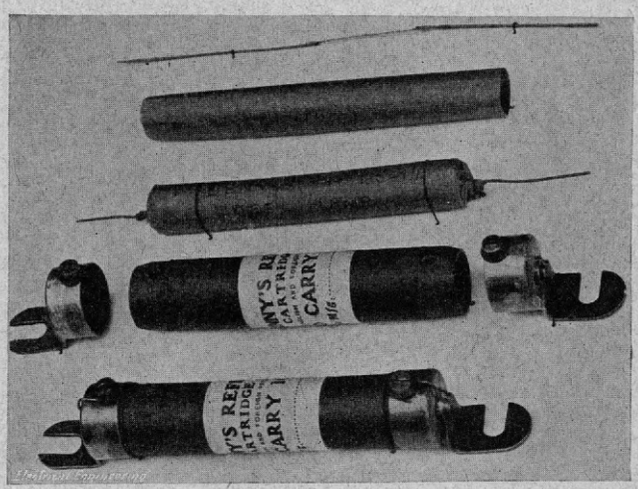
Simplex Conduits, Ltd., have issued a new list of their well-known "Spookie" shades, for which they are now sole selling agents in Great Britain, Europe, the British Empire, and the



"Spookie" Screens.
(Simplex Conduits, Ltd.)

Argentine. Several new designs of candle, pendant, table-lamp and other shades are included, as well as a novelty in the shape of "Spookie" screens, which may be clipped on to any standard pendant or bracket in the manner shown in the accompanying illustration.

A novel form of refillable cartridge fuse has recently been devised by Mr. C. W. Denny (39 Oakley Crescent, Chelsea), which we are able to illustrate. The unique feature about this fuse being that the refills, which are made up in paper or asbestos tubes, are accurately calibrated and packed, making the operation of refilling as simple as possible, and also main-



Denny Refillable Cartridge Fuse.

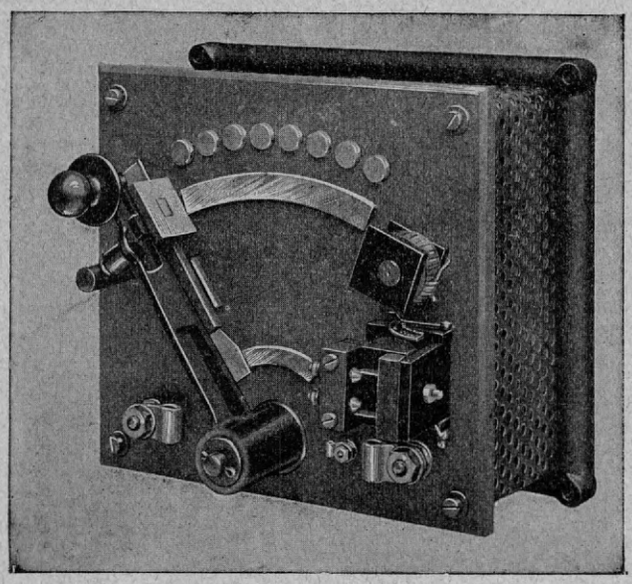
taining the maximum degree of accuracy. Refills for various capacities and voltages can be supplied, neatly packed in cardboard boxes, for a very small cost. The refills, which are practically paper cartridge fuses, are an easy fit into the outer fuse-case proper, and can also be made to fit porcelain-handle type fuses.

A new "preliminary" list of electric light fittings from Simplex Conduits, Ltd., contains illustrations of designs in the Adam, Georgian, Dutch, and Modern styles, as well as some specially designed for Holophane glassware. This list is to be followed by a further and much more comprehensive catalogue in a few weeks' time.

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Miscellaneous.

We illustrate here one of the latest patterns of open-type lever-pattern motor starters of Messrs. A. Reyrolle & Co., Ltd., fitted with no-voltage and overload resistances, which, together with others of the protected type, are dealt with

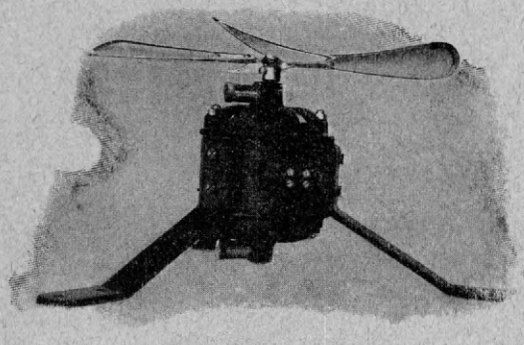


Lever Pattern Open Type Starter, with "Current Growing" Resistance.

(A. Reyrolle & Co.)

in a new pamphlet just issued, which gives a remarkably large range of sizes. These starters are provided with the firm's patent "current-growing" resistance, which in effect acts as an electricity valve, and, owing to improved manufacturing facilities, considerable reductions in price are noticeable.

The accompanying illustration shows the Simplex shaft fan. It is fitted with three substantial cast legs to enable it to be fixed in chimney shafts and large pipes. No speed regulation is provided, but a rheostat can be used if desired. Full particulars of other fans and small motors made by Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.), include the desk type with swivel and trunnion movements



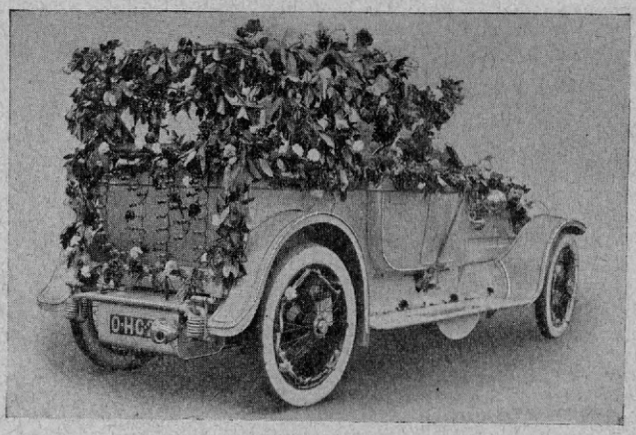
Simplex Shaft Fan.

and three-speed regulation controlled by handle in base, and a type for ship work of the fixed and trunnion pattern. These two types are fitted with brass blades and guards, but the porthole fan has flat blades. Automatic shutters, made with aluminium vanes to open automatically or by hand, are supplied for use with the porthole fan. They can all be driven by D.C. series-wound or single-phase commutator motors, or by motors of the single and three-phase induction types.

Electric Companies.—According to an article on company registrations in 1911 in the *Investors' Guardian and Joint Stock Companies' Review*, the total capital of companies connected with the electrical industry registered in the first half of this year amounted to only £509,145, as compared with £2,016,320 and £1,522,507 for the first halves of 1909 and 1910 respectively.

OSRAM LAMPS FOR CAR DECORATION

THE accompanying illustration, which has been sent us by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), represents a Daimler car belonging to Mr. G. F. Heath, of Birmingham, which has attracted considerable interest in the Midlands on account of its elaborate scheme of decorative illumination, the entire effect being produced



by means of 400 Osram lamps. A number of Osrams were affixed to the wheels of the car, and, revolving with them, greatly added to the effect. Such a test speaks well for the strength of the Osram filament, and if they will stand the jolts and jars to which the wheels are subjected on rough roads, they are certainly qualified to stand the wear and tear of ordinary everyday use.

TIME SWITCHES

MESSRS. W. GEIPEL & CO. (Vulcan Works, 72A St. Thomas Street, London, S.E.) have recently developed new designs in this kind of switch. Of the two types made, the "Arbiter" type is arranged for switching on by hand and switching off automatically.

These are made in two sizes, the larger size containing an oil-immersed contact quick break switch with sparking tips, operating handle, and a 35-day clock; whilst the smaller size has a quick break knife switch and a 16-day clock.

The adjustable timing system consists of a rotating dial engraved with the hours, six to six, on either half, and a number of movable discs arranged behind the dial can be set to the restricted period of time required. A roller lever rests on the periphery of the discs, which are provided with projections, so that when the time for switching off arrives the roller is lifted on to the higher periphery, and the circuit is automatically broken. No current can then be obtained until the lever is allowed to fall on to the lower periphery.

The "Opus" type is arranged to switch on as well as off automatically and the timing mechanism is similar to the "Arbiter" type, except that the discs have triangular projections with only one periphery. The small size of this type has a quick make and break knife switch and a 16-day clock, and is arranged to operate two or more circuits as additional functions. The dial system of this size consists of an outer stationary disc divided into minutes, and an inner revolving disc divided into hours, which rotates once every twenty-four hours. Four adjustable pointers are placed over the revolving disc for setting the times of switching "on" and "off." These switches have proved very reliable in every-day use, and we understand that the Manchester Corporation have a large number in use, their last repeat order being for 30 of the "Arbiter" type.

Electric Irons.—We have received from the Armorduct Manufacturing Co., Ltd. (Farringdon Avenue, E.C.), a leaflet dealing with "Armorduct-Therma" electric irons. These are made in several varieties, including heavy tailoring irons, heavy laundry irons, domestic and light laundry irons, with consumptions from 275 to 600 watts, and varying from 4 to 21 lbs. in weight. A useful 4 lb. domestic 275 watt iron can be obtained as cheap as 12s. 6d. complete. In order to demonstrate the durability of the apparatus, samples were sent to various supply engineers, who have reported on the tests they have made. In one case, an iron was kept for one month in circuit continuously without detriment, and other tests were carried out with equal success over continuous periods of 1,000 hours, 5,000 hours, and five weeks.

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REVIEWS OF BOOKS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

The Ventilation of Electrical Machinery. By W. H. F. Murdoch. 79 pp. 7¼ ins. by 4⅝ ins. 30 figures. (London: Whittaker & Co.) Price 3s. net; abroad, 3s. 2d.

More is known by the average designer of electrical machinery of the data for calculating the losses which will take place in a particular machine than about the capability of the machine to get rid of the heat due to these losses, whereas the latter is really the governing feature in determining the size and cost of the machine. The matter is of growing importance with the high speeds and large outputs now called for, and the author is sanguine enough to look forward to the time when by application of artificial local cooling, the cost of large generators may be reduced to one-half or even to one-third of the present cost per kilowatt. The effect of increasing the output above the normal on the efficiency of a generator, and the effect of speed on temperature, is first discussed, and it is shown that continuous overloads are not as disastrous to the efficiency as is generally supposed. The general laws of heating and cooling are introduced with admirable clearness, and the ventilating action of an armature receives as excellent treatment. Data are worked out as to the cooling effect of fans and oil and water circulation; and various methods of cooling in use are described. The author uses a fair amount of mathematics throughout to deduce his quantitative data, but not more than should be at the fingers' ends of the designer, to whom the book will be welcome.

The Elements of Telephony. By A. Crotch. 90 pp. 7½ in. by 4⅝ in. 51 figures. (London: E. & F. N. Spon.) 1s. 6d. net; by post, 1s. 7½d.

In the ninety pages of this book the reader is given a good general idea of the working of a telephone and telephone exchange, and of the functions of the auxiliary apparatus. The descriptive and explanatory matter is, however, not entirely free from those defects which are almost inseparable from a book dedicated both to the layman and to "those who have some slight acquaintance with the subject."

Mathematics for the Practical Man. By G. Howe. 143 pp. 7½ in. by 5¼ in. 42 figures. (London: Constable & Co.) 5s. net; abroad, 5s. 3½d.

We have here a preparatory course in mathematics, such as it is necessary for the student to grasp thoroughly before he can take up any further studies in the principles of engineering. As mentioned in the preface, it starts at the beginning of the subject, assuming no knowledge beyond that of arithmetic. The feature of the book is that it is a master in itself; the author has attempted to explain the various steps and stages in very simple fashion, and in as short a way as possible. The first nine chapters deal with the fundamentals of algebra, and take the student up to quadratic equations and variation, but this last chapter is rather brief. More important still is the chapter on trigonometry, which, though short, is sufficient at any rate to stimulate interest. In the description of logarithms, we note that in the case of the negative characteristic, the minus sign is put before the whole expression, as log. $0{\cdot}00386 = -3{\cdot}586587$, instead of over the figure, thus, $\bar{3}{\cdot}586587$. The use of logarithms in solving difficult expressions is well brought home to the student. The final chapters deal briefly with the elementary principles of co-ordinate geometry and the calculus. The usual tables of logs. and natural sines, cosines, and tangents appear at the end of the book, but we find no answers to encourage the student to work out for himself the many problems set in the different chapters.

Electricity in Locomotion. By A. G. Whyte. 143 pp. 6½ by 4⅛ in. 18 figures. (Cambridge: University Press.) 1s. net., by post 1s. 2d.

This is one of series of manuals on various subjects connected with science and literature addressed to the general reader, and therefore not highly technical. Mr. Whyte gives a good idea of the general position of electricity in traction matters, and is particularly clear in his exposition of the effects of the Tramways Act of 1870, and other considerations of a non-engineering nature, which proved such a serious handicap to the tramway undertakings of the country, such as the high cost of obtaining powers, the exorbitant demands of local authorities, and the reckless cutting of fares which has taken place. He looks to the trolley omnibus to infuse some new life into electric traction on roads, and gives a few suggestive notes on electric automobiles, petrol-electric vehicles, and electrical marine propulsion, as well as main and suburban railway problems. The whole is easy reading, but we do not like accelerations expressed in "inches per second per second," nor is the description of the position of the gyroscopes in the Brennan monorail car quite correct.

The Compulsory Working of Letters Patent. By F. W. Beney. 15 pp. 8½ in. by 5½ in. (London: W. Clowes & Sons.) 3d.; by post, 3½d.

This little pamphlet is a repetition of the author's views upon the compulsory working clauses of the Patents Act of 1907, which were published in the *Empire Review*, in January last. It is written in a strongly "Imperialistic" tone. The author deprecates the policy of revoking patents for non-working, in connection with which he quotes the support of the Patent Agents' Institute and other bodies expert in patent matters, and urges the retention only of the portion of the Act relating to compulsory licences. He would, however, attach no working conditions to any patent granted to an Imperial citizen, but would apply the principle of compulsory licences to foreign patentees residing in a State that is willing to grant us a reciprocal advantage.

Steam Turbines. By J. W. Roe. 143 pp. 9¼ in. by 6¼ in. 77 figures. (New York: McGraw-Hill Book Co.) 8s. 6d. net; abroad, 8s. 11d.

The author of this book on the steam turbine steers a middle course between elaborate treatises for the skilled designer and so-called practical handbooks for those in charge of turbines, and sets out with the two-fold purpose of providing, first, a text-book suited to a short course on steam turbines in engineering schools and colleges, and secondly a book for the engineer on the principles and the general design of turbines, without going into refined treatment of the more difficult problems entering into their design. A nice balance is maintained between theory and practice, and the utility of the book is enhanced by frequent references to larger works and the collection of problems at the end of each section.

Hydro-Electric Practice. By H. A. E. C. von Schon. 383 pp. 9¾ in. by 7½ in. 140 figures. Second edition. (London: J. B. Lippincott Co.) 25s. net; abroad 26s. 2d.

The revision which this edition has undergone relates chiefly to the hydraulic part of the book, which, as we pointed out in a review of the first edition (Electrical Engineering, Vol. V., page 535, June 16th, 1909) constitutes the major, and also the best-written, portion of the book. That the book has been appreciated at any rate in America is shown by its having reached a second edition so soon, but, as we said in our original review, while we might recommend the book to the electrical engineer wishing to widen his knowledge of hydraulic matters, we would not put it in the hands of a hydraulic engineer wishing to become acquainted with the principles of electrical engineering.

Whittaker's Arithmetic of Electrical Engineering. 166 pp. 7¼ in. by 5 in. 11 figures. Second edition. (London: Whittaker & Co.) 1s. net; abroad, 1s. 2½d.

This little book is intended to aid the student who wishes to apply his theoretical knowledge to practical problems. In each chapter, formulæ are deduced representing the various laws, and problems, based on these, are fully worked out. There are 300 examples supplied for the student to work out for himself, and these include a good selection taken from the City and Guilds of London Institute examinations, besides a large number taken from the Board of Education examinations. Answers to all the questions are given at the end of the book.

Practical Dynamo and Motor Management. 48 pp. 7¼ in. by 6½ in. 21 figures. (London: S. Rentell & Co.) 6d. net; abroad 7d.

A number of useful and really practical hints on the management of dynamos and motors, as well as the diagnosis and remedy of faults, are given in this convenient sixpennyworth. Both continuous- and alternating-current machines are dealt with. A considerable amount of space is devoted to commutators, but, in the treatment recommended, insufficient distinction is drawn between turning and grinding of commutators.

NEW PUBLICATIONS

"The Design of Static Transformers. By H. M. Hobart. 174 pp. 8¾ in. by 5¾ in. 101 figures. (London: Constable & Co.) 6s. net; abroad, 6s. 5d.

"Shop Management." By F. W. Taylor. 207 pp. 8¾ by 5¾ ins. Four figures. (London: Harper and Bros.) 5s. net; abroad, 5s. 6d.

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OVERHEAD EQUIPMENT ON THE PRUSSIAN STATE RAILWAYS

In Electrical Engineering of July 20th, 1911, page 414, the electric locomotives for the Dessau-Bitterfeld section of the Prussian State railway system were described, and we now give particulars of the overhead equipment for the same line, which was carried out by the Allgemeine-Elektricitäts Ges. The live wire is suspended on the catenary system from a galvanised steel rope of 42 sq. mm. section, and containing seven separate wires. These are supported from iron girders, which are U-shape for ordinary spans, but are held by tie-rods or made with struts for longer spans. The whole system is divided into sections of one kilometre each, and in the centre of each the line is rigidly fixed, whilst at the ends it is stretched by automatic tightening devices. This arrangement is one of the features of the installation, and produces a uniform tension throughout. In addition to the rope cable and the live wire, it consists of a span wire connected at each point of suspension of the steel rope, and is arranged to expand in opposition to the latter, so that all sag due to expansion is taken up. The construction is as follows:—The two ends of the two tightening sections are led a short distance past one another, and connected to weights. The tension due to these is evenly divided between the three wires and kept constant by connecting their ends to a lever with unequal arms. The lever carries a pulley, over which a cord passes for holding the weights, and a loose pulley is also provided, so that a quadruple ratio is obtained, and the necessary tension produced with a minimum weight. The weights are of cast-iron, and run in guides mounted below the mast. At the girders the steel rope lies loosely on a double cone-shaped insulator, and passes underneath in a loop, and is held 2½ in. from the girder by a special stranded wire support. The span wire is also looped in this way, and is connected to the rope cable by clamps placed at the end of the wire support, and two disc insulators are also fixed on each side of the clamps. The live wire is fixed at the sides by stays of steel tubing, on which contact-wire clamps are mounted, so that it can slide and hold the live wire fast. At the other end the tubing is fixed to the mast by a joint, and can turn in a vertical direction. At this point the whole system is double insulated from earth by connecting a bell and a grooved insulator in series. In order to ensure uniform wear of the bow collectors, the live wire is erected zigzag, thus allowing each point of suspension to deviate about 1 ft. 8 in. from the centre of the track, and in order to allow the wire to rise slightly, under pressure from the bow, without bending the suspension wires. The latter are provided underneath with a loop, which permits a vertical movement of the wire of about 2 in. The suspension wires are of galvanised steel wire of 3 mm. diameter, and the contact-wire clamps of pressed brass. They grip the grooves in the live wire with two jaws, and are fixed to the suspension wire by a slotted holder. The track sections are divided, so that parts can be switched out without cutting off the whole line. At these section divisions horn switches are mounted on the masts, to which two contact wires are connected. These are operated by a winch at the foot of the mast; they have double insulation, and, when required, are opened to cut the sections behind them out of circuit. The two main lines are separated from each other electrically, but a switch is provided in each section, which, in case of breakdown, is closed, and connects all the sections behind with the other line. Another feature of the system consists of the safety arrangements provided on the loading track. The contact lines are specially isolated and earthed under ordinary working conditions, and can only be switched in after warning signals have been given. These signals, supplied with current from a small auxiliary transformer, are automatically operated from the contact live switch, which is actuated by a crank mechanism, with two contact devices connected to a bell and a lamp circuit. For the first thirty seconds after operating the crank the switch does not work, but the bell rings and the lamps light up, and remain alight as long as the loading track is under pressure.

The equipment of the locomotive shed at Bitterfeld is also interesting, the full pressure of 10,000 volts being used inside. A switch is provided on the roof for each contact wire, which cannot be switched in before the warning signal has been given. This signal is similar to the one already described, but instead of the lamps a transparent sign is suspended over each track. When the operating device has been released, the switches spring back to the off position and earth the wires to the shed. The pressure for the shed is supplied by a novel arrangement in connection with the overhead equipment of the turn-table, which is fed from the main line. An angle iron ring is suspended directly over the centre of the turn-table, and in its inner circle a number of slots are provided, corresponding to the number of tracks in the sheds. These slots are gripped by the anchoring clamps for each line. The whole system is supplied by turbo-alternators of an output of 3,750 k.v.a., the alternator generating a single-phase current at 3,000 volts and 15 cycles. This is transformed and transmitted to sub-stations at 60,000 volts, where it is again reduced to a working pressure of 10,000 volts. We are indebted for the above particulars to the *A.E.G. Zeitung*.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ALUMINIUM.—Two leaflets from the British Aluminium Co. (109, Queen Victoria Street, London, E.C.) illustrate aluminium in its standard forms, and its use for bus-bar and switchboard connections.

CONDENSER TUBE PROTECTOR.—An apparatus, known as the Harris-Anderson condenser tube protector, for the prevention of pitting and corrosion of the tubes, is the subject of a pamphlet received from the Harris Patent Feed Water Filter (1910), Ltd. (82, Victoria Street, S.W.). This apparatus is extensively used on numerous steamships, amongst which are the Cunard Co.'s, Bibby and Son, Williamsons, Ltd.; also by the Corporations of Dundee, Dublin, Belfast, Devonport, and Partick electricity works. Large repeat orders have been received from the A.E.G., Berlin, and Bibby & Son, Liverpool.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

PULLEY-BLOCKS AND CRANES.—The Derome Standard Pulley-Block and Crane Manufacturing Co. (78, Southwark Street, London, S.E.) have issued a booklet describing and illustrating their lifting appliances, including various standard types of pulley-blocks, with or without chain drive, and overhead travelling cranes, besides electric runaways, which enable one ton to be moved about at 300 ft. per minute. We understand that any pulley-block with the required length of chain, will be sent out on approval, free of all charges, and at the firm's own risk, on the receipt of a post-card with the necessary particulars.

INDUCTION MOTORS.—A pamphlet, dealing with alternating current induction motors for three-phase and single-phase 50-cycle circuits, has been sent to us by T. W. Broadbent, Ltd. (Victoria Works, East Parade, Huddersfield). A special feature of these motors is the robustness of their construction, both electrically and mechanically. The stators are wound with "asbestin" insulated wire, and the insulating materials are such as to withstand high temperatures without injury. The rotor conductors are expanded at the ends to fit the short-circuiting rings, which are very massive, of low resistance, and offer a large cooling surface. The machines are of high frequency and power factor, and have a small percentage slip. They will work at 25 per cent. overload for one hour without injury.

University College, London.—We have received a copy of the prospectus for the forthcoming session of the Faculty of Engineering of University College (Gower Street, London, W.C.). Students can either take a degree course leading to the London B.Sc. in engineering, or a diploma course for which a certificate is given. Both courses are of three years' duration, and students desiring to commence either next session should communicate with the Provost of the College not later than September 20th. Specialisation in electrical engineering is possible in the second and third years. Special courses can be arranged for those who have received partial training elsewhere, and there are exceptional facilities for post-graduate and research work. Prof. J. D. Cormack is Professor of Mechanical Engineering, and special lectures are given in this division by Mr. A. H. Barker on heating and ventilating. The Electrical Engineering Department is under Prof. J. A. Fleming (Pender Professor of Electrical Engineering); Mr. W. C. Clinton is Assistant Professor; and lectures in electrical design are given by Mr. E. Kilburn Scott. The laboratories are very completely equipped. Municipal engineering is dealt with by Prof. Osbert Chadwick. Engineering students have also opportunities to study in other departments, such as those of geology, mathematics, physics, applied mathematics, and chemistry. A considerable number of scholarships are open to those taking engineering subjects, including an entrance scholarship of the value of 120 guineas, application forms for which must be obtained before September 5th.

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TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The French Ministry of Public Works has decided upon the establishment of three wireless stations for the express purpose of giving signals by which ships provided with directive receiving apparatus, such as the Bellini and Tosi "wireless compass" (see ELECTRICAL ENGINEERING, Vol. VI., July 28th, 1910, page 491), can ascertain their position in time of fog. The first will be at Créach d'Ouessant, where every six seconds the Morse letter O will be given out in a manner which will produce in a receiving telephone a note corresponding to 522 vibrations per second. At the second station, at l'Ile de Sein, the note will be higher, 783 per second, and the letter S will be repeated; while the third signal, from the *Le Havre* lightship, about seven miles from Cape La Hève, will employ a wave-length of 24 metres and repeat the letter H with the same note as the first mentioned.

For some time the French Government have sent out regular time-signals at 11 o'clock in the morning from the Eiffel Tower. This is now made of still more use to mariners by being followed by a series of meteorological signals, reporting the height of the barometer and the direction and force of the wind and the roughness of the sea according to a certain code at the following stations:—Reykjavik (Iceland), Valentia (Ireland), Ouessant (France), La Coruna (Spain), Horta (Azores), and St. Pierre et Miquelon (Newfoundland).

As a result of the successful experiments in direct telephony over the new Channel cable between Paris and towns as far north as Aberdeen, a list of towns is to be published shortly with which telephonic communication will be available with France.

In answer to a question in the House of Commons last week, the Postmaster-General stated that at the present time he was unable to give the cost of the two automatic telephone exchanges which are to be erected at Epsom and Caterham Valley. The chief object of the experiment was to ascertain the working expenditure.

The National Chamber of Trade have addressed a further communication to the Postmaster-General, urging the appointment of a committee of inquiry into the work and management of the telephone system of the country.

The accounts of the Hull Municipal telephone system show a surplus of £1,168 on the past year's working.

Telegraphic communication between Rome and Constantinople was restored on the 2nd inst., and on the 4th inst., the cable between Guam and Manila was in working order again. It was only reasonable to expect that the Hayti revolution should have brought interferences with land lines in its train. Communication with Jeremie, Aux Cayes, and Jacmel is down, and telegrams are being sent south to places in Hayti by mail. The El Arich route failed beyond Gaza on the 6th inst., but was repaired on the following day. Owing to pressure of work, the exchange of telegraphic correspondence with Morocco is subject to delay, and telegrams can only be accepted subject to this condition.

LLANELLY ELECTRICITY WORKS

THE inauguration of the undertaking of the Llanelly & District Electric Lighting & Traction Co., Ltd., was on July 13th, when a luncheon was given by the contractors, Messrs. Balfour, Beatty & Co., Ltd. The Lighting Order was originally granted in 1891 to the Llanelly Urban District Council, but remained in abeyance for several years. In 1908, however, it was transferred to the Company, and an agreement was entered into with the Urban Council whereby the street lighting was to be converted from gas to electricity within a period of two years. The conversion of some existing tramway lines from horse to electric traction has also been carried out by the contractors, and an additional five miles of track constructed (making in all about 6¼ miles of track) under the Llanelly & District Light Railways Order, 1907, as amended in 1910.

The light and power system adopted is direct current, 500 volts, three-wire, the majority of power consumers being across the 500, and the lighting across the 250-volt sides. The power station is situated close to the North Dock, from which the circulating water for condensation purposes is obtained. Work was commenced on it in July, 1910, and the supply was started on the first day of this year. In addition to laying cables, the contractors had to convert over 530 gas lamps to incandescent electric lamps, and to erect 40 Crompton-Blondel flame arc lamps. Each incandescent standard has one 50-c.p. metallic filament lamp, and the arc lamps, in addition to the 1,500-c.p. flame arc, are provided with two incandescent lamps for all-night lighting.

The generating plant consists of two Belliss engines, one coupled to a 300- and a 150-kw. generator by the Rees Roturbo Co., and the other to a 500- and a 150-kw. generator of the same make. One condenser, supplied by Messrs. Cole, Marchent & Morley, is placed midway between the two engines. Steam is supplied from two Babcock & Wilcox water-tube boilers, with super-heaters. The condensed water is taken through a Paterson combined feed water purifier and heater, and is delivered to the boilers by a Weir feed pump, with a Worthington pump as a standby. A 1,000-ampere-hour battery, by the Chloride Electrical Storage Co., along with an automatic Entz booster, is provided, and the switchgear is arranged so that the battery and booster can be put on either to the lighting and power or traction loads. The balancer was supplied by the Rees Roturbo Manufacturing Co., and the switchgear by the British Thomson-Houston Co., Ltd.

The cables are laid throughout on the solid system in earthenware troughs, and this portion of the work was supplied and carried out by Callenders Cable & Construction Co.

The tramways actually constructed total about 6¼ miles of route, and included the conversion of one mile of horse lines.

Work was commenced in March of this year, and the first section, consisting of some 4½ miles of track, was inspected by the Board of Trade and opened for traffic on June 16th. The remaining section (that to Pwll, about 1¾ miles) has now been constructed, and was inspected by the Board of Trade on August 1st. The track and overhead equipment do not call for special remark. Ten cars have been supplied by the British Thomson-Houston Co., with bodies being built by the United Electric Car Co., Preston. A new car-shed has been built capable of accommodating twenty cars. The whole of the lighting and traction system was designed by Messrs. Balfour, Beatty Co., Ltd., 22A College Hill, Cannon Street, London, E.C., who were also the contractors.

SERIOUS EXPLOSION AT AN ELECTRICITY WORKS DUE TO WATER HAMMER

ON Wednesday last week, a Board of Trade enquiry was held with regard to a fatal steam pipe explosion which occurred at the Bow Road Works of the Charing Cross, West End, and City Electricity Supply Company, on October 31st last year. Mr. A. A. Hudson, K.C., and Mr. J. Fullerton Bell conducted the enquiry on behalf of the Board of Trade, and it lasted until Saturday.

It appears that some alterations were being made, involved by the substitution of steam-driven for electrically-driven exciters, and two stop valves were taken into use which had previously been used at the company's Lambeth Works. Last September the valves were stripped entirely and examined by Mr. E. Coates, station superintendent, and Mr. J. W. Kingston, the works foreman, and they were found to be generally in good working order, except that it was deemed necessary to fit one of the valves with a new spindle. This was done, and the alterations in connection with steam supply to the exciters were made in October, and everything was connected up ready for steam to be admitted into the new range on October 31st. The boiler-house foreman received directions from Mr. J. W. Kingston as to what was to be done, but in carrying them out it appears that proper precautions had not been taken for the drainage of the pipes, and also that by the omission to open one of the valves, only part of the system was placed under steam, so that water hammer was produced which caused the explosion. Both the valves in question were fractured, two men—the works foreman and one other man—were killed, and three were injured. Mr. H. W. Kingston, the company's engineer-in-chief, and Mr. Ernest Coates, the station superintendent, both gave evidence at the enquiry. The Board of Trade inspectors held that sufficient consideration had not been given to the possibility of mistakes being made by the men who actually let live steam into the new range, and that the station superintendent himself ought to have been present at the time this was done.

OSRAM·LAMPS

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published August 3, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

14,126/10. **Electric Clocks.** F. Holden. An electric clock in which the pendulum or balance wheel carries a pivoted contact, which, by the motion of the pendulum, periodically engages a fixed contact and closes the electric circuit. The moving and fixed contacts are magnetised, so that when nearly touching a magnetic attraction takes place of sufficient strength to prevent a rebound. One figure.

16,258/10. **Electric Safety Fuses.** M. Kallmann. An electric safety fuse, comprising a main fuse, which normally carries most of the current, and an auxiliary fuse with a high temperature coefficient and a very high resistance. This is placed in parallel and arranged to break after the main fuse has blown. Means are also provided for protecting the auxiliary fuse when the main fuse blows.

17,010/10. **Braking Induction Motors.** E. Rosenberg and J. S. Peck. In the braking of induction motors, where the motor is disconnected from the alternating current supply and one of the windings is supplied with direct current, means are provided for a resistance, placed in circuit with the other winding, to be varied automatically by a device which operates in accordance with the motor speed as a generator, or with the frequency or voltage of the current generated by the secondary member of the motor. Six figures.

18,295/10. **Sparking Plugs.** J. C. Anderson. The manufacture of sparking plugs, in which the shell is heated and confined within a mould. A heated electrode is located in the shell, into which molten glass is poured, and finally compressed and welded to the metallic members of the plug. Four figures.

22,507/10. **Rotating Commutators.** Vickers, Sons & Maxim and A. D. Williamson. This invention relates to the attachment of commutators, and consists of a series of segmental pieces constituting a ring with a cylindrical inner face and a conical outer surface, also a collar surrounding the ring and having a conical inner surface to correspond to the outer surface of the ring, and means are provided for moving the collar axially on the ring to insert an inward pressure. Six figures.

28,588/10. **Electric Relay Apparatus.** The Westinghouse Brake Co., Ltd. A relay comprising a rectangular core of magnetisable material with two opposite pole pieces projecting inwardly. The remaining sides of the rectangle are connected by a bar passing between the pole pieces and the movable part of the relay, constituting a short-circuited coil, which moves in the space between the poles and the bar, and these are provided with windings supplied by an alternating current. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Booker, Ogilvy-Webb, and Reinecke, 9,191/10.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: Campbell and Shaw [Transmission of electric signals] 3,422/11.

Dynamos, Motors, and Transformers: Klein [A.C. and D.C. machines] 16,763/10; Sumpter [Control of reversing variable speed motor] 17,222/10; Watkins [Carbon grinding device for] 17,236/10; James [Driving variable speed machines] 17,247/10; Rogler [Motor for driving blowers, &c.] 21,235/10; Railing and Bartlett [Commutator cooling] 9,201/11.

Electric Ignition: Raggett, Maclean and Murray [Ignition systems] 20,531/10; Anderson [Sparking plugs] 29,489/10.

Electrometallurgy and Electrochemistry: Harden and Electric Furnaces & Smelters, Ltd. [Production of metals] 21,206/10; Stassano [Electric furnace] 8,901/11.

Heating and Cooking: Frosali and Visconti [Heating apparatus] 10,767/11.

Incandescent Lamps: Eisner [Manufacture of filaments for] 17,469/10; Bacci, 27,240/10.

Instruments and Meters: Arno [A.C. power measurement] 9,580/10; Stroude and Josephs [Thermo-electric temperature apparatus] 1,100/11; Weston [Measuring instruments] 5,267/11; Siemens Bros. & Co. (*Siemens and Halske Akt.-Ges.*) [Instruments, dynamometer type] 13,707/11.

Switchgear, Fuses, and Fittings: Lichtenfeld [Switch devices] 16,904/10; Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [Motor starting devices] 17,166/10; Tucker [Switches] 20,900/10.

Telephony and Telegraphy: Judd and Hardie [Telegraph relays] 17,523/10; White [Intercommunication system] 22,239/10; Perotti [Transmitting and registering verbal messages device] 24,347/10; Goldschmidt [Method for receiving electric waves in] 8,387/11.

Traction: Siemens Bros. & Co. (*Siemens and Halske Akt.-Ges.*) [Railway signalling apparatus] 5,596/11.

Miscellaneous: Bonhomme [Wireless signalling] 17,172/10; Venner [Resistance for heating apparatus] 17,684/10; Murphy [Electric oscillations and H.T. discharges] 29,802/10; Frisby [Electric current detectors] 7,569/11; Schattner [Rheostats] 7,736/11; Crook [Selective electric signalling] 8,283/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Incandescent Lamp: Schaller, 16,195/11.

Miscellaneous: Pörscke and Achenbach [Electrodes for secondary cells] 10,264/11.

Opposition to Grant of Patents

30,602/09. **Separators for Primary Batteries, &c.** P. Marino. This patent has been granted in spite of opposition. It deals with the construction of separators for primary batteries and secondary cells by a process of treating the fibrous material for use as separators.

Amendments

19,626/06. **Textile Machinery.** Brown, Boveri & Co., Ltd. The amendments to this specification referred to in Electrical Engineering, of March 23rd, 1911, page 156, have been allowed. The patent covers improvements in electrically-driven ring spinning machines.

7,612/08. **Textile Machinery.**—Brown, Boveri & Co., Ltd. The Comptroller has allowed the amendments to this patent. We gave particulars of them in Electrical Engineering, of March 23rd, 1911, page 156. The specification deals with electrically-driven ring spinning machines.

1,805/10. **Sterilisation of Liquids.** V. Henri, A. Helbronner, and Max von Recklinghausen. As a result of the extended investigation under section 8 of the Patents Act, a disclaiming note has been inserted in this specification, which relates to apparatus for sterilising liquids by means of ultra violet rays.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

18,644 of August 11th, 1897. **Wireless Telegraphy.** Oliver J. Lodge and A. Muirhead. This invention deals with systems of telegraphing by Hertzian waves, and provides means for greater certainty of action, and for increasing the distance of transmission.

18,868 of August 14th, 1897. **Linotype Machines.** W. S. Scudder. Describes the manufacture of matrix-bars having intaglio characters formed in metal, which is electrolytically deposited in recesses in the edges of the bars.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distribution Systems, &c.: M. Meirowsky [Electric insulation] 9,325/02; W. J. Davy [Electric distribution] 8,951/07; A. G. Inrig [Insulating material] 9,094/07.

Electrometallurgy, &c.: P. Hubert [Electroplating] 8,679/03; G. Gin [Reduction of ores] 8,221/05.

Incandescent Lamps: J. Davis, 8,903/07; T. Elliott [Supporter for], 9,345/07.

Instruments, &c.: G. Hookham and S. H. Holden [Motor meter], 8,984/07; B. North and R. Pohl [Electrolytic meters], 9,337/07.

Switchgear, &c.: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Controllers], 9,112/06; M. W. W. Mackie [Switches], 9,191/06; E. Schattner [Switches], 8,842/07; K. Hahn [Vapour Electric Apparatus], 8,874/07; E. T. Bumpstead and H. C. Glover [Switches], 8,913/07; F. Decker [Engine stop-gear], 9,109/07.

Telephony, &c.: J. H. Parsons [Telephone Systems], 8,881/07; Amalgamated Radio-Telegraph Co. (*H. Rosenthal*) [Wireless Telegraphy], 9,028/07 and 9,051/07.

Miscellaneous: British Thomson-Houston Co. and F. Holden [Coin freed apparatus], 9,135/02; T. Twynam [Utilising slag], 9,073/07; M. Möller [Electric clocks], 9,240/07; H. C. L. Holden and G. K. B. Elphingstone [Electric lighting systems], 9,294/07; A. Coates and H. W. Hacket [Governor valve operation], 9,338/07; F. Diehl and A. F. Becker [Electric fans], 23,756/07.

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ELECTRIC TRACTION NOTES

As the result of a conference, the Leeds tramway strike was settled late on Thursday last, and traffic was resumed on Friday. The men's working hours have been reduced from 60 to 54 per week, and a compromise has been arrived at with regard to spread-over terms, &c.

At the meeting of the London, Brighton & South Coast Railway last Wednesday, reference was made to the increasing success of the electrified lines, which showed conclusively that electric traction on a railway could more than hold its own in competition with electric trams. The electrical services between Victoria and the Crystal Palace had only been running since May 12th, but the result was equally satisfactory. At the end of this year, when it is hoped similar services will be established between London Bridge and the Crystal Palace, the attainment of even better results is expected. The additional receipts derived from the electrical services represented nearly 30 per cent. of the total increase of passenger receipts.

At the general meeting of the Central London Railway, Mr. H. F. Parshall, Chairman, announced that considerable progress had been made with the new system of ventilation by ozonised air. The plant is already in operation at the Bank station, and it was hoped that the equipment of all the other stations would be completed by September. Four hundred thousand cubic feet of air per hour will be pumped in at each station, containing ozone in the proportion of one part in 10,000,000. Considerable progress has been made with the Liverpool Street extension.

According to the report of the London Electric Railways Co., the gross receipts on revenue account showed an increase of £27,193 compared with the corresponding half of last year. The working expenses increased by £7,699. After providing for interest and rents, and reserving £7,500 for contingencies and renewals, there remains a balance of £124,156. The directors recommend that a dividend at the rate of 4 per cent. per annum be declared on the 4 per cent. preferred stock and that a dividend at the rate of 1 per cent. per annum be declared on the ordinary shares, leaving a balance of £14,516 to be carried forward.

The half-yearly report of the Metropolitan District Railway records an increase of 9·25 per cent. in the passenger receipts and 4·60 per cent. and 6·92 per cent. in the train mileage and car mileage respectively, as compared with the corresponding previous half-year.

An increase of 27,961 miles run by electric trains on the Great Western Railway as compared with the previous corresponding half-year is recorded in the report.

The cost of electric train working on the North Eastern Railway for the half-year ended June 30th, 1911, was £16,168 (as compared with £15,978 for the previous corresponding half-year). Of this, £12,331 is the cost of energy purchased. The total car miles run by electric traction had increased from 1,836,048 to 1,892,439 for the same periods. The passenger train miles were 597,953, and the goods train miles 2,537.

The report of the Liverpool Overhead Railway records an increase of traffic receipts of £1,968; 5 and 1 per cent. dividends are recommended on the preference and ordinary shares respectively, with £4,665 carried forward.

The Tyneside Tramways and Tramroads Co. report a surplus of receipts over expenses of £4,288, which, after deduction of interest, &c., and including last year's balance, gives £989 available for distribution. Dividends of 5 per cent. on the preference and 1½ per cent. on the ordinary shares are recommended, and £1,000 is to be carried to reserve. The traffic receipts show an increase of £882.

After meeting capital charges amounting to nearly £20,000 and £760 legal expenses, there was a loss of £115 on last year's working of the Birkenhead tramway undertaking. The rates will have to be drawn on in addition to the extent of £1,000, which is the annual contribution to renewals fund. £7,050 has been contributed to relief of rates from the Stockport tramway undertaking.

An interim dividend at the rate of 4 per cent. per annum has been declared by the Bristol Tramways & Carriage Co.

The Brighton, Hove & District Railless Traction Bill has been approved by the Select Committee of the House of Commons. The scheme proposed involves the running of an accumulator omnibus as far as the boundary of Brighton. The battery, weighing a ton and a quarter, would then be removed, and the car run to Rottingdean by the railless trolley system. On the return journey the battery would be replaced. The work is to be completed within two years.

It is stated that trolley omnibuses will be employed on the new lines from Moor Side to Grain's Bar, Oldham. The estimated cost has been given at £1,500 per mile.

Trolley omnibuses are under consideration in Munich, and a Commission has been appointed to report on the matter.

The report of the Commission on railway electrification in Switzerland is stated to contain estimates showing that the conversion of the St. Gotthard line to the single-phase system with 15,000 volts 15 cycles, will entail 8 per cent. less capital expenditure than if it were carried out on the third rail continuous-current system. The cost of the conversion is estimated at £2,700,000, and a 10 per cent. reduction in working costs is anticipated.

The adoption of electric traction is under consideration on various local lines in the neighbourhood of Cologne and Bonn. The scheme would involve an expenditure of nearly 1½ millions.

A concession has been granted for the construction of an electric railway from Piazza Venezia, in the middle of Rome, to the seashore at Ostia, about 18 miles.

The paper on rack-railway locomotives of the Swiss mountain railways, by Messrs. T. Weber and Abt (Winterthur), read at the Zürich meeting of the Institution of Mechanical Engineers, contained, in addition to particulars of steam locomotives, a few notes on electric rack locomotives. Electric traction was first applied to a rack-railway on the Gornergrat line, opened in 1898, where locomotives, each driven by two 9 h.p. three-phase motors, are employed, giving a maximum tractive force of 5·9 tons and a speed of 4·3 m.p.h.; regenerative as well as mechanical braking is employed. Similar locomotives are in use on the Jungfrau railway. The first Swiss rack-railways to be worked by continuous currents are stated to be the Aigle-Leysin and Bex-Gryon-Villars lines, opened in 1900 and 1901 respectively. In these locomotives a friction disc-coupling to reduce shocks was first employed between the motor and the gearing. Three-phase motors are employed on the Brunnen Morschach line, and the mechanical arrangements include a safety grip on the rack.

The Wengernalp Railway commenced to use electric driving in June, 1909, and now has ten locomotives of 300 h.p. each. These are generally of the same construction as those of Gornergrat and Jungfrau, but are built for 80 cm. (2 ft. 7½ ins.) gauge. They have an equalisation of pressure on the rack-wheels arranged by means of balancing levers, as well as a system of automatic interlocking which prevents the automatic brakes from being put in action when the train is going uphill. Each locomotive is provided with two-series continuous-current motors, each of 150 h.p., this full power being capable of continuous use. The motors make 750 r.p.m., and they are worked in series by bow contracts at 1,500 to 1,800 volts. Electric braking is used when running down hill.

The Stanstad Engelberg line, opened in 1898, is partly rack and partly adhesion, and employs three-phase current at 750 volts. Each locomotive has two 150 h.p. motors, and special arrangements permit of the carrying and rack axles being connected by coupling-rods. This is also done on the locomotives of the Martigny-Chatelard line, opened in 1904, which, however, are driven by continuous current. In addition to the locomotives there are on the Martigny-Chatelard line also nine motor-carriages, each of which rests on two four-wheel bogies. Each bogie has two motors of 80 to 100 h.p., which, by means of spur-wheel gearing an intermediate shaft, transmit the power on the rack as well as on the adhesion-axles. This rigid connection between adhesion and rack-wheels is not recommended by the authors of the paper, but up to date the system has worked without any interruption.

On the Monthey-Champery line, opened in 1906, motor coaches are used on which the bogies each have one adhesion and one rack-wheel driving motor, each independent of the other, allow varying gradients to be worked in the most efficient manner by the rolling stock. The adhesion-axles are driven by the adhesion motor and connected by coupling-rods. The rack-wheel motor works by means of double spur gear on a rack driving-wheel mounted loose on one of the adhesion-axles. The locomotives on the Montreux-Glion line are also arranged so that they can run either only by adhesion or by the rack gear only. The two rack driving-axles are each connected to the neighbouring adhesion-axles and carry a loose rack brake-wheel. The rack-wheels are always in motion as they are coupled up through double spur-wheel gearing to the motors. For running on the adhesion part

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of the line, a friction-clutch coupling keyed on to the intermediate shaft transmits the power from this by spur-wheel gearing and connecting-rods to the adhesion-axles.

The Blonay-les-Pleiades and the Altstätten-Gais railway lines are intended to be brought into service during the present summer. The first works with mixed locomotives similar to those on the Montreux-Glion line, the second line has six-wheeled motor carriages having bogies similar to the Monthey-Champery type. Switzerland has a total of 120 steam locomotives as well as forty-five electric locomotives, and motor coaches arranged for working with rack gear. The total length of the rack-railways is 87 miles.

According to the *Electric Railway Journal*, all the cable lines of the United Railroads of San Francisco are now electrically driven. The speed of the cables has been increased about 3 per cent., and owing to the constant speed of the motor, a much more uniform speed is obtained than with the steam engine, which could not be controlled within less than 5 per cent.

A slight collision occurred last Friday on the electrically-driven wire-rope railway up Great Orme's Head, Llandudno, owing to one of the cars missing the points at a passing-place. The cars were going slowly at the time, and only a few persons were slightly injured.

LOCAL NOTES

Blackpool: *Municipal Wiring.*—The deputation at the M.E.A. Convention has reported:—"We do not advocate the Corporation doing the actual wiring work, but if the Corporation had the powers it would enable the Electricity Supply Department to obtain much new business in the hiring out of motors, &c., and thus increase the output and sale of electricity. When the Corporation do obtain powers, the Electricity Department will, in all cases, invite tenders for local contractors for carrying out the actual wiring, and thus no injustice will result to the wiring contractors."

Burton-on-Trent: *Electricity Showrooms.*—As the result of attending the Brighton Convention of the I.M.E.A., Councillor King has recommended the Council to open electricity showrooms.

Canada: *New Water Power Plant.*—It is anticipated that the Winnipeg water power generating station at Point du Bois will be in operation on August 15th.

Dover: *Electricity Undertaking.*—A recommendation of the Electricity Committee that the salaries of several officials of the Electricity Department should be raised has been rejected by the Council.

Greenock: *Electricity Accounts.*—A profit of over £5,000 is reported on the electricity undertaking, after payment of all capital charges, &c. The corresponding profit for the previous year was £3,427.

Guisborough: *Electricity Supply.*—As a result of a petition asking for a scheme for electric supply, a Committee has been formed to report on the question.

Halifax: *Electricity Accounts.*—The profit for the year has amounted to £4,366, as compared with £1,883 for the previous year.

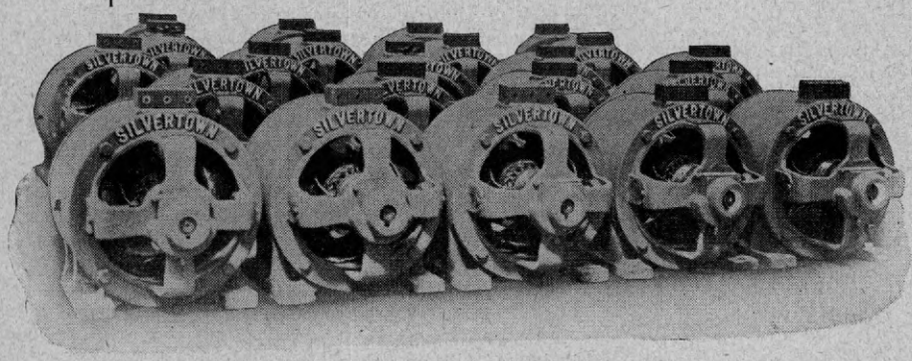
Hull: *Electricity Accounts.*—After payment of capital charges, a net profit of £8,347 remains for the year out of a gross profit of £32,746. This is slightly in excess of the amount for the previous year.

Ilford: *Electricity Accounts.*—A final balance of £1,400 on the last year's working has been carried to reserve and depreciation account.

Llandudno: *Reduced Tariff.*—The recommendation of the Electricity Committee that the price of electricity for lighting be reduced from 5d. per unit to 4½d. has been approved by the Council.

London: *Marylebone.*—A suggestion of the Electricity Committee to the effect that wiring of installations under the three

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years' hire system should be sublet entirely to contractors, has been approved by the Council.

St. Pancras: Electricity Profits.—There was a net profit of £13,203 upon the electricity undertaking last year after meeting capital charges.

Morley: *Electricity Accounts.*—The final result of the year's working has been a deficit of £530, against that of £793 for the previous year.

Nelson: *Supply of Brierfield.*—At Nelson Town Council, on August 3rd, the Chairman reported that the Board of Trade had decided to make an Order authorising the supply of electricity in bulk to Brierfield, subject to a provision that such supply should not be used for traction purposes in connection with tramways worked by the Burnley Corporation.

Newcastle: *Supply of Walker and Newburn.*—An agreement has been arrived at whereby the supply of electricity to Walker will no longer be taken from the Newcastle Electric Supply Co. but will be given by the Corporation. The supply of Newburn is to be given by the Newcastle District Electric Lighting Company, at 0·55d. per unit.

Newport (Mon.): *Electricity Undertaking.*—Two members of the Electricity and Tramways Committee have resigned as a protest to alleged bad management of the undertaking generally, especially as regards to the condition of the tramway track and cars.

Northallerton: *Street Lighting.*—The tender of the Northallerton Electric Power Co. for street lighting for five years has been accepted.

Stockport: *Electricity Accounts.*—A gross profit on the year's working of £10,235 has been made, out of which £3,539 has been contributed in relief of rates.

Yarmouth: *Interruption of Supply.*—Supply was interrupted for about half an hour on Monday evening, and some inconvenience was caused at hotels, places of entertainment, &c.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bacup.—It has been decided to ask for sanction to borrow £1,250 for electricity purposes.

Belfast.—It has been decided to make application to the Local Government Board for a loan of £40,000 for plant extensions and mains.

Biddulph.—A scheme has been laid before the Council for electric lighting of the village with overhead distribution.

Birmingham.—A Local Government inquiry was held last week into a loan of £934 for the purchase of a site for extensions to the Summer Lane station. It is proposed to instal two new 5,000-kw. sets.

Bispham.—The Local Government Board has sanctioned a loan of £10,800 for extensions.

Britonferry.—Application is to be made to the Local Government Board for a loan of £1,200.

Burnley.—The Local Government Board has sanctioned the borrowing of £8,552 for extensions at the electricity works.

Epsom.—The Electrical Engineer has recommended the expenditure of £3,500 on extensions, including a Diesel engine. An expert is to be appointed to advise in the matter.

London: *Southwark.*—A loan of £4,456 is to be applied for, for extensions, including new battery room, machinery mains, house services, and meters.

Melrose.—The Electric Supply Corporation have been granted consent to the erection of overhead wires for supply to a number of districts outside the town.

It has practically been decided to erect a power station to supply electricity to St. Boswells, Newtown, and Bowden.

Wath.—The Yorkshire Electric Power Co. has placed a scheme of electric supply before the Council.

Wednesbury.—Application is to be made to the Local Government Board for a loan of £238 for small mains extensions.

Wimbledon.—A Local Government Board inquiry was held last week concerning a loan of £7,459 in connection with the extension of electric supply into the Maldens and Coombe district.

Wolverhampton.—A 400-kw. rotary converter and switchgear is to be purchased at an estimated cost of £1,500.

Worthing.—A Local Government Board inquiry has been held regarding an application for a loan of £4,950 for extensions at the electricity works. It is proposed to put down two 125-kw. sets driven by Diesel engines.

Wrexham.—The Local Government Board have sanctioned loans for the following purposes:—Traction battery (£437), meters (£140), extensions to feed pumps, forced draught furnace, automatic expansion gear to one engine (£450), street lighting (£500), extension to condensers (£80), electrical instruments and sundries (£50), machine tools (£220), erecting and fitting out stores and offices (£350), coal elevator (£300), switchboard (£260), reversible booster (£150), switchboard (£100).

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Aberdeen.—Cinematograph theatre.

Aberytswyth.—Additions to Council school.

Belfast.—New schools. Architect, W. J. Fennell, 2 Wellington Place, Belfast.

Birmingham.—Tramway depôt at Hockley. A. Rowse, King's Court, Colmore Row.

Bradford.—Residence for Medical Officer at City Hospital.

Brighton.—Receiving homes and infirmary. J. W. Hawker, 3 North Street.—New Presbyterian Church. E. Proctor, 83 St. Paul's Churchyard.

Doncaster.—New lecture hall and school.

Dover.—Infants' school. Borough Surveyor.

Eccles.—Public baths in Cromwell Road. Architects, Brameld & Smith, 4 Cannon Street, Manchester.

Gillingham.—Royal Naval and Marine Orphanage.

Hampstead.—New police station.

Ilkestone.—New schools.

Irvinestown (Co. Fermanagh).—A lighting scheme for the Parish Church is under consideration.

London.—Erection of Deptford Central Library.

Nottingham.—Veterans' and Union Jack Club, Carlton Road. Architect, A. Marshall, King Street.

Oswestry.—Infirmary, &c.

Sussex.—The East Sussex County Hall and Courts are to be wired for electric lighting.

MISCELLANEOUS

London.—Tenders are required by August 18th for a three years' supply of electrical accessories by H.M. Office of Works.

Portsmouth.—The Traffic Committee of the Tramway Committee recommend a number of tramway extensions at a total estimated cost of £31,500.

Rishton.—The directors of the Victoria Mill, Rishton, have decided to work their machinery by electricity. This will be the first mill in the district to adopt this method. There will be a separate motor for each loom.

St. Helens.—The London & North Western Railway have been in treaty with the Corporation regarding a supply of electricity for power purposes to their Earlstown Waggon Works.

TENDERS RECEIVED AND ACCEPTED

Blackburn.—The tender of McPhail & Simpson, Ltd., for a superheater and fittings, has been accepted.

Dundalk.—The following tenders, amounting in all to £16,186, have been accepted:—Oil engines and generators, Messrs. Mirrlees, Bickerton & Day, Ltd., Hazel Grove, Stockport; main, Messrs. Siemens Bros. & Co., Ltd.; switchboard, &c., Messrs. Brook, Hurst & Co.; battery (Tudor Accumulator Co.'s plates), the Sandycroft Foundry Co.; booster, British Westinghouse Co., Ltd.

Luton.—The tenders of the Hudson Economiser, Ltd., for a cooling tower (£637), and of Messrs. Hayward, Tyler & Co. for an electrically-driven feed pump (£120), have been accepted.

Shanghai.—An order has been placed by the Municipal Commissioners with the General Electric Co. for 1,700 Osram lamps from 100 to 400 c.p.

Wednesbury.—The tenders of the Tudor Accumulator Co., Messrs. Johnson & Phillips, and H. J. Smith, relating to extensions of the electricity works, have been accepted.

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APPOINTMENTS AND PERSONAL NOTES

Mr. T. A. Edison arrived at Fishguard on Monday. According to the *Times*, he is spending a two months' holiday in England.

Mr. Hugh M'Lean, Electrician, Great North of Scotland Railway Locomotive Works at Inverurie, has been appointed by the Chloride Electrical Storage, Co., Ltd., as their representative in the Argentine.

The salary of Mr. W. H. Cook, Electrical Engineer, Luton, has been raised from £400 to £450 per annum, and that of the Chief Assistant, Mr. H. A. Kell, from £140 to £165.

Applications are invited for the position of entire control of a factory in the Midlands employing a thousand hands. (See advertisement on another page.)

Applications are invited for the posts of Junior Drawing Office Assistant and Assistant Junior Demonstrator at the Northampton Polytechnic. (See an advertisement on another page.)

Mr. P. Spalding, formerly Engineer to the Galway Electric Lighting Co., has been appointed Electrical Engineer to the District Council of Dundalk at a salary of £250 per annum.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5, Philpot-lane, E.C., inform us that the price of electrolytic copper bars c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 10s. (last week the same).

Bankruptcies.—As the result of creditors' meetings in the bankruptcy of Messrs. J. G. Childs & Co., Ltd., electrical engineers, Willesden Green, London, the liquidation of this firm has been left in the hands of the Official Receiver. The company was registered in 1907 with a capital of £20,000, and has involved losses each year since. The accounts showed assets valued at £3,410, which are entirely absorbed in a debenture of £5,000. The unsecured liabilities amount to £20,640.

The Official Receiver's statement of the bankruptcy of W. H. Ridpath, electrical engineer, Ilkestone, shows assets amounting to £140, and a deficiency of £1,210.

The public examination of C. F. Lindop, electrical engineer, 62 Dale Street, Liverpool, took place last week. The debtor appears to have formed his business into a limited company in a somewhat irregular manner, and as further information was required, the examination was adjourned until September 18th.

An Old Electric Light Installation.—An electric lighting plant that is interesting on account of historical features rather than its efficiency is that of the South Foreland Lighthouse on the cliffs between Dover and St. Margaret's Bay. At the present time only the "high" lighthouse is in use, as the "low" lighthouse, lower down on the cliff, was put out of service some years ago, when the fixed light of its partner was converted into a revolving light. The light is given by a single vertical carbon open arc lamp, with clockwork feed and fluted carbons about seven inches in length, which have to be renewed several times in one night. For this purpose, two separate lamps are employed, arranged so one can be slipped into place when the other is withdrawn for carboning. Alternating current, at a high frequency, is supplied, and the lamp takes about 60 amperes. The power station is about 100 yards distant, and contains steam-driven alternators of the old Holmes magneto pattern, with rows of inwardly-pointing permanent horseshoe magnets between the poles, between which pass the coils of the revolving armature. Two such alternators are used in series on the arc lamp, and they are coupled together and driven by an elaborate arrangement of countershafts, fast and loose pulleys, &c., from a single cylinder horizontal engine. A duplicate plant was used for the low lighthouse, and is now retained as a standby. The engines have each their own condenser, with the air pump worked off the tail-rod, and steam is supplied at 35 lbs. per square inch, from a pair of Cornish pattern boilers. The alternators have been running for over forty years, and are still in excellent condition. The magnets are, however, remagnetised every few years. Of switchboard, properly speaking, there is none, but the circuits are connected up to links on a wooden board. The plant is an interesting example of practice in the pioneering days.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Welsbach Light.—At the statutory meeting of the new Welsbach Co., last week, a number of shareholders expressed their dissatisfaction with the method of the reconstruction of the company, and stated their intention of asking the Board of Trade to hold an inquiry into the conduct of the business prior to the constitution of the new board. Objection was also taken to the presence of Major Pringle, of the Board of Trade, on the board. The general meeting will be held in December.

Kensington & Knightsbridge Electric Supply Co.—An interim dividend, at the rate of 8 per cent. per annum, is declared upon the ordinary shares for the June half year.

Brompton & Kensington Electricity Supply Co.—An interim dividend, of 9 per cent., is declared upon the ordinary shares for the June half year.

Charing Cross, West End, & City Electricity Co.—An interim dividend, at the rate of 5 per cent. per annum, is declared upon the ordinary shares of the West End undertaking.

Metropolitan Electric Supply Co.—An interim dividend, at the rate of 4 per cent. per annum, has been declared.

Westminster Supply Corporation.—An interim dividend at the rate of 10 per cent., for the half year ended June 30th, is announced.

Mather & Platt.—An interim dividend at the rate of 10 per cent. per annum is declared on the ordinary shares for the half year ended June 30th.

Yorkshire Electric Power Co.—The net profit for the half-year ended June 30th, after deduction of mortgage interest, was £4,137, as against £2,622 and £1,069 for the two preceding corresponding half-years. A dividend at the rate of 6 per cent. on the amount paid up on the cumulative preference shares is recommended, with £12,476 11s. 1d. carried forward.

French Westinghouse Co.—There was a loss of about £6,500 on the working for 1910, which the report attributes to the poor financial return made by the electrical department. Mention is also made of a poor year by the Italian Westinghouse in consequence of the Italian Government interrupting the execution of its programme of street railway electrification.

Llanelly Electric Lighting & Traction Co.—A prospectus has been issued inviting applications for £50,000 5 per cent. debentures at par.

Lamp Lowering Gear.—We have received from the London Electric Firm (George Street, Croydon) a collection of illustrations of the various forms of lowering gear for arc lamps and metal filament lanterns, in which they specialise. With regard to the latter application, it may not appear warrantable, at first sight, to fit such gear, seeing that the lamps only require attention for cleaning and for replacing defective or worn-out lamps, say, once a month; yet a simple calculation of the cost of such attention, with its expenditure of time and labour in wheeling the costly and cumbrous tower waggon, shows that the quite moderate cost justifies the installation of such gear; whilst in cases where it is already installed for arcs, it can be used without any alteration whatever, except in cases of two (or more) circuit clusters, and in these cases the cost of alterations are quite trifling. The contact-suspension device is of the firm's well-known postive acting weight relieving type, and the winch of their equally well-known self-sustaining pattern, without ratchets, pawls, springs, or triggers.



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SUMMARY

Some grievances have been placed before the Postmaster-General by a deputation of telegraph and telephone employees. (Page 465.)

The main power supply to the exhibition at Turin is effected by a special generating station containing coal- and oil-fired boilers, reciprocating steam-engines and turbines, as well as oil engines of several makes. (Page 457.)

Judgment has been obtained in favour of Osram Lamp Works, Ltd., in an action brought by them against the British Tungsten Lamp Co., Ltd., for infringement of certain metal filament lamp patents. (Page 457.)

A paper read recently in America describes some researches into the electrolytic corrosion of reinforced concrete. (Page 457.)

A work by Mr. H. M. Hobart on transformers is reviewed on page 488.

Notes on arrangements for the forthcoming session at some of the leading technical colleges are given under the heading of University and Technical College Announcements. (Page 458.)

Mr. Dugald C. Jackson, in his presidential address to the American Institute of Electrical Engineers, dealt with the duty of the electrical engineer to the public and to his nation. He defined in broad terms the professional spirit which should actuate the engineer, and pointed out that they must necessarily deal with the commercial and economic problems associated with the industries which they dominate. (Page 459.)

Some new conduit fittings and a new form of screwdriver are described in short articles on page 460.

A short article warns mains engineers of the possible effect of the heat spell upon their networks, and recommends systematic testing immediately wet weather sets in. (Page 461.)

The fire at the Carlton Hotel, London, last week has been erroneously attributed by a daily paper to the fusing of electric wires. (Page 461.)

A letter from a contractor in the North of England agrees with our remarks last week as to the inactivity of the Electrical Contractors' Association. (Page 461.)

The present situation of the manufacture of steel in the electric furnace is reviewed in a short article on page 461.

Among the specifications published by the Patent Office last week was one covering a machine for grinding the contact surface of carbon brushes by A. Watkins. A new form of switching device, consisting of strips of sheet metal laid on the floor, is described by S. Lichtenfeld. F. Eisner introduces a new binding medium for the manufacture of tungsten filaments, and R. F. Venner has patented an electric heater in which the heating coils are immersed in mercury. A specification by R. Bacci describes an incandescent lamp which is capable of being dismantled for renewing the parts. The desired amendments to a patent by

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H. T. Hansen relating to block signalling systems have been allowed. (Page 462.)

Under the heading of electric traction notes is given a *résumé* of the labour situation in the electric traction industry. £18,750 has been contributed to relief of rates by the Salford Corporation tramways. The introduction of trolley omnibuses in Dundee has been definitely decided upon. Other notes in this column include particulars of the purchase, by the Birmingham Corporation, of tramway lines in the neighbourhood formerly worked by companies. (Page 463.)

In a paper read before the American Institute of Electrical Engineers on the transmission system of the Colorado Power Co. some interesting points in the construction of the line to meet the severe weather conditions are given. (Page 464.)

In a short article on the electrical equipment of the rolling stock on the Schöneberg-Berlin Underground Railway, an ingenious scheme for running a train out of the car-shed without using the third rail is described. (Page 464.)

A surplus of £6,680 is recorded on the working of the Glasgow Electricity Department. The Aldrington Electricity Works reports a deficit of £207 for the year. The price of street lighting is to be reduced in Islington, and a surplus of £1,000 is to be added to the rates. The Electricity Committee at Newport (Mon.) have been directed by the Town Council to report further on the administration of the undertaking. A large power station in Italy, which supplies the greater part of Turin, has been destroyed by fire, but this does not affect the exhibition. (Page 465.)

The Local Government Board have now sanctioned a further loan of £50,000 for extensions at Dublin. Loans amounting to £2,350 are to be applied for at Hereford, and a Local Government Board enquiry has been held at Wimbledon (£7,459). (Page 465.)

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Mr. E. Crabb has been appointed Second Secretary to the Post Office in succession to Sir A. F. King, who has been made Secretary, and in view of the approaching telephone transfer, and in order to secure co-ordination of the Telegraph and Telephone Departments, the Postmaster-General has established a post of Third Secretary with supervision over those Departments. Mr. A. M. Ogilvie, hitherto Assistant Secretary in charge of the Telephone Department, has been appointed to the new post.

On Monday last, the Postmaster-General received a deputation from the Postal Telegraph Clerks' Association urging a number of grievances in the administration of the telegraph and telephone services. In event of an unsatisfactory reply a mass meeting is to be convened.

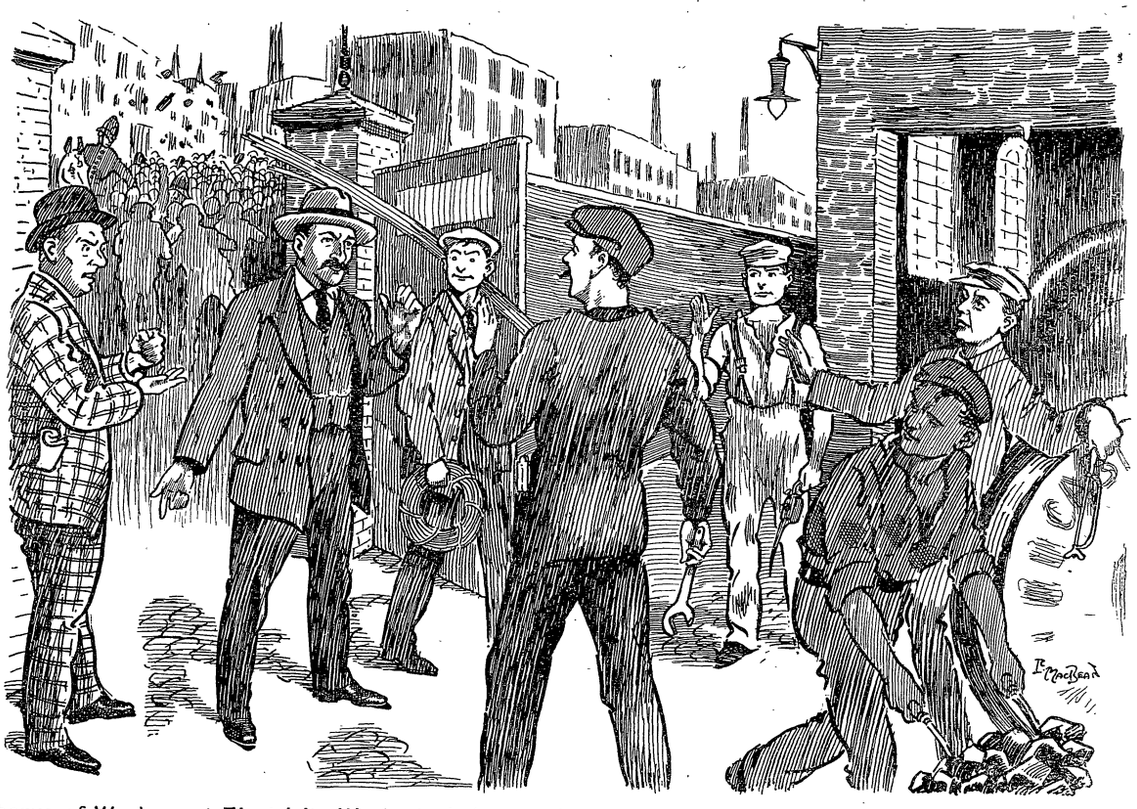
On Friday last, when the House of Commons was in Committee on the Telephone Transfer Bill, Mr. Peto moved the insertion of words to make it clear that a portion of the £4,000,000 should be devoted to the development of the telephonic system "in rural as well as in urban areas." Capt. Norton maintained that there was no object in inserting these words, because the clause would carry out the object which the hon. member had in view. The amendment was negatived.

A powerful wireless telegraph installation is being installed at the new London Opera House in Kingsway, by which passengers on Atlantic liners and others will be able to book seats in advance.

A private wireless service is in use between the Wanamaker Stores in New York and Philadelphia. It is stated that by its use a considerable sum is saved which was formerly spent in telephone charges.

It is stated that the German Government has established a wireless telegraph station on one of the Spanish islands about 84 miles from Teneriffe at an important strategic point.

The only item of interest in the world of telegraphic failures and repairs is that of a breakdown of the lines of the Indo-European Telegraph Company on the 9th and 10th inst. between Tiflis and Tauris.



Chorus of Workers at Electricity Works to Labour agitator: No, we will not join you. We are satisfied with our conditions and our interests are common with those of our employers.

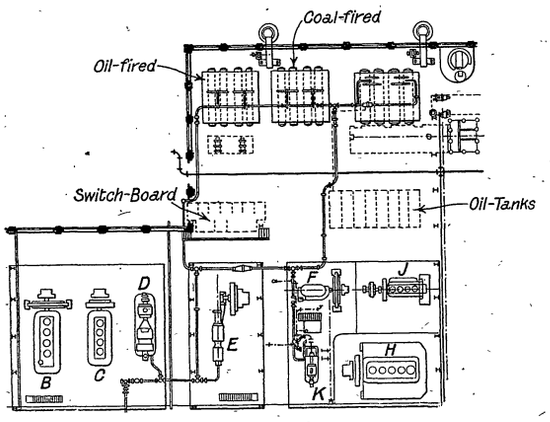
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ELECTRICITY AT THE TURIN EXHIBITION

ELECTRIC power for the needs of the Turin Exhibition is supplied from a special generating station forming one end of the gallery of "machinery in motion" in the western part of the exhibition, and with a plant capacity of some 10,000 h.p., as compared with 900 h.p. for the Turin Exhibition of 1884 and 1,250 h.p. in 1898. A plan of the station is given in the accompanying figure.

The first section of the boiler plant consists of two Babcock-Wilcox water-tube boilers of 16,000 sq. ft. heating surface, producing steam superheated to 600° F. at a pressure of 185 lbs. per sq. in. The boilers supply a 1,200 kw. turbo-alternator and a 500 h.p. vertical engine, set by Swiderski, of Leipzig. There is also a complete power equipment by Franco Tosi, of Legnano, comprising the following items:—Two batteries of boilers of 19,500 sq. ft. total heating surface for a steam pressure of 185 lbs. per sq. in., one coal fired and the other oil fired; a tandem compound 600–800 h.p. engine, running at 125 r.p.m.; a 5,000 kw. steam turbine, running at 1,500 r.p.m.; a four-cycle heavy oil engine of 600 h.p., running at 150 r.p.m., and a 1,000 h.p. two-cycle heavy oil engine for the same speed. A 1,000 h.p. Diesel engine of Sülzer Bros. manufacture is also installed, as well as a 400 h.p. Diesel engine, made by the Italian Langen & Wolf Co.

These various engines are coupled to the generators detailed below:—One 5,000 kw. turbo-alternator coupled to the Tosi turbine, and one continuous-current machine for the Diesel engine, by the Langen & Wolf Co.; two Brown Boveri machines for the Tosi heavy oil engines, a Brown Boveri alternator driven by the 1,200 h.p. Swiderski turbine, and alternators by the Societa Nazionale delle Officine di Tanigliano, driven by the 1,000 h.p. Diesel Sülzer, the 600 h.p. Tosi, and



PLAN OF POWER STATION.

B	1000 h.p.	Tosi oil engine.
C	600 h.p.	,, ,, ,,
D	4500 h.p.	,, steam turbine.
E	600 h.p.	,, horizontal engine.
F	500 h.p.	Swiderski vertical engine.
H	1000 h.p.	Sülzer-Diesel engine.
J	450 h.p	Langen & Wolf Diesel engine.
K	1200 h.p	Swiderski steam turbine.

the 500 h.p. Swiderski engines. An electrically-driven forced-draught plant on the Prat system is provided.

All the alternators generate at 6,400 volts, 50 cycles, three-phase and four main feeders leave the central switchboard for various sections of the exhibition where transforming sub-stations are situated. The main switchboard is also connected up to the 6,400 volt mains of the municipal supply of Turin, which can be utilised as a standby. In addition to the main power station, separate generating plant is provided for the Swiss and British sections respectively, the latter of which is driven by suction gas engines of the Campbell Gas Engine Co.

Current is transformed down to 500 volts for the motor circuits, and the arc lamps, which are arranged in groups of six in series, and to 220 and 125 volts for other purposes, including the incandescent lighting. Considerable care has been exercised in the supervision of the wiring all over the exhibition, and an insulation resistance on the basis of 1,000 ohms per volt is said to have been specified. Very complete fire-protection arrangements have been made, both from the point of view of fire alarms and water supply. Some of the fountains and ornamental cascades are supplied from electrically-driven pumps, that in the British section being fed by a centrifugal pump driven by a 180 h.p. three-phase motor. Numerous small generating plants are, of course, scattered over the sections, as, for example, a model small hotel plant driven by a 4 h.p. petrol engine and utilising accumulators forming part of the exhibit of the Italian Touring Club. Electrical driving is also used very largely for every purpose throughout the exhibition.

Electrical interest is, however, largely concentrated in the Palace of Electricity, where French exhibits are particularly prominent, including two Delaunez-Belleville boilers destined for the Saint-Denis station, Paris, and a 6,400/100,000 volt step-up transformer on the stand of Messrs. Vedovelli & Priestley, connected to a short 100,000-volt transmission line to another part of the exhibition, partly overhead and partly through a cable. A popular display to demonstrate the "marvels of electricity" has been arranged in this section by Professor Arno, and popular experimental lectures are also given on the principal applications of electricity. The most interesting electrical engineering exhibits in the British section are the generating plant driven by a Campbell suction gas plant already mentioned, and a fine display of electrically-driven textile machinery. The area of the whole section amounts to 10,000 sq. ft. For the above particulars we are indebted to *Le Génie Civil* (Paris).

METAL FILAMENT LAMP PATENTS

IN an action brought in the Chancery Division of the High Court of Justice by the Osram Lamp Works, Ltd., against the British Tungsten Lamp Co., Ltd., and another for infringement of Letters Patent, an Order was by consent made on the 26th day of July, 1911, whereby it was (among other things) ordered that the defendants, their servants, agents, and workmen be restrained during the continuance of certain Letters Patent from importing into and from making, selling, offering for sale, supplying, and using in this realm any illuminating bodies or electric lamps containing illuminating bodies made according to or in manner described and claimed in the specification of such letters patent or according to or in manner only colourably differing therefrom, and generally from infringing the rights of the plaintiffs under the said letters patent. And that the defendants do pay to the plaintiffs the sum agreed for damages sustained by the plaintiffs or to be sustained by reason of the infringement of the said letters patent by the defendants by the manufacture and sale prior to the date thereof of lamps and filaments and the sale of the lamps then in stock, or by reason of the user of such lamps and filaments. And that the defendants do pay to the plaintiffs their costs of the said action to be taxed by the taxing master.

THE ELECTROLYTIC CORROSION OF REINFORCED CONCRETE

A PAPER by Messrs. C. E. Magnusson and G. H. Smith, read at the annual convention of the American Institute of Electrical Engineers, contains an account of a research on the corrosion of reinforced concrete by stray currents, the results of which may be summarised as follows: Concrete and cement, when dry, are good insulators and show a specific resistance of about 1,000 megohms per cubic centimeter. Their conductivity depends upon the porosity of the material and the nature of the solution in the pores, a solution of aqueous sodium chloride making them fairly good conductors of electricity. With the liquid in the porous spaces as the conductor, the current flowing through the concrete probably follows the ordinary laws of electrolysis. A current of low density passing through cement or concrete does not effect their compressive strength.

The observed data showed that in cases where the samples thus soaked failed due to corrosion, the corrosion of the iron, caused by the current, precedes the crack in the concrete; that the increase in volume, when the iron changes into an oxide or a salt, is the direct cause of the failure of the concrete. A remedy was found for this by covering the iron bar with two coats of various commercial paints and letting them dry before making up the blocks. With an electrolyte of salt water, there was no evidence of corrosion in three tests lasting from 125 to 250 days, made with samples treated in this way.

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REVIEW

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

The Design of Static Transformers. By H. M. Hobart. 174 pp. 3¾ in. by 5¾ in. 101 figures. (London: Constable & Co.) 6s. net; abroad, 6s. 5d.

It is not often that a text-book of design has so interesting and readable an introduction as that in which the author here sketches his personal connection with the pioneering days, when the principles underlying the transformer were being gradually threshed out, and the interest stimulated by this presentation of the way in which the problems occurred will be a help to the study of the ways in which they have been overcome. In the body of the work Mr. Hobart follows the subject through with his customary clearness and logical sequence, assisting his text with numerous curves, diagrams, &c. The section on heating of transformers is particularly valuable. The author confines himself entirely to real practical design, and refers the reader to other works for the academic study of transformer theory. We notice that the practice of using the comma instead of decimal point, which had been abandoned in some of the author's most recently published books, has been reverted to, but the reiteration of the protest against this which we have made in reviewing other of Mr. Hobart's works does not interfere with our appreciation of the general merits of this publication.

UNIVERSITY AND TECHNICAL COLLEGE ANNOUNCEMENTS

An advanced course of instruction on "The Systematic Design and Manufacture of Dynamo Electric Machinery" is to be given at the City and Guilds Engineering College, Exhibition Road, South Kensington (Imperial College of Science and Technology), during the forthcoming session. The course will be somewhat of a new departure, and is intended to prepare men to take up positions as designers in electrical works. It will deal with present-day problems in design, construction, and testing, in a thoroughly practical manner. The lecturer will be Mr. W. E. Robson (late Chief Designer and Assistant Manager, British Eletcric Plant Co., Alloa, N.B., formerly Chief Draughtsman in the Electric Manufacturing Department of Armstrong, Whitworth & Co.'s, Elswick; and Deputy Chief Draughtsman at the Brush Electrical Engineering Company's Works, Loughborough). The lectures, about forty-five in number, will be delivered during the first half of the session (October to February), and the practical work will commence in October and continue throughout the session. Ratings, frame sizes, windings, &c., for complete lines of machines will be considered in detail, as well as works organisation required for systematic manufacture and for developments. In addition to lectures, practice in designing, estimating, and drawing office work will be given, and advanced laboratory work relating to the limiting conditions existing in modern machines. An experienced designer and draughtsman, specially engaged for the purpose, will devote his whole time to the drawing office work in connection with the course. Application for admission to the whole course, or parts thereof, to be made by letter to the Dean, City and Guilds (Engineering) College, Exhibition Road, London, S.W.

The ordinary courses at the college in Civil and Mechanical Engineering are under Prof. W. E. Dalby, and Prof. T. Mather has charge of those in Electrical Engineering. They are divided into Diploma Courses for the Associateship of the Institute in the branch of engineering selected, special or partial courses for students who can engage in research work or omit part of the regular course, and advanced specialised courses for post graduate and other duly qualified students. Courses are also conducted in railway engineering, structural engineering, and the design and construction of electrical machinery.

As stated in Electrical Engineering, August 10th, p. 448, those desiring to commence courses in engineering at University College, London (Gower Street, W.C.) should communicate with the Provost before September 20th, and should send a full statement of their previous training. Students can either take a degree course leading to the London B.Sc. in engineering, or a diploma course for which a certificate is given. Both courses are of three years' duration. Specialisation in electrical engineering is possible in the second and third years. Special courses can be arranged for those who have received partial training elsewhere, and there are exceptional facilities for post-graduate and research work. An Entrance Scholarship, value 120 guineas, will be competed for in September next.

The full day courses in mechanical and electrical engineering at the Northampton Polytechnic Institute (St. John's Street, E.C.) will commence on October 2nd. The courses give a thorough groundwork in general engineering, and in electrical engineering, specialisation can be effected later in the directions of heavy electrical engineering or telegraphy and telephony, including wireless. Three entrance examinations are offered at the entrance examination on Sept. 27th and 28th. The courses include two summer periods of about six months in commercial workshops, and extend over four years altogether.

The session at the Borough Polytechnic Institute commences on September 25th. The course in electrotechnics, under D. J. Henderson, occupies four years, devoted respectively to general principles, technical applications (including electrical design, continuous current work—instruments, testing dynamos and motors—and alternating current work—principle and theory, measurements, alternators, motors, transformers, single and polyphase work). A three years' course in electric wiremen's work is given, and there are also elementary and advanced courses in electrical design and workshop drawing.

Complete three years' courses leading to a diploma or to a University degree in Electrical Engineering are held in the daytime at the South-Western Polytechnic Institute (Manresa Road, Chelsea, S.W.), and a four years' evening course is also held.

The 1911–1912 Session of the Engineering Department of the University of Birmingham, the electrical section of which is under Prof. Gisbert Kapp, commences on October 2nd. The full courses extend over four years, and students who enter after Matriculation and pass successfully the examinations at the end of each year will be entitled to the degree of Bachelor of Science in the branch of engineering to which they devote themselves.

The next session of the Engineering Department of the University of Edinburgh opens on October 10th. The Preliminary or Entrance Examination is held in September. The University provides complete Courses in Civil, Mechanical, and Electrical Engineering, qualifying for the degree of B.Sc. in Engineering, and extending over a period of three years.

The engineering instruction provided at University College, Nottingham, includes courses of instruction for the London University B.Sc. Degree Examinations in Civil, Mechanical, and Electrical Engineering, and for College and other Diplomas in Engineering and Mining. The Session begins October 2nd.

The next session in the departments of electrical, civil, mechanical and mining engineering, fuel and metallurgy, &c., at the University of Leeds will commence on October 3rd, on which day the entrance examination will be held.

A two years' course of instruction in electrical measurement and practical electricity will be commenced at the University College of North Wales, Bangor, under Prof. E. Taylor Jones and Mr. W. E. Williams in October.

Manchester Smoke Abatement Exhibition.—It is anticipated that a feature of the Smoke Abatement Exhibition to be held in Manchester from November 10th to 25th will be a display of electrical heating and cooking appliances. The demand for space has been made all the more keen by the concessions made to the electrical firms who are showing by the Corporation Electricity Department.

London Generating Stations and the Strikes.—It is announced that most of the London generating stations, including those supplying traction systems, have a sufficient supply of coal on hand to meet eventualities in view of strike troubles.

Electrical Fatality.—A caulker named F. H. F. Best met his death at Smith's Dock, Middlesbrough, last Friday in a somewhat remarkable way. While walking along a jetty he dropped some white lead which he was carrying into an open conduit containing electric mains, and in inserting his hand through the slot in the conduit came in contact with a live conductor and received a fatal shock.

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ELECTRICAL ENGINEERS AND THE PUBLIC

MR. DUGALD C. JACKSON, the new President of the American Institute of Electrical Engineers, delivered his inaugural address on June 27th. Members of the Institute, he said, are pleased to refer to electrical engineering as a Profession, and to the Institute itself as a Professional Society. The word profession "implies professed attainments in special knowledge, as distinguished from mere skill; a practical dealing with affairs, as distinguished from mere study or investigation; and an application of such knowledge to uses for others, as a vocation, as distinguished from its pursuit for one's own purposes." This sets the professional man in a position which demands from him an attitude of service and of leadership. His duties must be performed with a touch of disinterested spirit in addition to the vocational spirit of earning his livelihood. Such men have a duty to the public; and in the performance of that duty they must exert their influence on that thought and practice of the day which affects the welfare and progress of the nation.

It may be retorted, Mr. Jackson continued, that questions relating to the welfare and progress of the nation are matters of economics and sociology, and not of engineering. The affirmation contained in this retort I will admit, but the negation I deny. The theory of modern economics is built up under the influences produced by the introduction of steam power, with its potent agencies comprised in the steam railroad, ocean navigation, and the use of steam power in industrial operations. These agencies are the creatures of engineers, and the further developments of economic theory are largely dependent on those industrial changes which are continually produced by the inventive activities of the great body of engineers. When I speak of industrial operations or industrial conditions, it must be understood that I include among industrial affairs the great means for transportation and intercommunication which are comprised in railways, telegraphs, and telephones, in addition to the manufacture and distribution of products which involve the application of mechanical power, and the manufacture, accompanied by distribution by pipe or wire, of the media for providing illumination and power. The engineers have precipitated these affairs on the world by their inventions; these affairs are in a large measure the support of the engineering profession; and it is the duty of engineers to do their share in moulding their various economic creatures so that the creatures may reach the greatest practicable usefulness to society.

It may again be retorted that the tenets which I am advocating will lead engineers out of a professional spirit and into "commercialism." The word "commercialism" strictly means the characteristics of business or commercial life, but custom has made it applicable to any undue predominance of commercial ideas in a nation or community, and it has thereby come to infer a willingness to establish the strife for money in a position of precedence over reason and righteousness.

It has been alleged that learning loses of its dignity by becoming fashionable. It has also been alleged that learning loses of its dignity by becoming useful. Of the latter, at least, experience has proved the contrary—happily for engineers who are proud of their profession, for engineering is necessarily an embodiment of the useful application of knowledge and learning. Engineering, relating, as it does, to the application of the powers of nature to useful purposes, must necessarily bring its followers into intimate contact with commercial affairs in an age when, as in ours, the industries dominate commerce, and the abatement of war has reduced the importance of military engineering. A true engineer is a devoted follower after truth. He differs diametrically from the devotees of pure "commercialism," who are strictly opportunists. He also differs from pure idealists, who are often notable for refusing to accept any advance unless it wholly meets their personal ideals. The spirit of the engineer rejoices in obtaining any move toward the truth, but is always seeking farther advance.

Those who accept even in part the usual evolutionary doctrines which are summed up by Herbert Spencer in his view that progress occurs by successive differentiations and integrations producing development from the homogeneous to definite, coherent heterogeneity, will assent to the proposition that the modern giant corporation follows in the wake of the one-man business and the simple partnership in response to an inextinguishable natural law. The progress of corporation development cannot be prevented. We must, therefore, adjust our mental attitude to dealing properly with the situation; and in making the adjustment we must return to the old and approved recognition that a misdeed is a personal thing, and remember that responsibility for it cannot be shifted from the personality of the man in responsibility to an impersonal aggregation entitled a corporation which he manages. But if we must establish personal answerability to the public, we must also establish fair and generous dealing by the public.

The building up of a great industrial nation in an honourable state of civilisation is subject to many hazards—an error may cause injury to the structure that takes years or even decades to eradicate. The forward route is untested, and real progress can be made only by judiciously combining teachings from the records of yesterday with experience of to-day to make a working theory for to-morrow. It has been suggested that a theorist should be defined as a man who thinks he may learn to swim by sitting on the bank and watching a frog. The definition is as inaccurate as defining a black object as an object without colour. Theory, as the word is used by engineers, means a working hypothesis founded on all known facts and experience, which may be used to guide progress beyond the margin of past experience. Every successful, progressive man is a constant user of theory in this proper sense of the term. Theory is not antagonistic to practice, but is founded on experience, and is a guide to progress. Custom should be followed only when it has reason to support it. In the juncture now before us we must utilise the best theories of the corporation relations and the rights of persons and property, and cautiously extend our practices accordingly. No body of men is better equipped for this sound and scientific procedure than a body of professional engineers for the reason that this procedure is in accordance with the every-day steps of their business life. Moreover, the engineers of experience are well adapted to grapple with the mighty problems of a new age, for the reason that an efficient engineer must associate audacity and sobriety in his spirit.

Some people seem to believe that all public service corporation men are either wicked or are liars or thieves. This has as little foundation in fact as a belief that all men in Spain carry mandolins or that Spanish women always wear mantillas. It is necessary for all men trained in straight thinking to combat such folly and to cry out for fair dealing, one with the other, as between the public service corporations and the public which they are established to serve. No engineer does his duty who does not stand with fidelity for equally square treatment *for* as *by* these corporations. These corporations are not here as vampires on society, but are here to serve the needs of the people in a reasonable and business-like way; and their proper objects cannot be accomplished unless they are treated with reason and established in confidence. They obtain their income from serving the public, and they cannot give generous service unless they are granted generous opportunities. A scrupulously frank and honest dealing with the public by the companies should be insisted on, but the public must be taught the importance of dealing on its part with an equally scrupulous fairness and a well-balanced generosity. It is here that I say lies a duty of electrical engineers to the public. It is to give of their time and brain to establish convincingly the facts which the public do not understand in regard to the business of the public service companies, to indicate the means for rightly treating these new influences which we and our fellow engineers have been creating by our works, and to aid in establishing measures which will favour and sustain mutual confidence and fair dealing between them and the public.

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CONDUITS AND FITTINGS

A PARTICULARLY complete new catalogue of conduit material, fittings, &c., has just been issued by the Armorduct Manufacturing Co., Ltd. (Farringdon Avenue, E.C.). Among the contents to which attention may be drawn specially are the Armorduct patent universal "knock-out box" illustrated in the accompanying figure. This avoids the use of separate patterns of one-, two-, and three-way boxes. Shoulders are provided on each side, which are stop-tapped, so that any one can be used as in inlet by simply knocking out the "film" or diaphragm, which closes the hole. A number of sizes are supplied, and the standard box has a heavy cast-iron cover. The company also list a series of oblong junction boxes with various styles and positions of



Fig. 1.—Universal "Knock-out" Junction Box.

outlets, which should prove very useful, and in connection with these have got out a special design of porcelain interior arranged so that the conductors do not anywhere cross each other on live parts of opposite polarity. Floor inspection boxes with oak or brass covers are also made. Attention may also be drawn to a series of 10 ampere switch and plug fittings for various classes of work, and an interesting novelty is an adjustable fittings box for sunk work, which can be set so that the interior fittings are parallel to the wall surface, even when the box is out of true in the plaster. The list concludes with a copious assortment of distribution boards and water-tight fittings.

A FRICTION DRIVE SCREW-DRIVER

A NEW form of screw-driver has been brought out by the Benjamin Electric, Ltd. (1A Rosebery Avenue, E.C.), to meet the demand for a moderate-priced tool combining the advantages of both the ordinary and the ratchet screw-drivers without the disadvantages of the latter. The friction drive is the feature of the tool. The frictional surfaces between the cap and the handle engage with the ordinary pressure used in driving the screw. The spring in the handle releases the friction when the pressure is relieved on the reverse movement, at the same time maintaining a constant pressure on the screw, thus holding the blade firmly in the slot while returning the hand. The free swivel connection between the cap and the handle enables it to be driven very rapidly by the simple operation of the thumb and fingers. It is very useful for all one-hand work, especially in difficult places. The rotating cap always moves with the hand, and therefore does not rub the skin. It is always ready to drive screws in either direction without any adjustment, and there are no ratchet teeth to get out of order. The blade is made of crucible steel, and the handle is of black insulating material moulded to the blade, and fluted to insure a firm grip and prevent rolling.

OSRAM-LAMPS

THE STRENGTH OF METAL FILAMENTS



THE accompanying illustration has been reproduced from an untouched photograph taken of a lamp sent to the General Electric Co. (67 Queen Victoria Street) by Rawlings & Co., of 303 High Street, Lee, Kent. This lamp has recently withstood a test such as does not fall to the lot of many. For some considerable time past it has been burning in a private garage in Kent, and on Thursday last it had the misfortune to be struck by the rear part of a car backing into the garage. It is of interest to record that the only damage done to the lamp was the indentation of the cap shown in the illustration, the filament after the collision being found absolutely intact.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ALUMINIUM.—The British Aluminium Company (109 Queen Victoria Street, London, E.C.) have sent us two leaflets illustrating aluminium transmission lines erected at Aldershot for the British Government, at Klondyke, and on the sea-coast.

TECHNICAL BOOKS.—We have received from H. K. Lewis (136 Gower Street, W.C.) catalogues of new books and editions which have been added recently to his medical and scientific consulting library, which includes works on electrical engineering and allied subjects.

MOTORS.—We have received a small folder from the Union Electric Co. (Park Street, Southwark, London, S.E.), giving prices of their standard direct-current motors. This is arranged in compact form, and of a size suitable for the card case. On the outside a useful table of fuse wires is given.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

A DOMESTIC MOTOR EQUIPMENT.—An outfit for electrically driving sewing machines has been designed by Siemens Brothers Dynamo Works, Ltd. (Caxton House, Westminster, S.W.). The equipment includes a D.C. motor, a foot-control switch, two lengths of flexible cord with plug adaptors for connecting to the supply and switch. The 1-16 h.p. motor stands on two metal rails fixed to the table by a special clamp. It can be fitted to all kinds of treadle machines without alteration, and the machine can be converted again to treadle drive in a few seconds. The speed of the machine is varied by means of the foot-control switch, so that the operator's hands are free.

"UNION" INTERPOLE MACHINES.—A list of direct-current interpole machines has been sent to us by the Union Electric Co. (Park Street, Southwark, London, S.E.). These are listed in a large range of sizes, and can be supplied with various mechanical protections to suit different purposes. In addition, all dimensions, with and without slide rails, are given.

SHADES AND LAMPHOLDERS.—New cards from Simplex Conduits, Ltd., deal respectively with lampholders of English manufacture and "Spookie" shades.

Parliamentary Intelligence.—The East Kent Electric Power Bill has been read a third time in the House of Commons. The Bill promoted by the Rhondda Council for the supply of electricity for power and lighting purposes in the districts of Treherbert, Treordry, Pentre, Ystrad, Tonypandy, Penygraig, Trealaw, Porth, Ynyshin, Tylorstown, and Ferndale has been ordered to be reported for third reading.

"Bottled Sunshine."—According to the *Daily Express*, a bogus company in America has been obtaining money from investors on a scheme for generating electricity from sunshine. An arrangement of mirrors was placed on the roof of a house, and wires were provided by which the energy was taken to "bottles" for storage. Incandescent lamps were claimed to be lighted by the apparatus, but were really fed by a hidden battery. The promoters have been arrested.

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EFFECT OF THE HEAT SPELL UPON CABLE NETWORKS

THOSE in charge of electricity undertakings and distributing networks should not be lulled into a false sense of security by the absence of faults and general leakage on their mains during the long season of hot and dry weather, which is probably now drawing to a close. On the contrary, the unusual conditions of temperature and dryness which have been experienced in this country during the past six weeks or so may eventually in many cases have a very adverse effect upon the cable networks. The heat has penetrated deep into the ground, the cables will have undergone expansion, and the surrounding soil contraction and cracking, due to the expulsion of moisture; unusual strains will have been placed upon the cables and their connections, especially at the points at which they are led into service-boxes, &c., and even solid systems may not have been exempt from the effects of the continuous high temperature.

As soon as the rain sets in, faults and leakages will begin to develop, just as they do soon after thaw and rain follow a long period of frost. As is the case with the large majority of cable faults, however, the result will not be immediate breakdown where small breaks and crevices have occurred in the lead-covering of the cables or at the points of entry to junction-boxes. Frequently such faults can be detected by testing long before they have become sufficiently serious to develop into serious earths or short circuits.

We recommend, therefore, that preparations should be made by the mains departments for dividing up and testing systematically their whole networks as soon as the weather breaks. Not only will it then be possible to discover and repair any incipient faults that may be developing—thus guarding against subsequent surprise interruptions to supply—but this course will have the additional advantage of enabling such repairs as will be needed to be carried out during the season of light load, when the temporary disconnections that may be necessary can be made with the least inconvenience to consumers.

"THE FUSING OF ELECTRIC WIRES"

AT least one daily paper has stated that the serious fire at the Carlton Hotel, London, last week was due to the fusing of electric wires, but our readers are by this time sufficiently experienced to know that this has become almost the stock explanation that is given when the source of a fire is undiscoverable. The official report of the Fire Brigade was to the effect that the cause of the outbreak was unknown, and at the coroner's inquest on Saturday there was not a particle of evidence pointing to the fire having originated in the electrical circuits. Superintendent W. J. May, of the Fire Brigade, said that there were wires short-circuited after the fire, but it is hardly conceivable that this should be otherwise in view of the general damage done to the building. Another witness, Mr. S. Neumann, the staff manager, spoke of noticing a smell resembling that of burnt rubber while on his round, but as he saw the fire well alight and flames shooting through the service lift when he got downstairs, the smell he noticed was obviously that of some burning material after the outbreak, and does not point in any way to the fire being occasioned by the short-circuit of a cable.

As was to be expected, the jury found that there was not sufficient evidence to show how the fire originated.

Electricity in Textile Mills.—In a note on page 442 of ELECTRICAL ENGINEERING of August 3rd, we regret that the name of Mr. S. D. Schofield, Electrical Engineer to the Shipley Urban District Council, was given incorrectly as J. Schofield in the list of members of the Textile Mill Driving Joint Committee.

CORRESPONDENCE

THE ELECTRICAL CONTRACTORS' ASSOCIATION.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—You ask why the E.C.A. is not progressing. I may sum up the situation in one word: "jealousy." Our branch here has not met for *eight* months. Ask why, and the reply is "There is nothing to discuss."

This is pure nonsense. There are many burning questions to discuss: The general keeping up of prices; the keeping out of little firms that spring up for a year, break the prices, and go bankrupt; the blacklisting of competing wholesale houses; &c.

For anything to be done to meet *any* of these difficulties contractors must have confidence, and lay information before *regular* meetings. It is here the big failure comes. Contractors are frightened of bringing up anything that may place a competitor in possession of the name of a customer. The same with the wholesale-cum-wiring house. The idea is to get the sublet contract. Refusing to tender and blacklisting the firm seems to be utterly unthought of. Others will tender if we don't, is the cry.

A scheme of development with some backbone in it organised from the central office. Something to show what the C.M.A. exists for, and then for big revival meetings. Each member seeing how many contractors he can get to come. An active policy, and then we shall have sufficient weight to make ourselves a power instead of a sleepy, go-as-you-please, troubles-must-not-be-mentioned, pleasure club.

Yours faithfully,

Sheffield. H. G. HALL.
Aug. 15th, 1911

ELECTRIC STEEL

AN interesting article appeared in last week's "*Times* Engineering Supplement" on the claims of the electric furnace for melting and refining steel. It is pointed out that the electric furnace can give larger casts with cheaper and cleaner melting, and that the demand for big ingots of crucible quality for die ingots up to 2 tons weight of sound and regular steel for crank shafts and car axles is growing rapidly.

The writer points out that a 2-ton electric furnace cast is as easy if not easier to effect than a 50-lb. crucible cast. Taking the theoretical figure of 490 Board of Trade units for melting, superheating, and "killing" one ton of steel, and assuming an efficiency of from 50 per cent. to 55 per cent., and a price of 0·6d. per unit (which is being charged by the Sheffield Corporation for this purpose), the melting cost for power comes out between £2 and £2 3s. per ton of steel product, say £3 when lining repairs, &c., are included. This can be compared with the cost of about £7 10s. per ton by the ordinary methods. The writer thinks that the immediate commercial future of the furnace is for small foundries making light and intricate castings, and considers that the characteristics of electric furnaces at the present time fit them for the manufacture of special steel for which there is no demand in great bulk. Later on he thinks that the results will lead to the replacement of crucible steel, Swedish billets, and products of intermediate quality, by electric steel in tube-making concerns. The statement that has been made that the electric furnace can produce a high-class steel from inferior materials he characterises as merely an enthusiastic deduction from laboratory experiments.

As to the characteristics of electric steel, he points out that steel can only be freed from occluded gases and deoxidised by an iron free slag, and it is on this that the superiority of electric over other steel depends. He gives particulars of some tests which certainly show the superiority of electric over ordinary steel, but he points out that the quality depends not only on the purity of the raw materials, but largely on the skill of the metallurgist, and he sounds a note of warning against forming a judgment on the material produced by inexperienced melters or ineffective furnaces.

The Institution of Civil Engineers.—The Council of the Institution of Civil Engineers have made the following awards in respect of students' Papers read during the session 1910–1911:—The "James Forrest" Medal and a Miller Prize to Mr. D. Hay, B.Sc. (Birmingham), and Miller Prizes to Messrs. D. A. Howell (Bristol), R. Bonner (Bristol), G. F. Walton (London), R. G. Parrott (Manchester), E. E. Farrant (London), A. C. Dean. B.Sc. (Manchester), H. W. Coales (Birmingham), A. H. Meade (London), A. C. Swales (Leeds), and H. J. F. Gourley, B.Eng. (Manchester).

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published August 10, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

16,904/10. **Contact Switches.** S. Lichtenfeld. Two strips of thin sheet-metal of opposite polarity are placed on either side of a room under the carpet. Extensions, arranged alternately, are attached to these. A series of curved strip metallic springs are fixed to one set of extensions, which bridge one or more of the extensions of opposite polarity, so that when they are subjected to pressure, contact is made and the circuit completed. These are suitable for working electric circuits, burglar alarms, etc. Five figures.

17,236/10. **Grinding Carbon Brushes.** A. Watkins. A machine for grinding the contact surfaces of dynamo brushes has a rocking frame with inclined sides, and carried by a spindle. The spindle is mounted in side frames supporting a cross piece, which carries a wooden block with a curved surface to correspond to that of the commutator. One end of the spindle is fixed to a handle for rocking the frame to and fro, and over the block a sheet of glass-paper is placed, and fixed by clamps at each end of the frame. The brushes are held in a fixed position by carriers attached to the centre of the side frames, and are adjusted to the desired angle by a pivoted plate holding the same. This may be set to any angle by a rod engaging with radial slots formed in the carriers and fixed by screw nuts. The grinding is effected by working the handle backwards and forwards. Four figures.

17,469/10. **Tungsten Filaments.** F. Eisner. A new binding medium, which renders the filament free from carbon, is composed of hydrazine or its compounds, which is mixed with the tungsten. The mixture is squirted through a dye, forming a thread, which is heated in vacuo or in a reducing gas to convert it into a conductor. This heating partly decomposes the mixture and allows some of the metallic elements to escape. In order to complete the elimination of the foreign elements, and to weld the tungsten particles together, the filament is flashed by a current in a glass bell.

17,684/10. **Heating Apparatus.** R. F. Venner. For the purpose of increasing the efficiency of such apparatus, an insulated resistance conductor is immersed in mercury, which is poured into the heating vessel. This is made of a material which is not affected by the mercury. The conductor terminals are hermetically sealed into the vessel, which may be advantageously exhausted of air. The heat generated in the conductor causes a continuous circulation of the mercury, which transfers the heat to the walls of the vessel, the surface of which is much larger than that of the conductor itself.

21,206/10. **Production of Metals.** J. Härdin and Electric Furnaces & Smelters, Ltd. This invention refers particularly to the reduction of tin ores. Both the reduction and the purification of the impure metal are effected at a very high temperature of 1,500 to 2,500° C. in one, instead of the usual two furnaces. The impurities are removed by adding to the furnace a quantity of a strong and rapid oxidising agent, such as saltpetre, in the form of briquettes from 1 in. to 1½ in. cube. To prevent the metal leaking through the porous lining, the latter is lined at the back with sheet-metal, with openings at the lowest part, through which the metal can escape into a channel underneath. Two figures.

27,240/10. **Incandescent Lamp.** R. Bacci. A lamp capable of being disassembled for the renewal of parts, has the glass part of the base, which makes contact with the bulb, made either concave or convex, and their surfaces are ground so as to make an exact fit. In addition to this, air-tightness is further assured, first by coating the surfaces very uniformly with a fatty substance, such as grease having a graphite base, and secondly by a collet of a substance soluble in boiling water, which is placed around the exterior of the joint. The grease does not solidify nor effect a tight hold when the lamp is put into boiling water, but allows the bulb to come away. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad. Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables & Wires, Insulating Materials, &c.: Bullers, Ltd., and Twiss [Insulators] 3,272/11.

Dynamos, Motors and Transformers: Electric & Ordnance Accessories Co., Garner, and Mueller [Controllers for] 17,349/10; Hallstream [Automatic stopping of machines] 18,012/10; Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [Controllers] 18,191/10; Brown, Boveri & Co. (*Akt.-Ges. Brown, Boveri et Cie.*) [Dynamos] 18,195/10; Fried. Krupp Akt.-Ges. [Separately-excited current generators] 7,045/11.

Electrometallurgy and Electrochemistry: Helfenstein [Furnace] 17,650/10; Imray (*Shawinigan Carbide Co.*) [Furnace electrodes] 9,633/11.

Incandescent Lamps: Wardle [Lanterns for] 18,241/10; Pape, 29,939/10; Lobel and British Ever Ready Electrical Co. [Portable] 9,050/11.

Instruments and Meters: Kessels [Printing telegraph instruments] 17,322/10; Weintraub [Meters] 3,648/11.

Switchgear, Fuses and Fittings: Olvis [Switching means for accumulator charging] 9,775/10; Reyrolle and A. Reyrolle & Co. [Cut-outs] 19,851/10; Leitner [Automatic switches] 20,257/10; Sutton and Sutton [Control of electrical circuits] 20,685/10; Etchells [Push-button switches] 22,355/10; Electric & Ordnance Accessories Co. and Collins [Time limit devices] 4,457/11; Wallace and Graham [Switch] 6,861/11 and 6,862/11; Creswick and Bentham [Cartridge fuses] 9,038/11.

Telephony and Telegraphy: Neuhold [Automatic systems] 23,669/10.

Traction: Siemens Bros. & Co. (*Siemens & Halske Akt.-Ges.*) [Alt.-current block circuits for signalling] 10,834/11.

Miscellaneous: J. Hawley, Ltd., Saunders and Jones [Electromagnetic separator] 17,126/10; Belshaw [Electric light reflector] 17,902/10; Tribelhorn [Driving mechanism] 3,151/11; Timar and Presser [Welding] 4,602/11; Whalton [Hammers] 12,742/11; Galletti [Production of quenched spark discharges] 10,639/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: Benz & Co., Rheinische Gasmotoren Fabrik Akt.-Ges., 16,604/11.

Electrochemistry, &c.: Elektrochemische Werke Ges. [Production of ammonium nitrate] 16,426/11.

Switchgear, &c.: Stille [Switch] 13,648/11; Gasnier [Electromechanical speed control] 16,644/11.

Miscellaneous: Chemische Fabrik Buckau [Manufacture of magnetite electrodes] 16,902/11.

Amendments

25,129/09. **Block Signalling Systems.** Hans Theodore Hansen. The amendments to this specification, referred to in Electrical Engineering of June 15th, 1911, p. 334, have been allowed. It deals with a method of utilising Hertzian waves, which control an apparatus on the train for setting a signal at danger.

25,670/10. **Röntgen Ray Apparatus.** H. F. Bigge and F. R. Butt. As a result of the extended investigation under Section 8 of the Patents Act, a disclaiming note has been inserted in this specification. It provides certain improvements, so that it can be used for either right- or left-hand operation, or from above or below the patient.

1,037/11. **Switches.** A. W. Penrose. This specification has been amended under Section 8 of the Patents Act, by way of disclaimer. It deals with the construction of a switch in convenient form for readily attaching the conductors.

Expiring and Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: A. Gross, 9,591/07.

Distributing Systems, &c.: Bullers, Ltd., and E. H. Chambers [Insulators] 9,515/07; S. B. Storer [Transformers] 9,683/07.

Dynamos, &c.: Akt.-Ges. Brown, Boveri et Cie. [Regulation of] 9,306/04 and 9,385/04; A. F. Hills, D. Urquhart, and A. E. Honey, 9,372/04; Elektricitäts Akt.-Ges. Vorm. W. Lahmeyer & Co. [Regulation of] 8,785/06; F. Thursfield [Control of] 9,576/07.

Instruments, &c.: B. North and R. Pohl [Meters] 9,463/07.

Storage Batteries: H. W. Lake (*C. E. Hite, U.S.A.*) [Primary] 9,477/07.

Switchgear, &c.: W. W. Lackie, W. T. Calderwood and W. H. D. MacEwen [Switches] 9,535/03; V. Mainprize [Cut-outs] 9,434/07; P. Watson [Switches and cut-outs] 9,652/07; C. A. Day (*Dr. Paul Meyer Akt.-Ges.*) [Switches] 9,743/07; Electric & Ordnance Accessories Co. and R. F. Hall [Cut-outs] 9,868/07.

Telephony, &c.: Oliver J. Lodge [Telephones] 9,712/98; J Murgas [Wireless telegraphy] 9,726/07; H. J. Roberts, 9,923/07; D. Marzi, 17,704/07.

Traction: S. P. Wood and Mackenzie & Holland [Signal contacts] 9,377/04; H. H. Lake (*Hall Signal Co., U.S.A.*) [Signalling] 9,586/04; A. N. Connett [Points, switches, and conduits] 8,931/05; J. F. Simpson [Track brakes] 9,390/07; H. M. Abernethy and G. L. Weiss [Semaphore signals] 9,437/07, 0,438/07, and 9,439/07.

Miscellaneous: A. E. T. Bergstrom [Locking device for submarine mines] 9,465/07; G. Whittaker and J. R. Ashworth [Magnetic Separators] 9,718/07.

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ELECTRIC TRACTION NOTES

The attention of most persons in this country lately has been focussed largely upon the strikes and general labour unrest which has been spreading like an epidemic throughout the land during the last few days, presenting problems still far from solution. So far as the electric traction industry is concerned, the most serious manifestations have been at Glasgow, where on Saturday morning last, after a midnight ballot, about 2,000 motormen and conductors, out of the total of 2,739, struck work, and the service was practically suspended, with the accompaniment of rioting, collisions with the police, damage to the cars, and injury to several persons. The points at issue have been under discussion for some time, and are mainly connected with hours of labour, as to which a compromise was thought to have been arrived at. Attempts were made to persuade the employees at the Pinkston power station to come out, but these remained staunch to their duty. A mass meeting was held on Sunday night, and further disorder broke out. The situation improved slightly on Monday, while the decision of the Corporation was awaited, and a limited service was run with some difficulty. The tramway committee decided to leave the matter in the hands of Mr. Dalrymple, the general manager, and late in the day the men agreed to abide by the arbitration of the Board of Trade. On Tuesday the strike had practically collapsed, and the full service was resumed. Many of the men, however, will not be reinstated. The loss in revenue is estimated at £6,000.

The state of affairs in London is also causing some uneasiness. The men have formulated a series of demands, and, if a satisfactory reply is not received, threaten to hold a mass meeting on Saturday, followed by 24 hours' notice of a general strike on Monday. A scheme of Conciliation Boards has been in operation since Nov., 1909, and has so far dealt satisfactorily with matters in dispute, but the men addressed a deputation direct to the Highways Committee in April last, urging certain demands for slightly higher wages, but mainly revision of working hours; but the Council were unwilling to override the Conciliation Boards, and hence the present deadlock. The final reply of the Council was expected last night.

There is also some unrest among the London Tube railway men, who have taken advantage of the situation to urge demands formulated before the present labour struggles began. A statement has, however, been made by the general manager of the City & South London Railway that there is no disaffection on that line.

In several other towns dissatisfaction has been expressed by labour organisations claiming to represent tramway men, including Blackpool, Preston (where a threatened strike was averted by certain concessions last week), and on the Mossley, Hyde, and Dukinfield tramways, where a demand for increased wages and holidays has been refused by the Ashton Corporation. The motormen and guards on the electrified section of the Lancashire & Yorkshire Railway are also threatening to make common cause with the Liverpool railway strikers.

A strike of the tramway men at Douglas (Isle of Man) has been settled by a revision of wages.

The tramway men at York have also been holding meetings to urge their grievances.

We recently published a note referring to the purchase by the Birmingham Corporation of some sections of the company-worked lines in the district for a sum of £151,500, and are now able to add some additional particulars with regard to the transfer arranged. With the falling in of the leases of the cable line operated by the City of Birmingham Tramways Co. and of the company's electrical lines along the Bristol Road and Pershore Road, the company was left with three "fag ends," viz., (*a*) One at the end of the Bristol Road route, including a power house and depot, about 0·6 mile long; (*b*) a length of line at the end of the Stratford Road route, about 1¼ miles long; and (*c*) a length of line about 0·9 mile long at the end of the Yardley route. In addition to these fragments the City of Birmingham Tramways Company was operating the whole of the tramways in Aston on behalf of the Aston Local Authority. At the present moment all these lines are outside Birmingham, but on and after Nov. 9th next they will be included in the area embraced by Greater Birmingham. The Birmingham Corporation, which has made it a *sine quâ non* for some time past that all tramways in Birmingham shall be operated by the Corporation, were naturally anxious to acquire the residual interests of the City of Birmingham Tramways Company, and, after lengthy negotiations, have purchased these interests, lock, stock, and barrel, for the round sum mentioned, viz., £151,500. These lines will, until the end of the year, be operated by the Company for and on behalf of the Corporation, and from the beginning of next year will pass completely over to the Corporation. The cars of the Birmingham and Midland Tramways Joint Committee (to which the City of Birmingham Tramways Company belongs) will continue to have access to the city, as the working arrangements with the Birmingham Corporation are of a very friendly character and mutually satisfactory. The cars from Dudley already run into the heart of Birmingham under an arrangement with the Corporation, and in a few months' time the cars from West Bromwich will do the same.

The annual report of the Salford Corporation tramways, which now embrace 75 miles of route, employing 200 cars, records an increase in receipts of £4,636. The receipts average 9·98d. per car mile. The year's working resulted in a gross profit of £87,277, of which, after capital charges and payments to local authorities for running powers, &c., had been met, and contributing £692 to depreciation and renewals fund, left £18,750 available for relief of rates. The total working expenses averaged 6·411d. per car mile.

The introduction of trolley omnibuses on the Clepington Road route, Dundee, as feeders to the Maryfield and Downfield routes, has been definitely decided upon. The matter has been under consideration for some time, and a deputation visited the Continent in connection with the matter some time back.

At the annual meeting of the New General Traction Company, Baron d'Erlanger expressed himself confident that the corner had been turned. They awaited the result of arbitration as to the price that they would receive for the Coventry system when taken over by the Municipality, but it was now paying 5¾ per cent. instead of 3½ per cent. as before. The Norwich system was also improving. The profit for the year was £3,675, against £501 for the previous year.

The North Metropolitan Tramways Co. have still their Leytonstone and Barking depôts to be disposed of. As soon as purchasers are found for these the company will go into liquidation.

The year's working of the Stalybridge and District tramways has resulted in a deficit of £5,938. The working expenses per car mile are given as 5·44d.

An interim dividend of 5 per cent. is announced on the ordinary shares of the Oldham, Ashton & Hyde Electric Tramways.

According to an official report just issued, the last extension on the L. and Y. Rly. Co.'s lines to Town Green is already showing gratifying results. One half of the total increase in the number of passengers carried by the L. and Y. Rly. Co. during the past half-year was in respect of the company's electrified lines.

Among forthcoming foreign electric traction enterprises mentioned by the *Board of Trade Journal* are a line from Sevastopol to Alushta (about 84 miles), for which Imperial assent has been granted to the formation of a company by a Mr. Ushkoff, and additional tramways at Barcelona and Madrid.

The York City Council have decided not to proceed at present with the tramway extensions on the Heworth route.

At the yearly meeting of the Mersey Railway Co., J. Falconer, Esq., M.P., the chairman, in reply to a question, stated that the Tirrill Regulator recently installed was effecting a saving of £500 a year, so that it has abundantly justified itself.

The last half-year's working of the Dublin and Lucan Electric Railway has resulted in an available balance of £919 after providing for debenture interest. A dividend at the rate of 5 per cent. on the preference shares is to be paid, with £444 carried forward.

The Board of Trade have inspected and passed the Lanarkshire Tramway Co.'s extensions from Motherwell to New Stevenston.

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Plans have been approved by the Stalybridge Corporation for reconstruction of track on the Ditchcroft Hill section of the Stalybridge, Hyde, Mossley, and Dukinfield tramways in view of a recent accident.

A network of local lines in southern Hungary, which are now worked principally by petrol-electric cars (see ELECTRICAL ENGINEERING, Vol. IV., page 510), are to be converted to electric traction with overhead lines at 1,650 volts continuous current. Current will be supplied over a three-phase line from a power station at Arad, and converted to 1,650 volts continuous at a sub-station at Gyorok. Each motor coach will have four 50-h.p. motors, arranged in groups of two in series.

According to *Elektrische Kraftbetriebe und Bahnen*, the tramways at Parma are equipped on the single-phase system with 400 volts contact line pressure, and employ the Brown, Boveri Co.'s Deri motor, in which the whole of the control is effected by shifting the brushes. The newest cars have two 25 h.p. motors, and the controller hand wheel is connected to the brush holders by flexible shafts.

A Paper by J. Petit, recently published in the Bulletin of the Soc. Internationale des Electriciens (Paris), contains an account of the Nord-Sud Metropolitan Railway of Paris, which is distinct from the other metropolitan lines and has been in operation for nearly a year. The line is about 12 miles in length, and is run on the three-wire system with 1,200 volts continuous, using the track as neutral conductor. Each train has a motor-car at either end provided with four 125 h.p. motors arranged in groups of two in parallel. One motor-car takes current from the overhead wire, and is thus on one side of the three-wire system, and the other is connected by shoes to an insulated third rail, which forms the other outer conductor and is thus on the other side of the system. This arrangement avoids earth currents, and the insulation has only to be designed for 600 volts. The overhead circuit feeders are of aluminium cable. Some of the motors are of the Thomson-Houston interpole pattern, and others, without interpoles, were supplied by the Westinghouse Co. The power supply is 13,000 volts three-phase, which is converted by transformers and 1,500 kw. rotary connectors in the substations to 600 volts continuous. The convertors are of the American General Electric Co.'s interpole design, and are arranged in pairs on the two sides of the three-wire system.

A form of petrol-electric road train, known as the Müller road train, which has been adopted experimentally by the German Army, is described in *Motor Traction*. The locomotive is equipped with two petrol motors aggregating about 180 h.p., and placed one at each end. These drive continuous-current generators contained in the central cab, which supply current to motors geared to every axle throughout the train. Each vehicle, including the locomotive, is provided with two two-wheeled bogies, upon each of which is mounted a motor driving through a differential gear and side chains. The bogies are connected together by the coupling rods between the vehicles in such a way that every vehicle steers itself automatically in the path of the locomotive. Either one or both of the generating sets may be used according to circumstances, and the control is mainly by generator shunt regulation. Electric braking throughout the train is provided for. For train making up purposes each vehicle is provided with a controller, so that it can be moved about independently by being connected to a flexible trailing cable. The cars can also be fitted with electric cranes if required. A complete train can transport a load of 30 to 33 tons in six waggons at about eight miles per hour.

The Federal Storage Battery Car Company, New York, has issued some striking average figures on the daily performance of Beach cars equipped with Edison batteries. A double-truck car, carrying 190 cells and four 15-ampere 200-volt motors, ran 312·2 miles, making 1·9 stops per mile. It propelled a weight of 16·8 tons at 20·2 miles per hour over an average maximum grade of 1·84 per cent., and it required only 43·8 watt-hours per ton mile. Its longest run on one charge was 135 miles. A single track car with 90 to 110 cells and two 30 ampere 85-volt motors ran 110 miles a day. It made five stops per mile, and carried seven passengers per car mile. It operated over grades of 3·8 to 4·5 per cent., and required 63·4 watt-hours per ton mile. The weight of the car is 7 tons, and it is geared for a speed of 22 miles per hour, including stops. This car has taken the place of steam equipment, and is said to save £7 a day in operating expenses.

TRANSMISSION SYSTEM OF THE CENTRAL COLORADO POWER CO.

A PAPER on the above system was read by P. T. Hanscom at the Annual Convention of the American Institute of Electrical Engineers, of which the following is a summary.

The transformers at the Glenwood power house and at all sub-stations are "delta" connected. Those at the Boulder power house are star connected, and are operated with ungrounded neutral. Two overhead earth wires are used throughout the Boulder line, and for a distance of five miles from any station on the Glenwood line, and they are earthed at each tower. The standard span is 660 ft., and the average throughout the lines is 750 ft. The conductors on the Glenwood line are No. 0 B. & S. copper, composed of six strands with a hemp centre, except between Leadville and Dillon, where they are of No. 1 copper, which is also used on the Boulder line. They are drawn to an elastic limit of 35,000 lbs. per sq. in., and ultimate strength of 60,000 lbs. per sq. in. There are a number of spans of 1,500 ft. and 2,000 ft., and one span of about 2,900 ft. with standard copper conductors. At some of the railroad crossings, and in a few spans exposed to severe winds, ½ in. high-strength stranded steel cable is used for conductors. The records of the operating department show ten interruptions during the season of 1910 from 63 lightning storms on the high-tension lines.

No electrical difficulties were traced to the insulators, while the mechanical difficulties of the insulators were limited to a few defective connecting links between units. The normal strength of the links was equal to the No. 0 conductor. In local sections exposed to the more violent winds, some difficulties were experienced from lack of stability of the conductors due to low horizontal stress and low vertical component at the point of support. In some of the spans where the line crosses the opening of canons, the wind which whirled with great force tended to lift the entire span. This shook the conductors violently, and mixed them up generally. It was therefore necessary to dead-end the spans, to increase the horizontal stress, and in one case, even to increase the spacing of the conductors. High-tension switches of the oil-break type are installed at all sub-stations, and no difficulties occurred in the operation of them with or without load. Under the present operating conditions, the power factor at all the power stations is about unity, so no attempt was made to control the charging current of the line. There are two 5,000 kw. generators installed in the Glenwood power house, and two of similar capacity at the Boulder power house The combined water-wheel capacity at both plants is 39,000 h.p. Aluminium cell lightning arresters are installed in some places, and their performance was satisfactory. Snow and sleet collect on the wires at the lower elevations during the spring and autumn months, and in one instance before the line was in commission the accumulation on a No. 0 conductor was found to be 1·9 lb. per linear foot. The voltage regulation at the Denver sub-station under normal working conditions is within 1 per cent. of a given value, the departure from which for different periods of the day is about 3 per cent.

SCHONEBERG-BERLIN UNDERGROUND RAILWAY

THE rolling stock on this line consists of twelve motor-cars. The electrical equipment of each of these, which are under multiple-unit control, consists of two 750-volt 40 h.p. direct-current motors. The brakes consist of a hand equipment and Siemens-Schuckert air brakes, which can be operated by the passengers in cases of emergency. Short-circuiting brakes are available should the air brakes fail. Each car is illuminated with 40-watt tantalum lamps, and are all equipped with Hartmann and Braun current clocks. These operate only when current is in the motor circuit. It was found that they reduced the current consumption by about 10 per cent. The energy is transmitted to a sub-station at 6,600 volts, which is transformed to 780 volts direct current by two 750 kw. motor-generator sets. A 375-cell storage battery is also installed. This has a discharge capacity of 888 ampere-hours, and is used in circuit with a reversible booster. It also supplies a 750-volt lighting circuit through two independent circuits for the tunnels and stations. One of these circuits is a bare copper wire, which is carried on porcelain insulators, so that the line can be tapped at any point for lighting and power.

The tunnel service is greatly assisted by the use of a

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private telephone system, and an elaborate clock synchronising system is installed to insure the same time at all stations. The clocks are operated electrically in half-minute impulses in synchronism with the master clock. A relay system is used in cases where the distance from the main clock is too great to insure absolute synchronism. They are regulated to keep the same time as those of the Berlin subway system.

In the car house an ingenious scheme is provided to shift cars without employing the third rail. This is accomplished by using an overhead trolley carriage. One side of this has a collecting mechanism running in an overhead contact trough, and the other a pair of wheels which run on an overhead track parallel to the trough. The trolley rod, through which the current is conveyed, carries a contact shoe, and this makes contact with a recessed casting on the top of the car. In order to keep the contact shoe free of the car roofs, the rod is under tension. Directly the shoe is interlocked, the car can be moved along until it strikes a stop in the trough. This stop automatically disconnects the car when it reaches the third rail section. This method renders the car independent of the ordinary conductors. The contact rail, which is of soft iron of **T**-section, is placed on vulcanised rubber insulators, having a cast-iron base. For these particulars we are indebted to the *Electric Railway Journal*.

LOCAL NOTES

Aldrington: *Electricity Accounts.*—The year's working has resulted in a deficit of £207, as against that of £404 for the previous year.

Berlin: *Labour Unrest.*—Reuter states that some 3,000 electrical fitters are agitating for higher wages.

Brighton: *Electrical Exhibition.*—It has been decided to hold an exhibition of electrical appliances in the entrance hall of the Aquarium during October.

Burnley: *Supply to Reedley Hallows.*—The Rural District Council on August 10th decided to consent to the application by Burnley to the Board of Trade, for the grant of a Provisional Order under the Electric Lighting Acts, authorising the supply of electricity within the parish of Reedley Hallows.

Cheltenham: *Extension of Area of Supply.*—Application is to be made to the Board of Trade for a Provisional Order extending the area of supply to include Leckhampton, Swindon, Prestbury, Bishop's Cleeve, Southham, Brockhampton, and Woodmancote, and the Borough Electrical Engineer has been instructed to prepare a scheme.

Donaghadee (Ireland).—The Council's Electric Lighting Order, which has passed its third reading in the House of Lords, has been amended with respect to breaking up of a railway crossing so as to make it necessary for application to be made to the Board of Trade if it should be decided to carry the lines under the railway.

Ealing: *Electricity Accounts.*—The past year's working has resulted in a profit, after meeting capital charges, of £1,665, of which £118 has been expended on disconnecting pillars, £316 has been transferred to machinery replacement account, and £208 has been paid to permanent men engaged on capital account, and about £100 expended on cookers and arc lamps for hiring out. With the inclusion of last year's balance, £4,275 is carried forward.

Finchley: *Interruption of Supply.*—Owing to a fault on the main, the street lighting in part of North Finchley was extinguished on Sunday and Monday nights.

Glasgow: *Electricity Accounts.*—The year's revenue has increased by £14,567, largely due to new power consumers. The final surplus on the year's working was £6,680, and the total costs work out at just under 1·5d. per unit.

Police Lamps.—The Chief Constable suggests that electric lamps be substituted for oil lamps for the constables, and the matter has been remitted for consideration and report.

Herne Bay: *Interruption of Supply.*—Owing to a mishap to an engine, the electric light on the new pier pavilion was extinguished last Friday night for an hour or two.

Hessle: *Electricity Supply.*—The Hessle Urban District Council has adopted a scheme for the purchase of supply in bulk from the City of Hull.

Irvine: *Lighting of the Harbour.*—The Harbour Trust has decided to obtain a report on the cost of lighting the harbour by electricity, and as to what further use could be made of that power with a view to cheapening the costs in any other branch of the harbour plant.

Killeshandra (Ireland).—An inquiry has been held by a Local Government Board inspector into an application by the Cavan Rural District Council for power for electricity supply in Killeshandra.

London: *Islington.*—The price of street lighting is to be reduced from £12,000 to £11,000, and the surplus of £1,000 is to be applied to relief of rates.

Lytham.—Mr. Butterworth, a solicitor, of London, has intimated to the Council that he intends, on behalf of a client, to apply to the Board of Trade for an Electric Lighting Order for this Urban District.

Newport (Mon.): *The Electricity and Tramway Undertakings.*—The Town Council, after considerable discussion, adopted a resolution at the last meeting, that the Electricity Committee be requested at an early date to report to the Council upon the whole position of the administration of the electricity and tramway undertakings, and as to any, and if so what, changes are desirable in the present control and management.

North Berwick: *Electricity Supply.*—A site for a generating station has been leased to the Company on the application of Messrs. Crompton & Co.

Oldham: *Motor Hiring.*—On account of a local protest, the Town Council have decided to discontinue motor hiring, provided that local traders will take up the business.

Turin (Italy): *Fire.*—The Northern Italy power station, which supplies the greater part of Turin, has been almost entirely destroyed by fire. The City tramway service is at a standstill, but the Exhibition, which, as described in another column, has its own power station, is not affected.

Whitworth (Lancs.).—The District Council here have applied for an extension of their Electric Lighting Order of 1905.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Dublin.—The Local Government Board has now sanctioned a further loan of £50,000 in addition to the £50,000 already sanctioned out of the £128,129 originally applied for. A clearer statement of the proposals is required before the remainder is sanctioned.

Dumbarton.—Extensions are to be made to the electricity works.

Hereford.—It has been decided to apply to the Local Government Board for sanction to the following loans:—£500 for short extension mains; £1,000 for services; £850 for mechanical stokers.

Ipswich.—Tenders are required by Aug. 24th for the annual contract for paper-insulated underground cables. Fee, £1 1s. Particulars from Chief Engineer, Constantine Road.

Penang.—Tenders are invited by the Municipal Commissioners of Penang for one 500 kw. steam dynamo, condensing plant, and switchgear. Fee, £1 1s. Particulars from Preece & Cardew. Tenders by Sept. 5th.

Wimbledon.—A Local Government Board inquiry was held last week into an application for a loan of £7,459, in connection with the supply of the Maldens and Coombe.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

LONDON.

Westminster.—Reconstruction of Middlesex County Guildhall.

Upper Tooting.—Primitive Methodist lecture hall, Lynwood Road. A. W. Edwards, 11, Foxbourne Road.

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PROVINCES.

Birmingham.—Parcels office extensions. Secretary, H.M. Office of Works, London.

Blackpool.—Electric light fittings are required for the new central library and art gallery. Particulars from Borough Electrical Engineer, West Caroline Street.

Bradford.—Corporation milk depot. Town Clerk.

Brighton.—Grammar school. Architect, S. B. Russell, 11, Gray's Inn Square.

Bristol.—Extensions to Grand Hotel. F. A. Jenkins, 44 Corn Street.

Carmarthen.—Extension to asylum. W. J. Wallis Jones, 34 Quay Street.

Edinburgh.—Ice rink at Fountainbridge, Edinburgh. Ice & Cold Storage Co., Ltd.

New school at Viewforth.

Farnborough.—Fire station. J. A. Hargreaves, Surveyor, Town Hall.

Gravesend.—Electric light is to be installed in the Technical School.

Lochgelly.—Additions to school. R. Small, Clerk, Town House.

Maidstone.—New County Council offices.

Mansfield.—New post office. Secretary, H.M. Office of Works, London.

Mansfield Woodhouse.—New Mission Church.

Northfleet.—Tenders are required for lighting of the Factory Club. W. H. Browne, Park House, Gravesend. Fee, 5s.

Nottingham.—Veterans' club. Architect, A. Marshall, King Street.

Pontefract.—Public Baths (Borough Surveyor).

Pontypridd.—New schools at Treorchy.

Ramsbottom (Bury).—A movement is on foot for electric lighting of St. Paul's Church.

Richmond.—Receiving homes. Architect, E. J. Partridge, Bank Chambers.

Rochdale.—Nurses' home at the Dearnley Workhouse.

Romford.—New council school. Architect, A. S. R. Ley, 214, Bishopsgate, E.C.

Swinton and Pendlebury.—Tenders are invited for electric lighting of a school in course of erection. T. J. Bushell, architect, John Dalton Street, Manchester.

Wareham (Dorset).—Drill hall and offices. Fletcher, Son, & Brett, Wimborne.

Wigan.—Isolation Hospital (A. Bornes, Surveyor, Town Hall).

Wye.—Extensions to Agricultural College.

MISCELLANEOUS

Australia.—Tenders are invited by October 3rd for paper-insulated lead-covered telephone cable by the Melbourne Deputy Postmaster-General. Particulars from 73 Basinghall Street.

France.—An expenditure of £466,708 has been authorised for improving the Paris telephone system.

London.—Tenders are required by Sept. 10th for telegraph poles by the General Post Office. Particulars from G. Morgan, Controller of Stores, 17-19 Bedford Street.

Sunderland.—Side lifeguards are to be fitted to the tramcars at an estimated cost of £250.

TENDERS RECEIVED AND ACCEPTED

Balmain, Australia.—The Balmain Electric Light & Power Supply Company, Ltd., have placed an order with Willans & Robinson, Ltd., Rugby, for a 500 kw. Willans Impulse-disc and drum mixed-pressure steam turbine, coupled to a general electric alternator and exciter. The turbine will exhaust into a vacuum augmentor surface condensing plant, which Willans & Robinson, Ltd., will also supply.

Bordon Camp.—Willans & Robinson, Ltd., Rugby, have received an order from the War Office for three Willans-Diesel direct-current generating sets to the specification of Messrs. Kennedy & Jenkin.

Haslingden.—At Haslingden Board of Guardians, on August 10th, the following tenders were accepted:—Mr. C. D. Copland: low-tension main cable between transformer chamber and main switchboard, £52 12s. 6d.; four vertical end boxes, £6 2s.; 50 yds. of rubber-covered cables, 2s. 4d. per yd.; coupling and laying cable, £3 10s.; seven lanterns, 37s. each; two pillar standards, £13. The tender of Messrs. Simpson Bros., of Hapton, for telephone and bell installations in the new infirmary (£42) was also accepted.

New Zealand.—The tender of the General Electric Co. for electrical plant, switchboards, and motor pumps for the Gisbourne Council has been accepted.

APPOINTMENTS AND PERSONAL NOTES

An engineer experienced in tramway track and concrete bed construction is required by the City of Santos Improvements Co. (See an advertisement in another column.)

It is announced that the partnership between W. C. C. Hawtayne and G. A. Zeden, carrying on business as consulting engineers at No. 9, Queen Street Place, in the City of London, under the style of Hawtayne & Zeden, has been dissolved by mutual consent as and from the 30th day of June, 1911. All debts due to and owing by the said late firm will be received and paid respectively by Mr. Hawtayne, who will continue the said business in his own name.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £58 5s. to £58 15s. (last week, £58 to £58 10s.).

Cables.—A firm in Turin desires to represent a British manufacturer of wires and cables.

J. L. Cateaux & Co.—We are informed that the business of Messrs. J. L. Cateaux & Co. (10 Bush Lane, Cannon Street, E.C.), including all assets and liabilities as from July 1st, 1911, has been acquired by the London & Rugby Engineering Co., Ltd., of the same address. Any accounts owing by Messrs. J. L. Cateaux & Co. will be settled by them as they become due, and all accounts owing to Messrs. Cateaux should be settled with the London & Rugby Engineering Co., Ltd. The business will be carried on by the new company on the same lines as heretofore, and will be managed by the principals of the old firm.

Mr. A. J. Greenly informs us that he has joined Mr. Marcus Heber Smith (115, Fleet Street, E.C.), who has a large business among the most prominent British advertisers in supplying them with ideas and designs for all kinds of business literature. Mr. Greenly, whose experience in this class of business has included four years in the advertisement department of Electrical Engineering, will devote himself chiefly to the branch of the business in connection with electrical and engineering industries. Mr. Greenly desires us to make it clear that his firm are neither printers nor advertising agents, and while it is a department of their business to act as advisers or advertising managers to any firm, in addition to the preparation of every kind of business literature, they do not accept commission from the papers in which the advertisements are inserted. Some of the designs which Mr. Greenly has shown us are certainly on strikingly original lines, and we understand that the firm has also retained the services of engineers having special aptitude for writing on technical subjects. We have no doubt that Mr. Greenly will be successful in his new undertaking.

NEW COMPANIES

LONDON & MEXICO CONCESSION SYNDICATE, 3 Lombard Street, E.C. Capital £20,000. To acquire concessions for the construction of tramways, telegraph, and telephone systems, &c.

PROVINCIAL ELECTRICAL CO., Birmingham. Capital £250. Manufacturers of and dealers in electrical apparatus.

ANGLO-FRENCH WIRELESS.—Capital, £50,000. Private company. To adopt an agreement with Compagnie Generale Radiotelegraphique. Registered by Waterhouse & Co., 1, New Court, Carey Street, W.C.

COMPANIA DE ELECTRICIDAD DE LA PROVINCIA DE BUENOS AIRES.—Capital £1,000,000. To adopt an agreement with A. L. Secretan & Co.

HYDRAULIC POWER & SMELTING CO.—Capital, £1,000,000. To adopt an agreement with Norse Power & Smelting Syndicate and K. Tillberg. Registered by Ingle, Holmes, Sons, & Pott, Capel House, E.C.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

W. T. Henley's Telegraph Works.—An interim dividend on the preference shares at 4½ per cent. per annum and on the ordinary shares at 10 per cent., have been declared.

Waste Heat and Gas Electrical Generating Stations.—An interim dividend at the rate of 5 per cent. per annum on the amount of share capital called up on July 31st has been declared.

Newcastle and District Electric Lighting Co.—An interim dividend at the rate of 3 per cent. per annum has been declared, with £6,885 carried forward.

Para Electric Railways and Lighting.—An interim dividend at the rate of 10 per cent. per annum is announced.

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ELECTRICAL ENGINEERING

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"Electrical Engineering," although the Cheapest Electrical Paper (Price **1d.** weekly), contains the Most Useful and Practical Articles, the Best Illustrations, and the Latest News. It is read by the Leading Electrical Engineers, and is regarded as a Reliable Authority in all matters connected with the Electrical Industry.

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SUMMARY

We publish an additional list of intending exhibitors at the Olympia Electrical Exhibition next month. (Page 468.)

The British Thomson-Houston Co. are now manufacturing all their Mazda lamps with drawn tungsten wire. An article describes the company's lamp works and methods of manufacture, explaining the direction in which the new lamps should be an improvement; appended to it is an account of the colossal research work which they and their American house have carried out in this direction, as revealed by the patents they have taken out. (Page 469.)

The Glasgow Corporation have successfully introduced a method of charging domestic consumers for heating and cooking, which obviates the necessity of putting in an additional meter to the lighting meter, and the placing of the apparatus on an independent set of circuits. (Page 472.)

The Cedegolo (Italy) water-power station of the Adamello power company is described. It generates at 12,000 volts, and transforms up to 72,000 volts by single phase transformers with primary and secondary "delta" connected. The station is to work in parallel with another one, which will also generate at 12,000 volts. (Page 472.)

An article upon the strike so far as it directly affected electric railways and power houses appears on page 473.

Among the specifications published by the Patent Office last week was one covering an automatic switch for connecting a dynamo to a battery of accumulators by H. Leitner. An electrode suitable for conducting very large currents into furnaces has been protected by O. Imray, and a new form of cartridge fuse is patented by W. Creswick and J. Bentham. Opposition has been entered to the grant of a patent to G. Lüdecke and the Imperial Lamp Works (Brimsdown), dealing with the manufacture of metal filaments. A patent by B. G. Lamme, relating to the rotary transformer for converting polyphase currents, has expired after the full term of fourteen years. (Page 474.)

Among the matters dealt with in our notes on "Telephony and Telegraphy (including Wireless)" are the granting to Lloyds of a wireless telegraph monopoly in Egypt, an alteration that has been made in the pension arrangements in connection with the transfer of the National Telephone Co.'s staff to the Post Office, a projected telephone line between France and Austria, and the provisions of the new Pacific Cable Bill and the Telegraph (Construction) Bill. (Page 475.)

In our Electric Traction Notes we record the fact that the Perth (Australia) Electric Tramways have offered their undertaking to the Perth Council for £500,000. An arbitrator is to be appointed in relation to the purchase, by the Coventry Corporation, of the local tramway system. A scheme of trolley omnibuses

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is proposed at Dewsbury. A number of other interesting traction notes are to be found on page 475.

Lieut.-Col. Von Donop's report to the Board of Trade on the serious accident on the Stalybridge Tramways last June has been issued. He has come to the conclusion that the driver failed to stop at the compulsory stop at the top of the hill on which the accident occurred, that the brakes were in order, and that it is doubtful whether the driver released the hand-brake before applying the magnetic brake. In the course of his report he mentions that the Westinghouse Brake Co. are now fitting their magnetic brake equipment with an additional contrivance enabling the track-brake to be applied mechanically as well as magnetically. (Page 476.)

A short article describes an electrically operated dam of the swing-bridge type. The structure can be swung across the stream in 90 seconds by two motors. In case of flood, the water is controlled by 32 wickets, which can be dropped into position in 60 seconds. The cables are laid in a shaft tunnel constructed under the stream. (Page 477.)

A short article describes the equipment of the Victoria Falls and Transvaal Power Co.'s Simmer Pan power house. It has a capacity of 18,000 kw., and supplies six 40,000 volt lines as well as six 10,000 volt lines. (Page 477.)

A new type of silica mercury vapour lamp burning in a quartz tube has been introduced, which is suitable for D.C. circuits, and requires a current of only 1½ ampere at 200–250 volts. The candle-power is stated to be 800. A fluorescent reflector for use with the tubular form of lamp to improve the colour of the light is also being put on the market. (Page 477.)

A fire doing damage to the extent of £2,000 occurred last week in a storeroom at the Gillingham Electricity Works.—Net profits are reported for last year upon the Melbourne Electricity Works (£44,402), Greenock (£5,520), Ilford (£1,400), and Halifax (£5,332).—The Local Government Board have refused a loan to the Biddulph Council for wiring and fitting premises.—The Board of Trade do not consider that the recent accident to a lady on a Dublin tramcar was due to any electrical defect, and have refused to order an inquiry. (Page 477.)

The Westminster Electric Supply Corporation require battery boosters and switchboards; the Dublin Corporation a large quantity of single-phase and three-phase meters, and the Cleethorpes Council vulcanised bitumen cables. An electricity supply scheme is under consideration for Burnham, and expenditures of £20,000 and £8,000 are contemplated in South Africa upon two electricity schemes. Considerable extensions are contemplated at the Worksop Electricity Works (Page 478.)

THE OLYMPIA ELECTRICAL EXHIBITION

SINCE the list of exhibitors which we published in our issue of July 6th, the following firms have taken space at the Olympia Electrical Exhibition, which will be held from September 23rd until October 21st:—

C. W. Armitage, Aron Electricity Meter, Ltd., British American Stamp Co., Bi-Metals, Ltd., Credenda Signs Co., Chicago Rawhide Co., Ltd., Micanite & Insulators Co., Ltd., W. F. Dennis & Co., Edison Manufacturing Co., Electrical Contractors' Association, Felt & Tarrant Manufacturing Co., Ltd., Heatly-Gresham Engineering Co., Haydn Harrison, Krausse & Auerbach, Kingolite Co., Mirrlees, Bickerton & Day, Ltd., Magic Appliances, Ltd., Peyton & Peyton, Ltd., August Reichwald, Ltd., Rose Bros., Sparkes & Co., Skefka Ball-Bearing Co., Ltd., W. J. Stokvis, C. Winston & Co., T. & E. Waunbacher, Wilson Hartnell & Co., Ltd., A. R. Witting and K. & Th. Moeller.

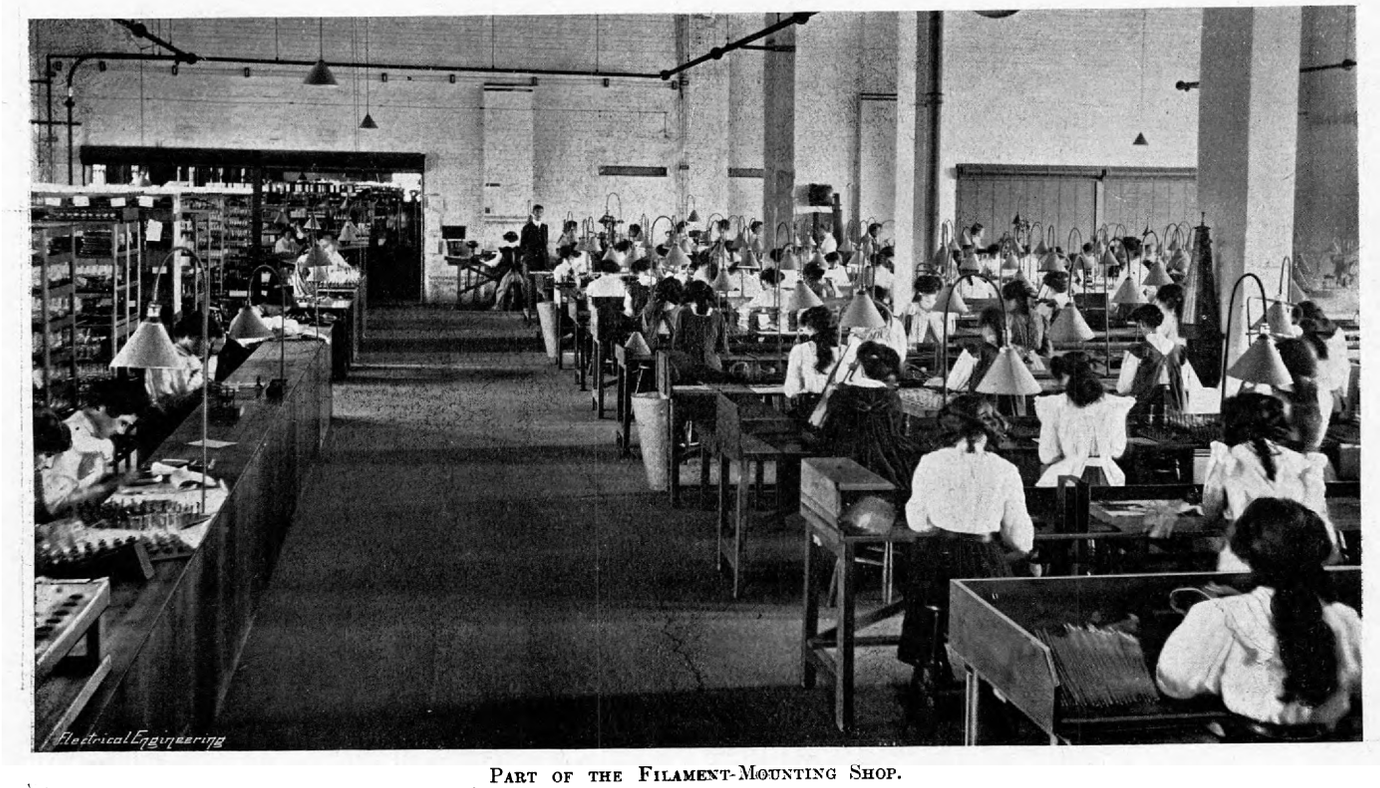


It has been suggested to us that Travellers in metal filament lamps should be prepared with some means of demonstrating visually to prospective purchasers the mechanical strength of their lamp filaments.

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THE NEW MAZDA LAMP: A STRONG DRAWN WIRE FILAMENT

AN important advance has been made in the methods of manufacture of "Mazda" lamps by the British Thomson-Houston Co., so important that a party of some fifty members of the technical and daily press were invited down to Rugby last week to inspect the Company's works. In future all the tungsten lamps made by the British Thomson-Houston Company will have drawn wire filaments instead of filaments prepared by the squirting or pressing process. The company are already prepared to execute orders for the new lamp with drawn wire filaments of 50 and 60 watt sizes for all voltages from 200 to 260 volts, and all standard sizes from the 10-watt 25-volt lamp to the 60-watt 130-volt lamp, excepting the 17-watt 100-130 volt size. The 17-watt 100-130 volt lamps, and the 32-watt 200-260 volt lamps, and all other sizes of Mazda lamps, will be also made with drawn wire filaments, as has been stated above, but will not be ready for delivery before October 31st, 1911.



PART OF THE FILAMENT-MOUNTING SHOP.

Ever since the supersession of the carbon lamp by the metal filament lamp became a certainty, lamp manufacturers have been endeavouring to solve the problem of drawing fine tungsten wire for the filaments. The extreme fineness of the filaments renders it necessary that they should be as strong and flexible as possible, and absolutely uniform in cross section, and it was evident that the ideal method of manufacture was to produce the metal in a sufficiently ductile form to enable it to be drawn into wire.

The usual method for the manufacture of "pressed" or "squirted" filaments is, briefly, to mix finely divided tungsten with a binding material, to press the mass through a die, and then to remove the binding material and to fuse the tungsten together by heating the filament to a high temperature in a "forming gas"—in some cases ammonia, in others a mixture of hydrogen and nitrogen—by passing an electric current through it. The filaments thus formed are in comparatively short lengths, which are then mounted by welding them to a number of wire supports projecting radially from the central stem of the lamp. The drawn wire filament, on the other hand, is one continuous wire, which is sufficiently strong to be threaded round the supports in one length, so that the manufacture is considerably simplified. The British Thomson-Houston Co. is therefore to be congratulated both on being able to produce a stronger lamp and on eliminating some difficult and delicate operations in the course of manufacture.

ELECTRICAL ENGINEERING was, we believe, the first paper to call attention to the progress that was being made in the manufacture of drawn tungsten filaments. An article dealing at length with one of the British Thomson-Houston Co.'s early patents was published in our columns on May 14th, 1908. On January 5th last year we dealt with the question again at some length, recording the British Thomson-Houston Co.'s claim for holding a master patent for a wire-drawing process of manufacture, which we described. On March 31st of the same year we gave some further information as to the progress the company had made, and were able to announce that some sizes of lamps with drawn tungsten filaments—to which the name "Mazdawire" was then given—were being placed on the market. It therefore gives us great pleasure to be able to publish further particulars with regard to the manufacture of the new lamp by the company on a very large industrial scale.

The lamp works employ some 500 hands, and are capable of turning out about 30,000 tungsten lamps and 35,000 carbon lamps per week, and they form one of the buildings of the British Thomson-Houston Co.'s electrical engineering works at Rugby. Everything is arranged so as to facilitate supervision, and the systematic progress through the shops of the lamps and parts in their various stages of manufacture. The

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workers showed considerable skill in carrying out the various processes, whether those carried out by hand or the glass work in which the operations involve the aid of special machines, and one could see that they worked with the regularity and precision of experience. The most interesting part of the manufacturing process was the extreme simplicity of mounting the tungsten wire on its supports. Instead of a lamp with from five to nine separate V-shaped filaments, each of which has to be separately welded at both ends to the supporting wires, the new Mazda lamp has a filament in one continuous length of wire, wound round the supports, and the two ends are simply pinched into small copper tubes at the ends of the leading-in wires. The filament is as fine as that of other metal filament lamps, but it can be handled as wire, and is simply reeled off a bobbin, cut to length, and wound on as stated above. The low voltage lamps are made with a plain wire, and the high voltage lamps with a crinkled wire, which gets supporting point is of course a great help in reducing breakages due to mechanical shock.

In fixing the exhausting tubes on the bulbs, a device is employed which we believe has not been adopted at all lamp works. The bulb is first punctured by a gas jet drawn out by compressed air, and as soon as the bulb is punctured the compressed air is automatically cut off, so that the flame recedes from the glass. The interior of the exhausting tube is covered with a phosphorus preparation, which assists in the complete exhaustion.

The next process is sealing the mounted foot and stem into the bulb, in which the operators are assisted by machines of the most modern type.

Rotary pumps are employed for exhausting, and these are connected up in such a way as to be particularly effective, the fine exhausting pumps being "backed up" by others, so as to enable each pump to work over a smaller range of pressure.



Another Shop in the Lamp Factory.

a greater length of filament into a smaller space, but until examined closely, so that the absence of welds at the bottom of each loop of the filament is noticed, both lamps resemble the ordinary metal filament lamp in appearance. The visitors were not privileged to view the wire-drawing shop, but were shown the filament-pressing, weighing, and forming shop—empty of workpeople.

As in other lamps, the first processes in the manufacture are cutting the tube for the foot, widening out the ends, and making and fixing the central stem and fusing in the leading-in wires. Platinum wire is employed as usual to pass through the glass, and copper wires lead from the ends of this to the lamp cap and the filament respectively. Copper is also used for the wires supporting the filament in the case of low voltage lamps, and molybdenum for high voltage. As regards the number of turns of the filament, the tendency is rather to increase these, and thus to use shorter spans, as this gives greater strength. Thus a 100 volt lamp would have six turns instead of the five filaments of the pressed filament lamp, and a 200 volt ten instead of nine. The absence of rigidity at each

The photometring and testing arrangements are very complete. On the testing racks the lamps are first subjected to 25 per cent. excess voltage for a quarter of an hour, and are then run for a longer period at their normal voltage to weed out any faulty lamps. The visitors were also shown some 100 volt lamps withstanding a pressure of 300 volts. Needless to say this was done solely for the benefit of the visitors, and is not the test to which Mazdawire lamps are normally subjected before being sent out to purchasers.

Our thanks are due to Mr. R. McNeil, the manager of the lamp works, who personally conducted our representative over the works, and took great pains to explain all the processes to us. We have also to acknowledge the cordial reception given us by Mr. Sporborg, the chief engineer of the company, and the efforts of Mr. F. Willcox, the organiser of the commercial side of the lamp department, who also gave us much interesting information and a long sample of tungsten wire about one mil in diameter, and who took the party to and from Rugby in a special train, arranging everything for their comfort and convenience.

The enormous amount of preliminary research and

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experiment which has culminated in the production of a commercial drawn-wire tungsten lamp by the British Thomson-Houston Co. is well brought out by a review of the numerous patents they have taken out:—

Probably the first indication in this country that metal filament lamp manufacturers were on the road to the production of drawn tungsten filaments was the publication in 1907 of a patent No. 21,513 of 1906, taken out by the British Thomson-Houston Co. (communicated to them by the General Electric Co. of America). The specification of this patent points out that tungsten, after prolonged heating, becomes altered in molecular structure, and is then ductile enough, when at a red heat, to be worked and drawn into wire. The initial rods of tungsten were produced by squirting or compressing a carbonaceous paste of tungsten powder, and these were then rolled and drawn. Special methods of keeping the tungsten hot during rolling and drawing, such as passing current through the wire during the process, are covered by this patent, and methods of preventing oxidation by enclosing the die and the hot part of the wire in a chamber containing hydrogen, are also described.

A later patent, No. 23,335 of 1906 by the British Thomson-Houston Co., covered the method of alloying tungsten with a ductile metal, and extracting the latter after the alloy had been drawn into fine wire for lamp filaments. This patent was the subject of a special hearing before the Comptroller-General (see Electrical Engineering, January 6th, 1910, Vol. 6, p. 5)., when the British Thomson-Houston Co. claimed that this was a master patent for the alloying of tungsten with a ductile metal for this purpose.

A later patent, No. 16,530 of 1907, also by the British Thomson-Houston Co., described the production of tungsten filaments from an amalgam paste, and referred to the possibility of drawing filaments from wires produced by this method. The specification of this patent was published in full in Electrical Engineering, May 14th, 1908, Vol. 3, p. 738. Its chief feature was an indication that a means had been found to work and draw the metal at a temperature below that at which tungsten oxidises in an ordinary atmosphere.

During 1907 and 1908 several patents were taken out by the British Thomson-Houston Co. for the manufacture of metal filaments, but all these seem to have referred to squirted filaments. A patent taken out in the following year, No. 23,499 of 1909, however, appears to mark an important step in the manufacture of drawn tungsten filaments. A full abstract of this patent was given in Electrical Engineering of February 16th, 1911, p. 84, a week after it was published. It relates to the mechanical treatment of tungsten whilst hot in order to render it ductile, as described in specifications 21,513/06 and 16,530/07. Pure tungsten powder is compressed into sticks about 8 in. long and $\frac{3}{8}$ in. square, in heated steel moulds. After heating in hydrogen to dispel any impurities, the sticks are sintered so as to become dense and hard by passing an alternating current of about 1,400 amperes through them for several minutes. They are then rolled or worked in a special swaging machine described in the specification, and, after repeated and prolonged working, the crystalline structure is said to change to a pronounced fibrous structure, so that the sticks are pliable, ductile, and very strong. Drawing is begun when the diameter is reduced to 35 mils, and is continued in successive stages until the diameter is 1 mil or less, as is required. In this patent again reference is made to the possibility of drawing the tungsten wire at ordinary room temperatures after prolonged mechanical working, and the claims of this patent cover this, but it will be seen that a later patent described drawing the wire at a dull red heat.

The next year again showed great activity on the part of the British Thomson-Houston Co. and their American house. The first patent taken out by the company in 1910 for drawn tungsten was referred to in Electrical Engineering of March 2nd, 1911, immediately after publication.

According to this patent, rods of about 40 mils diameter are squirted through dies or pressed into shape under hydraulic pressure from a paste of powdered tungsten and either a carbonaceous or an amalgam binder. They are then sintered at a much higher temperature than usual—closely approaching the melting point of tungsten—in an atmosphere of hydrogen and nitrogen for one to five minutes, and are then allowed to cool gradually, the current being reduced step by step over a period of from two to even 30 or 40 hours. After thus cooling from a very high temperature, the metal was said to be ductile when cold.

Patent No. 3,981/10 (Electrical Engineering, August 18th, 1910, p. 540) covered a process of pointing wires for insertion into the fine dies.

This was followed by a patent which is evidently a great advance, since it describes a process of manufacturing rods or filaments of tungsten without previously alloying it with any ductile metal, or adding a binder or amalgam paste. It is not unreasonable to suppose that this process or a modification of it is the one now employed by the British Thomson-Houston Co. in the manufacture of Mazda lamps. The patent (No. 8,031 of 1910) was applied for on April 2nd, 1910, accepted on July 3rd, 1911, and published just four weeks ago. Tungsten filaments prepared according to this process are said to remain ductile after prolonged use.

The preparation of the tungsten powder is highly important. Pure tungstic oxide (WO_3) is reduced to a very coarse powder by packing a tube of fused quartz ($1\frac{1}{2}$ in. diam. and five feet long) with the tungstic oxide. A passage is left right along the tube, and pure dry hydrogen is passed through it for from 5 to 15 hours, while the tube is heated to between 1,100° C. and 1,300° C. Water vapour is produced, and lower oxides are formed, the mass changing from the yellow oxide to the blue, brown, and black oxides, and finally to pure tungsten. The crystals of oxide are found to coarsen, especially during the brown stage. During the last few hours the same hydrogen may be used over and over again provided it is dried during circulation. (The yellow oxide may be previously heated to 1,000° C. for five hours in a covered Hessian crucible to coarsen the particles further.) The coarse tungsten powder is then pressed up in a strongly reinforced steel mould by an hydraulic press into sticks $\frac{1}{4}$ in. square and 6 in. long, special care being taken to avoid producing cracks in the sticks. The sticks are then placed in electrically heated tube furnaces for a preliminary firing in hydrogen at, say, 1,200° C. for 10 mins. to 60 mins. in order to harden them so that they can be handled without fear of breakage.

After this, the sticks are placed in a treating vessel, and current passed through them so that they are raised to a white heat. A reducing atmosphere of hydrogen is employed, and the metal sinters together into a strong coherent body, any traces of oxide being removed. To ensure thorough penetration of the hydrogen without fear of melting the interior of the rods, the temperature is raised gradually, and thus the current may be 1,400 amps. per rod for 15 mins., and then 1,700 amps. for another 15 mins., the current being then reduced in steps of 200 amps. per min., so as to cool the metal slowly, and to avoid a sudden drop of pressure of the hydrogen, which might cause air to be drawn into the vessel. A constant stream of pure dry hydrogen must be kept up.

The rods, which have a frosted appearance and a crystalline structure, are then worked in a swaging machine and drawn as described in Patent No. 23,499/09 (see above). They are passed into the swaging machine at a bright red heat by being previously heated in a tubular furnace with hydrogen. A reduction of 8 per cent. occurs each pass, and when the diameter is reduced to 0·03 in. the rods are drawn (through diamond dies) at a low red heat until a diameter of 0·0015 in. or finer is obtained. Before placing the filament in the lamp, it is freed from oxides or impurities on the surface by heating at 1,000° C. or higher in pure dry hydrogen. The fibrous structure developed during working and drawing disappears during heating, and a filament prepared by this process and run at 1·25 watts per candle is claimed to be quite free from brittleness, and to be ductile and strong.

There are 10 claims to this patent. The first covers broadly a conductor of ductile metallic tungsten which retains its ductility after prolonged heating. Claim 2 covers the use of "metallic tungsten in the form of relatively coarse powder" in the manufacture of such a conductor. The method of producing this coarse powder by the treatment of tungstic oxide as described above is covered by Claim 3, while Claim 4 covers the alternative method, including the previous heating of the oxide before reduction. The production of rods of pure tungsten by compressing the coarse powder in steel moulds and heating the compressed rod in hydrogen is covered by Claim 5, and the sixth claim covers the heating of the rods at an intense white heat in a vessel containing hydrogen. Claim 7 covers the method, described above, of sintering the rods, which consists in passing heavy currents through them. Claim 8 covers the working and drawing of these rods into wire, and the final heating of the wire to remove surface impurities. The whole process as described in the specification is covered by Claim 9, and Claim 10 is for the application of the process for the manufacture of filaments for incandescent lamps.

Two 1910 patents (Nos. 8,984 and 10,206) relate to the crinkling of the tungsten filament so that it can contract without pulling on the supports. The first only of these two patents has been published up to the present.

Patent No. 13,295/10.—This patent covers a leading-in wire of tungsten or molybdenum. The wire is cleaned in fused potassium nitrite before fusing into the glass. Apparently, however, platinum is still used for leading in through the glass.

Two other patents for lamp filaments (Nos. 30,323 and 30,324) were applied for by the British Thomson-Houston Co. in 1910, but have not yet been published by the Patent Office.

During the current year four patents relating to incandescent lamp manufacture have already been applied for by the British Thomson-Houston Co. Three of these, No. 2,826, relating to working refractory metals; No. 5,068, dealing with the exhaustion of lamp bulbs; and No. 6,988, broadly referred to in the title as for incandescent lamps, have not yet been published. The fourth (No. 3,028) describes a method of mounting the filaments on rows of alternating long and short arms on the carrier.

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CHARGING FOR COOKING AND HEATING THROUGH THE LIGHTING METER

CENTRAL station engineers and managers and also wiring contractors are always confronted with the difficulty of an extra meter, distribution board and wiring being required when a lighting consumer proposes to go in for electric heating on a small scale, and to profit by the cheaper heating rate. Many consumers who would willingly put in one or two electric radiators for occasional use, or an electric iron or small cooking and heating apparatus, for consuming energy at, say, 1d. or 1½d. per unit, object to having to pay some pounds for extra wiring, &c.; and the central station engineer may also find, if a heating and cooking circuit is added consuming only a few units a year, that the profit will hardly pay the capital charges and depreciation on the additional meter and its connections.

During the last few months Mr. W. W. Lackie, Chief Engineer to the Glasgow Corporation Electricity Department, has adopted a very simple system of charging which enables him to connect the heating and cooking apparatus used by domestic consumers to the lighting circuits, and to pass the current through the same meter. From examination of a large number of accounts from such consumers for a period of three years, he has found that they are practically stable from year to year, and even in the corresponding two-monthly account periods of different years, he has calculated that on an average the domestic consumer uses his maximum demand for 800 hours in the year divided up approximately as follows:—

June-July	40 hours
August-September	60 ,,
October-November	200 ,,
December-January	300 ,,
February-March	160 ,,
April-May	40 ,,

The present flat rate charged to domestic consumers is 3d. per unit. If, therefore, a consumer adds electric heating to his existing lighting connections, he is charged, for instance, during August and September on the basis of 60 hours' use of his maximum demand at 3d. per unit, and the balance of the amount his meter registers at a 1d. per unit, the latter being the regular charge for heating and cooking.

Thus, if a consumer intimates that he is going to instal a heating or cooking appliance, the District Superintendent visits the premises and reports whether the wiring is suitable for this or not. In the case of one-room-and-kitchen, two-rooms-and-kitchen, three-rooms-and-kitchen, and four-rooms-and-kitchen houses, the electric lighting department has practically fixed, from their experience gained over a number of years, the number of units to be charged at the lighting rate of 3d. in each two-monthly period, and they do not instal a maximum demand indicator.

In exceptional cases, such as large houses, however, they have sometimes taken the maximum demand, but in the majority of cases they simply assume that the consumer will use the same total number of lighting units, and they have divided these units in the proportions indicated above for each two months.

In the case of new consumers an estimate is made of the number of hours' use of maximum lighting demand that is likely to occur, and they are charged in the same manner.

Poor Electricity!—"Salamander" writes as follows to the *Evening News*:—"Last year you had voluminous correspondence on the alleged fact that the enormous use of electricity was responsible for the rainfall in general and the Paris floods in particular. Where are those correspondents now?" Probably they are preparing letters for the *Evening News* to explain that electrical engineers have profited by their warnings, and have reversed the direction of the current, so that drought has been produced instead of rain.

THE ADAMELLO 72,000 VOLT POWER TRANSMISSION PLANT

THE Cedegolo generating station, which forms part of the system of the Adamello Company in Upper Italy, contains several interesting features. The building covers an area of about half an acre, and half of this is occupied by the machine room, which will contain seven turbo-alternators and two exciters. Five of these have already been installed, each of which is of 5,000 h.p. of the Pelton type with horizontal shafts.

The three-phase alternators are connected to the turbines by rigid couplings; each set has an output of 5,000 K.V.A. at a speed of 500 r.p.m., and current is generated at a pressure of 9,000 to 11,000 volts at 42 cycles per sec. For this speed the turbines require about 35½ cubic feet of water at full load, using a fall of 1,542½ feet.

The high voltage of the generators is due to the fact that the station is required to work in parallel with the central station to be erected at Isola, three miles away, which will generate current at 12,000 volts. Fifteen single-phase transformers are erected in two rows, and are separated from one another by cells. They are connected in delta on both the primary and secondary sides. Each of these has an output of 2,700 K.V.A. at a pressure of 10,000 to 60,000 volts, which may be increased to 72,000 volts if one of the transmission lines breaks down and the entire energy has to be transmitted by the one line. They are of the oil type with water-cooling coils. The switchboard is designed so that it can combine the energy generated in the station itself with that supplied by the other plants, and transform it up to 72,000 volts for transmission and distribution to the industrial districts in Lombardy. The single-phase cables from the alternators are laid in a spacious underground passage, and run into the 12,000-volt bus-bar chamber on the ground floor, where they are connected to oil switches by bare copper connections. The switches are three-phase with instantaneous release, and allow the circuit to be broken in an oil-bath at two different points in each phase. The three phases pass through circuit-breakers and isolating switches, and are then led to the 12,000-volt bus-bars, which are separated by cement partitions. As two separate working systems are required for the power station, two sets of bus-bars are provided, which, if necessary, can be connected to one another to form ring mains. From the bus-bars the connections rise to the first floor, after passing through the 12,000-volt transformer oil switches. These are mechanically connected by a link chain to the corresponding switches for the primary side (72,000 volts), so that each transformer can be isolated in one operation. Switching in and out can be done by hand or electrically. The connections next pass to the 72,000-volt bus-bars on the second floor, where they are taken through current transformers, and to the switches for the outgoing line; finally, they rise to the last floor, where the lightning arresters are erected, both for the 72,000-volt outgoing lines, and for the 12,000-volt incoming lines from the Isola station.

The whole of the plant is controlled from switch desks, of which three have been installed, one each for the alternators, transformers, and transmission lines. On the machine floor there are twelve white marble panels carrying the instruments, and apparatus for the two exciters, a 500 h.p. synchronous motor, the two auxiliary transformers, the switches for the operating circuits, and for the motors driving the battery-charging dynamos. The battery consists of 69 cells, and has a capacity of 1,450 ampere-hours, with a discharge of 145 amperes. A double battery switch, for charge and discharge, is electrically operated from the switch panel mounted close to the machine room. The Allgemeine Elektricitäts Gesellschaft supplied the whole of the electrical plant above described.

Death from Electric Shock.—A verdict of accidental death was returned at an inquest last week concerning the death of a workman named F. H. Best, employed at Smith's Dock, Middlesbrough. An electric crane working on a jetty is supplied with power from bare wires at a voltage of 440. These wires run in a conduit, and the unfortunate workman received a fatal shock whilst endeavouring to recover a packet of white lead which had fallen into the conduit.

Fire at German Electrical Works.—According to a Reuter cable message from Berlin, a fire broke out on Thursday in the main cable shaft of the Essen-Rheinish-Westphalisches Electrical Works, which had the effect of completely cutting off the supply. The works furnish current to a number of large mines and factories, and considerable inconvenience was caused.

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THE STRIKE

NOW that the conditions of labour among the railway and other workers of the country seem to be gradually getting back to the normal state, it is pleasing to reflect what a small part electrical workmen generally have taken in the dislocation of our daily routine during the past fortnight, which reached a climax on Friday and Saturday. The absence of any serious signs of dissatisfaction among those employed in central stations may be attributed to the more happy conditions under which they work, or to a keener sense of their responsibility to the public than was exhibited by the railway men and others. Whatever the cause, we have reason to be proud of the fact, for the absence of effective street and domestic lighting for however short a period would have enormously increased the discomfort and even the dangers which were present. It is true that the tramway men in several towns showed signs of restlessness, but with a few notable exceptions, such as Liverpool and Glasgow, they were easily satisfied. One of the main grievances of the tramway men, especially drivers and conductors, is the large amount of time which they have to be away from their homes in order to put in their allotted number of hours work per day. This difficulty of "spread-over" time is one which tramway managers all over the country have had to contend with for years, and it seems impossible for the employees to realise that it is an inevitable condition of tramway working, due to the "rush hour" periods of traffic, and that it cannot be avoided if the undertakings are to be carried on with any pretence to commercial success. It is not a matter which managers have ignored; indeed, it has been given most earnest consideration, and strikes can in no way solve a problem of this magnitude.

At the present moment, there is considerable uncertainty as to what the L.C.C. tramway men intend to do. Their threat to strike last week, unless the Highways Committee will immediately meet to consider certain demands as to recognition of the Union, increase of wages, and a 48-hour week, have not been put into effect, in spite of the decision not to convene a meeting of the Highways Committee or the Conciliation Boards to go into the question during the recess. At a mass meeting on Sunday night a ballot was decided upon, but at the moment of writing no definite result has been issued. It is to be hoped that the lesson of the Glasgow tramway strike will not be lost upon the London tramway men, whose conditions, like those of all tramway workers, have vastly improved since the introduction of electric traction. It was stated in the daily papers that a company of soldiers guarded the Greenwich power station of the L.C.C. during the railway strike, but we are able to state that this was not so.

In spite of the withdrawal of so many railway men on Thursday, Friday, and Saturday, all the London electric railways maintained restricted services, with the exception of the City and South London Railway Co., who found it necessary on Thursday afternoon to suspend the whole of their service. All the railway power stations were guarded by troops, and as the men there were loyal, no anxiety was felt on the score of power supply. The inconvenience to the public, though considerable, was by no means of a magnitude to be termed a "paralysis" of the railways; indeed, from this point of view the strike was a failure. Once the railway managements were able to marshal the forces available, a degree of regularity was maintained which was quite astonishing in the circumstances. Probably the least affected line was the Central London, only a certain proportion of drivers having left their work.

At Manchester the railway men on strike made strong endeavours to induce the tramway drivers and conductors to come out, but without success. At first cars were forced through the crowd of strikers, but when this became impossible the police were able to keep the track clear at the depôts, and enabled the cars to get into the streets.

A dispute at Bath was settled. At Newcastle-under-Lyme a number of track workers employed by the Potteries Electric Traction Co. came out, and grievances were brought forward by the tramway men in several other towns, but no serious results are reported. Rumours were current that the Sheffield tramway men intended to strike, but this was officially denied by the district secretary of the Tramway and Vehicle Workers Union.

The chief anxiety was the possibility of getting coal supplies for the various electric power stations. Most had reserves sufficient to maintain the works for a week or more, but with the Government's promise of assistance from the military forces, there should have been little difficulty in getting further supplies.

The only real case of a strike at an electricity works was at the Liverpool Corporation main station at Lister Drive. At two o'clock on Thursday the workmen employed there followed the instructions of the Strike Committee, and withdrew from the station. It appears that although the services of a large number of volunteers were accepted, both from the remaining staff at the station (of all grades, including clerks and others), and of loyal citizens of all social rank, yet a complete supply of electrical energy for all purposes was not maintained. For some reason, in spite of this generous assistance, it appears that sufficient steam could not be kept up to supply the whole load, and although the street lighting and a portion of the tramway service was continued, a large portion, if not all, of the private lighting was switched off. We cannot but express our surprise that some means could not have been found to keep the whole supply going, at any rate on the Friday. If the incident came as a complete surprise to those in authority it may have been difficult to obtain sufficient stokers or supervision of inexperienced stokers between two o'clock on Thursday and peak time, but arrangements for a complete resumption of the supply ought to have been possible on Friday. It would be interesting to know whether as a last resort, when it was found that sufficient workers could not be obtained, troops were requisitioned, not merely to guard the station, but to do actual work in it, and if so, whether this request was refused. We cannot but think that the Commanding Officer would have considered it desirable to grant such a request in view of the terrible consequences of increased rioting and looting that might have occurred through the lighting of large buildings, stores, and warehouses being discontinued. Of course some damage might have been done to the electricity works plant which prevented the supply being maintained, but in any case a full explanation of the circumstances would be welcome.

The trouble at Liverpool is not yet ended, for a serious question has arisen as to the reinstatement of the 250 tramway men who went on strike. The Tramways Committee is in an awkward predicament, for the 1,500 men who remained loyal have threatened to strike if the 250 strikers are reinstated. The places of the strikers have been filled, and the Strike Committee refuse to allow the dockers to return until the tramway trouble is settled.

Among the various questions asked in the House of Commons on Tuesday was one with regard to the sending of soldiers to guard the Poplar Electricity Works. It seems that when the troops were first sent to London a list of the most important places to be guarded was prepared and military pickets provided. Included in these, presumably, was the Poplar Electricity Works. According to Mr. Lansbury, the Labour member, the Poplar Council resented this action, and ordered the troops away.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published August 17, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

20,257/10. **Automatic Switches.** H. Leitner. These are adapted to connect a dynamo to a battery for charging purposes. Two parallel electro-magnets are arranged with one of the cores to rotate through a suitable arc within its bobbin. One of them is placed across the dynamo brushes, and, when excited, it attracts a spring, which puts a fine winding on the other magnet in series between the dynamo and battery. If the current flows towards the machine the magnets repel one another, but if the flow is in the opposite direction, they attract each other, and actuate a contact which closes the circuit through a thick wire wound on the magnet containing the thin winding. When the battery voltage predominates, the thick winding releases the contact, and throws the switch out. Three figures.

9,038/11. **Cartridge Fuses.** W. Creswick and J. Bentham. The body of the cartridge is provided at both ends with a metallic socket, each of which carries one of the fuse terminals, and the usual bridge through which the fuse wire passes. Metallic caps screw on to the sockets, fixing the wire, and making the required contact, For renewals the end caps have only to be unscrewed and the wire placed in position. One figure.

9,050. **Portable Lamp.** A. Lobel and The British Ever-Ready Electrical Co., Ltd. The metal casing of the lamp has an insulating plug at one end, hollowed on its outside to receive a metal reflector, which is screw threaded to take the usual bulb. A dry cell is mounted inside the case with one pole connected to one lamp terminal, and the other, through a spring at the bottom, to the casing. Between the cell and and the casing a slidable switch tongue is placed. This is made to slide over one or more studs arranged between the outer casing and the plug to make contact between the reflector and the casing, and thus to close the circuit. Two figures.

9,633/11. **Furnace Electrodes.** O. Imray (*The Shawinigan Carbide Co., Ltd.*). An electrode suitable for carrying very large currents into furnaces has a metal head capable of conducting electricity, and containing a series of screw-threaded sockets. Graphite rods are screwed into these at one end. The other ends of the rods are internally screw-threaded, and recessed to take a similar number of non-graphite carbon rods, so that a series of pencils of high conductivity are formed, containing substances of different degrees of hardness. These are protected by a substance of a slightly lower conductivity, and are enclosed by a sheet-iron shell. Three figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Siemens Schuckertwerke-Ges., 7,501/11.

Distributing Systems, Cables & Wires, Insulating Materials, &c.: Friedmann [Joint boxes for wiring] 12,931/10; Bowden Wire, Ltd., and Larkin [Connecting devices for wires] 20,501/10; Electric & Ordnance Accessories Co. and Mueller [Combined switch and fuse-box for cranes] 20,995/10; Bullers, Ltd., and Dagnall [Cable supports] 22,153/10; Speakman [Insulators] 27,804/10; Adam [Tightening devices for cable conveyors] 1,909/10; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Materials] 5,167/11.

Dynamos, Motors, and Transformers: Adams Manufacturing Co. (*Cutler Hammer Manufacturing Co.*) [Controllers] 18,190/10; and [Control of] 18,306/10; Lewis [Control systems for] 8,783/11.

Electric Ignition: Fletcher and Dale, 23,807/10; Smith and Platt, 1,028/11; Wasserzier [For gas burners] 6,182/11.

Electrometallurgy and Electrochemistry: Ges. Für Chemische Industrie in Basel [Electrolysis of fused alkali chlorides] 18,300/10 and 17,047/11; Popp [Furnaces] 30,390/10.

Heating and Cooking: Hirst and Archer [Irons] 23,902/10.

Incandescent Lamps: Renton [Cord attachment for lamp-holders] 18,656/10; Marks (*Siemens and Halske Akt.-Ges.*) [Process for treating the surface of tantalum] 18,780/10; Gray [Portable, for mines] 21,080/10.

Instruments and Meters: British Thomson-Houston Co. and Martin [Meters] 23,066/10; Chamberlain & Hookham Ltd., and Holden [Meters] 10,080/11; Krummerer and Ges. Für Elektrotechnische Industrie [Photometers] 11,111/11.

Switchgear, Fuses, and Fittings: Herbert Morris & Bastert, Ltd., and Thorrington [Switches for runways] 19,352/10.

Telephony and Telegraphy: Habermann [Morse transmitter] 26,856/10; Klupathy and Berger [Submarine telegraphy and signalling] 27,144/10; Siemens Bros. & Co. (*Siemens and Halske Akt.-Ges.*) [Semi-automatic exchange systems] 12,117/11.

Traction: Webb, Brettell, and Adamson [Overhead switch-gear] 279/11; Klupathy and Berger [Railway signalling] 5,603/11.

Miscellaneous: Gabreau [Lighting for vehicles] 13,035/10; Rideal [Utilisation of the silent discharge] 18,680/10; Girardelli and Holzman [Time alarm device] 20,696/10; Rumpler [Formation of metallic coatings on aluminium] 23,359/10; Field and Ferranti, Ltd. [Resistances] 24,485/10; Parkes [Magnets for indicators, relays, &c.] 4,806/11; Dowsing [Apparatus for applying radiant heat to body] 6,526/11; Zickel [Shutter indicators] 10,545/10; Siemens Schuckertwerke-Ges. [Automatic regulators for circuits] 14,432/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution, &c.: Siemens Schuckertwerke-Ges. [Safety device for cables] 17,046/11.

Electric Ignition: Heyer [High-pressure current distributors for] 16,968/11, and [Make and break device for primary circuit of] 17,053/11.

Dynamos, Motors, &c.: Hüther [Enclosed, cooling of] 17,110/11.

Switchgear, &c.: Compagnie Des Compteurs Aron [Electro-magnetic circuit-breakers] 16,962/11.

Telephony, &c.: McBerty [Automatic exchange selector] 16,867/11, and [Semi-automatic systems] 16,869/11 and 17,211/11.

Traction: Legrand and Armel [Locking railway carriages electrically] 16,458/11.

Miscellaneous: Duschnitz [Formation of arc] 16,992/11.

Opposition to Grant of Patent

132/11. **Metal Filaments.** G. Lüdecke and The Imperial Lamp Works (Brimsdown) Ltd. Opposition has been entered to the grant of this patent. It relates to a process of treating filaments made from collodial tungsten, and a binding agent. These are heated in an open-tube furnace, which is supplied with a reducing atmosphere. This consists of a reducing agent mixed with an inert gas in such proportion that the filament is decarbonised.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

19,719 of August 26th, 1897. **Electrical Conversion and Distribution.** B. G. Lamme. For converting polyphase currents a rotary transformer is provided, having a rotary or stationary field, and a rotary armature wound with coils. The width of these coils is much narrower than the pole pitch, so that the maximum induction takes place over a greater portion of the polar surface. An arrangement for supplying a direct-current three-wire system is described. The outers are connected to the commutator brushes on the D.C. side of the rotary, and the neutral wire is taken to the centre point of the secondary windings of two stationary transformers, which are connected to the slip-rings of the rotary. The primaries of these are supplied by a two-phase generator. The currents flowing in the neutral wire are always direct currents. Although an alternating current flows in each of the transformer secondary coils, a reversal takes place at its ends once in each alternation, so that the direct current flowing in the neutral wire is a true alternating current in the transformer coil, which acts as an auto-transformer in supplying the two branches of the three-wire system.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: J. P. Gallois, 10,040/07.

Distributing Systems, &c.: British Thomson-Houston Co. (*W. S. Clark and G. H. Rupley, U.S.A.*) [Conductors] 8,207/00; B. G. Lamme, 8,711/05; W. T. Henley's Telegraph Works Co. and W. H. Nichols [Cable junction boxes] 10,406/07.

Dynamos, &c.: S. Z. De Ferranti, 10,231/02.

Electrometallurgy, &c.: O. Frick [Furnaces] 10,097/06.

Switchgear, &c.: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Switches] 10,242/04; Akt.-Ges. Brown, Boveri et Cie. [Switches] 543/07; G. M. Newbery and British Prometheus Co. [Switches] 10,119/07.

Telephony, &c.: J. Kitsee [Telegraphs] 10,249A/06; W. Sutcliffe [Relay] 10,091A/07; Siemens & Halske Akt.-Ges., 10,152/07; F. W. C. Le Tall (*P. C. Hewitt, U.S.A.*) [Wireless telegraphy] 10,259/07; R. C. Browne [Microphones] 10,440/07; S. C. Houghton [Telephones] 10,537/07.

Traction: H. A. L. Hepper [Interlocking points and signals] 9,219/01; C. W. Collins, W. J. Hayes, and F. W. Watson [Trolley-head sockets] 10,293/07; C. Crutchley, W. H. Whaite, H. S. Timmis, and W. R. Reeves [Recording signals] 10,348/07.

Miscellaneous: Sir W. J. Armstrong Whitworth & Co. and J. Honner [Cranes, capstans] 9,193/01; Allgemeine Elektricitäts-Ges. [Lifts] 10,171/07; K. Hahn [Vapour rectifier] 10,469/07; J. H. Robertson and J. C. Klatzl [Medical apparatus] 10,514/07.

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TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The Egyptian Government have granted a concession to Lloyd's for a monopoly of wireless telegraph work in Egypt. The large station which is to be erected at Port Said is expected to be working by October. At present there are small stations at Aden, Port Said, and Suez, but these will be superseded by the larger station mentioned above.

It is stated that a telephone line is to be constructed between France and Austria, passing through Germany and Switzerland. The Austrian administration was the first in Europe to equip long overhead lines with Pupin coils, and, as these were very successful, particulars as to the design of this new international line will be awaited with interest.

Clause 5 of the Telephone Transfer Act, which deals with the superannuation of transferred officers of the National Telephone Co., has been slightly modified in favour of the Company's employees. The Postmaster-General has altered the clause so that those members of the Company's construction staff who are now pensionable, and also pensionable officers in the contract department, will be placed on the Post Office establishment. Those employees not pensionable will be placed upon an equal footing with similar Post Office employees. Upon consideration of the Bill in the House of Commons last Thursday, an amendment was moved to Clause 2 with the object of providing specifically for telephonic developments in rural places. The Postmaster-General opposed the amendment, pointing out that it had always been left to the discretion of the Post Office to deal with these matters subject to the general control of the House of Commons. The amendment was negatived without a division.

With regard to the matter of rural telephones, the Post Office has already taken some steps, and a circular has been issued explaining the scheme which has been devised. According to the *Morning Post*, the system has been for some time working in the Bradsby District of Yorkshire with complete success, and the Board of Agriculture is co-operating with the Post Office with a view to its rapid extension throughout all rural districts.

According to a Canadian contemporary, there will be, when the constructional work for the present year is completed, 4,000 miles of telephone lines and 3,000 miles of rural telephone lines in the province of Alberta. At present there are 11,905 subscribers.

The central battery system of telephone working is at last to supersede the older method in Cape Town. The first C.B. exchange there is now in course of construction. In Durban there has been a central battery system for some years, whilst a large new installation was completed in Johannesburg a short time ago. Cape Town appears to have taken its time.

The text of the Pacific Cable Bill has now been published. The Bill provides for the construction of an additional submarine cable between Australia and New Zealand, and any extensions, connections, or re-arrangements in or near the Pacific Ocean which may be deemed necessary for the improvement of the Pacific Cable Board's undertaking in those parts. The contributing Governments have authorised the application of money for this purpose out of the reserve fund of the Board, provided that the reserve fund is not reduced below £100,000. Any money so applied is to be repaid in 35 years at 3½ per cent. per annum interest.

Under the Telegraph (Construction) Bill, which has passed its third reading in the House of Commons, the Post Office is empowered to place telegraphic lines across railways and canals, and to maintain and repair them. The Bill provides that 21 days' notice shall be given before the erection of such lines, that no damage shall be done by the Postmaster-General in the maintenance of the lines, and for the payment of any expenses incurred by the railway or canal companies in consequence of their existence. The Postmaster-General is also upon request, to alter within reasonable time, and to the reasonable satisfaction of the railway or canal company, any lines which interfere with the working of the companies. The Bill does not vary the existing conditions as to wayleaves. All matters in dispute are referred to the Railway and Canal Commission as arbitrators.

No interruption of great moment has occurred to telegraph and cable lines during the past week. Communication has failed between Sabang and Koetaradja (Sumatra), telegrams for the latter place being sent by telephone from Pangkalanbrandan, or by post from Sabang.

ELECTRIC TRACTION NOTES

We publish on page 476 the result of the Board of Trade inquiry into the accident which occurred on a steep hill on the Stalybridge tramways last June. The evidence showed that, as has unfortunately so frequently happened, the driver had in all probability locked the wheels with the hand-brake before applying the magnetic brake. Lieutenant-Colonel Von Donop, in his report, it will be seen, calls attention to the fact that the Westinghouse magnetic brakes are now fitted with an additional device enabling the track brake to be applied mechanically as well as magnetically.

At the half-yearly meeting of the Liverpool Overhead Railway Co. last week, Sir William Forwood, the chairman, stated that during the past few years the main structure of the Company's lines had been strengthened from end to end, and the cost met out of revenue.

A new agreement has been entered into between the Swansea Corporation and the Swansea Tramways & Improvements Co. with regard to the running of the tramways. This agreement provides for an extension of the lease to cover a period of 30 years at a rental of 2 per cent. upon the gross profits. In addition to the rental the Company is to pay the Corporation a further annual sum equal to 7 per cent. on the Corporation's capital outlay as from April, 1919.

The Dewsbury Tramway Co. have refused a request by the Corporation that a tramway should be constructed to Westborough, on the ground that it would not be commercially successful. The Company offer to prepare estimates for the installation of a trolley omnibus system to that district, or in the alternative for the Council to provide the necessary capital for the construction of a tramway, the company working the lines at an agreed rate per car mile.

The net profits upon the working of the Kalgoorlie Electric Tramways last year amounted to £15,199, against £16,573 in the previous twelve months. There was a decrease in the traffic receipts in consequence of a rush to the Bullfinch District, which took a large number of the mining population away from Kalgoorlie.

A scheme for the construction of electric tramways in the Western Valleys District of Monmouthshire has been discussed by the Abercarn District Council. A company deposited a Bill in Parliament this session for the installation of a trolley omnibus system in this district, but it was subsequently abandoned.

With reference to the notice of purchase given by the Coventry Corporation to the Coventry Electric Tramways Co., neither side can see their way to name a price which would form the basis of negotiations with a view to avoiding arbitration. Under the Company's Act of 1903, the Corporation have to buy upon "going concern" terms, and as the parties have failed to agree, the Board of Trade will appoint an arbitrator.

Due to the strike of motormen and conductors in July and August last year, the receipts of the Perth (Australia) Electric Tramways, Ltd., dropped from £74,649 to £68,790. The report deals at length with the cause of the strike, which finally came about through the men refusing to abide by a decision of the Arbitration Court in Australia. The net profit amounted to £8,999, and after meeting debenture interest and preference dividends, a 2½ per cent. dividend is declared upon the ordinary shares, placing £1,000 to reserve, and carrying forward £554. The Company still has a term of 29 years to run, and in view of the feeling that the undertaking should be acquired either by the Perth City Council or the State, the directors have offered the Council the undertaking for a sum of £500,000. Negotiations are still proceeding.

Finsbury Technical College Old Students' Association.—At the annual general meeting, held recently, Mr. R. J. Wallis-Jones was elected President. The following gentlemen were elected to represent the electrical students on the Council of the Association:—Vice-President J. E. Raworth, W. B. Esson, F. R. C. Rouse, C. B. Nadaud, T. H. West, and E. W. Moss. Mr. H. W. Gregory is Electrical Hon. Secretary.

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REPORT ON THE STALYBRIDGE TRAMWAY ACCIDENT

LIEUT.-COL. P. G. VON DONOP has reported on the serious tramway accident which occurred at Millbrook, on the Stalybridge, Hyde, Mossley, and Dukinfield Electric Tramways at 6.30 a.m. on June 5th. As a tramcar was descending Ditchcroft Hill, Millbrook, it got out of the control of the driver, and ran away. In running down the hill it attained a high rate of speed, and on reaching a curve at the bottom of the hill it overturned, falling over on its right side. There were 43 passengers riding in the car at the time; of these 13 were so seriously injured that they had to be taken at once to the Infirmary, and one of them subsequently died. Twenty other passengers were slightly injured, and the driver of the car was also somewhat injured. The car to which this accident occurred was a four-wheeled, single-truck, double-deck car; it was fitted with a hand-brake working blocks on all four wheels, and with the Westinghouse magnetic brake, which by one action applies a track brake on each rail, and at the same time works the blocks on the wheels. The car was fitted at each end with two sand pipes.

The steep portion of the hill is 229 yards in length, the first 83 yards of the descent being on a gradient of 1 in 15·3, and the remaining 146 yards on a gradient of 1 in 11·4. At the top of the hill, where the gradient of 1 in 15·3 commences, there is a curve of 1½ chains radius, which is right-handed for descending cars; there is then a length of about 100 yards which is straight, and then at the bottom of the hill, near the termination of the 1 in 11·4 gradient, there is a left-handed curve, which also is said to be of 1½ chains radius. For descending cars there is a compulsory stopping place at the top of the hill, *i.e.*, just at the commencement of the 1 in 15·3 gradient; there is a second compulsory stop about half-way down the hill, and a third one at the bottom of it. Speed when approaching this hill and when running down it is limited by Regulation to 4 miles an hour.

The line on which cars approach the top of the hill is on a falling gradient of 1 in 28·8.

There appears to have been a certain amount of moisture in the air at the time that this accident occurred, and it is stated that the rails were on that account in a slippery condition.

The evidence of the driver was that before leaving the Stalybridge Depôt at 4.33 a.m. he had satisfied himself that the controller and the sanding arrangements were in order, and on reaching a Board of Trade stopping place a short distance from the car shed, he tested the Westinghouse brake and found it worked satisfactorily. During his first journey down Ditchcroft Hill he had no difficulty in controlling his car with the Westinghouse magnetic brake. On the journey when the accident occurred, he stated that he stopped at the compulsory stopping place at the top of the hill, but seven passengers gave evidence to the contrary effect. On starting down the hill, he said, he released his hand-brake, and moved the controller handle to the first notch of power; the car started slowly, and when it had gathered sufficient speed he applied the magnetic brake at the first notch, and then moved it on to the second; the car appeared to be gaining speed, which he attributed to the bad rail, so he kept on dropping sand, but the car did not retard at all; he then moved the controller handle to the third magnetic notch, and then to the fourth, but with no effect; the car had by this time acquired a great speed, and coming to the conclusion that the magnetic brake had failed, he shut it off altogether and applied the hand-brake; he thought that the car was going to get round the curve safely, but owing to the passengers on the top not keeping their seats the car turned over and fell on its right side. He is confident that the magnetic brake did not act at all the whole way down the hill.

In connection with the above evidence, says Lieut.-Col. von Donop, it may be at once pointed out that the driver, according to his own statement, acted in entire opposition to his instructions. According to the rule for coasting gradients, he should have set the controller handle at the fourth braking notch, and eased off his hand-brake; on the gradient on which the car was standing, no application of power was necessary to start the car, as it would have at once commenced to run forward by its own weight, and the magnetic brake would then have come into action whilst it was travelling at a low rate of speed; if this speed had been found to be too low, the controller handle might then have been moved to the third notch, which would have allowed a slightly increased speed to the car before the brake came into action again. The special object of this rule is to ensure that in coasting down a hill the brake is applied whilst the car is running at a very low rate of speed, but the driver's action in first applying power and then applying the magnetic brake at the second notch would have prevented the brake from coming into action until the car had attained a comparatively high rate of speed. He had also neglected to carry out the instruction to test his magnetic brake before starting down the steep gradient.

At the time that the car in question commenced to descend Ditchcroft Hill, there was another car, which had just ascended the hill and which was standing inside the loop points at the top of the hill, nearly opposite the compulsory stopping place. Both the driver and conductor of this other car are certain that the car which met with the accident did not come to a stop before commencing to descend the hill. Both these witnesses concur in stating that when the car was entering the loop points the driver was applying his hand-brake very hard, and that shortly after running past the compulsory stopping place they saw him apply the magnetic brake, but that neither brake appeared to check the speed of the car.

The car had been examined before leaving the sheds, and was believed to have been in perfect order. The flanges of its wheels were found after the accident to be in excellent condition. After the accident occurred, the police very properly did not allow the car to be touched until the responsible officials of the tramways reached the spot. It was then found that the hand-brake was applied nearly fully, and the blocks were tight on the wheels. The car was drawn back to the sheds by another car, and on that journey its hand-brake was tried and found to be in thoroughly good order. After Lieut.-Col. Donop's arrival, a new trolley pole was fitted to the car, and it was taken for a run in his presence; the magnetic brake was then tried, and was found to act perfectly. There are, in his opinion, therefore no grounds for attributing this runaway to any defect either in the hand-brake or in the Westinghouse magnetic brake, and he thinks that it is very doubtful whether the driver released the hand-brake before applying the magnetic brake.

The Westinghouse Brake Company are now fitting their magnetic brake equipment with an additional contrivance, which enables the track-brake to be applied mechanically as well as magnetically; the driver has thus the power to apply the track-brake, even though the wheels of the car are not revolving. For gradients such as those which exist at Stalybridge, this device would form an additional safeguard, and the Stalybridge, Hyde, Mossley, and Dukinfield Joint Board, says Lieut.-Col. Donop, might be asked to consider the advisability of fitting it on their cars.

The report concludes:—"As regards the overturning of the car, it is certain that on approaching the left-handed curve at the bottom of the hill the car must have been travelling at a high rate of speed, and centrifugal force would tend to make it heel over to the right or outside of the curve. The curve was examined after the accident, and it was found that at one point its curvature was of but 56 ft. radius, which is an exceedingly sharp curve for a car to run over at a high rate of speed. The superelevation was also examined, and it was found to have become very irregular; the maximum was 2¼ in., but at some points, even where the curvature was sharp, it was as little as ⅛ in. Under these circumstances it was almost inevitable, at the speed at which the car was travelling, that it should have overturned at this curve. The rails on the curve were found after the accident to be in good condition, and there does not appear to have been any defect either in them or in the wheels of the car which can have contributed to the overturning. This is now the third case which has occurred on this hill of a car having been allowed to get out of the control of the driver, and there is clearly no assurance that it will not occur again. To a runaway car, the curve at the bottom of the hill is an almost certain source of danger, and it is imperative that some steps should be taken to minimise the danger arising from it. The want of uniform superelevation could be corrected by banking up the road, and this should in any case be done forthwith. But the curve itself requires relaying so as to do away with the very sharp portions of it which now exist. It should, in fact, be so relaid that the curvature should at no point be sharper than the 1½ chains radius originally approved for it. This is, I am aware, a more difficult matter, as it will probably entail some widening or diversion of the road. But until this alteration to the curve is carried out, I do not consider that any top-deck car should be allowed to travel on this hill. The improvement on this curve is a matter calling for the Joint Board's urgent attention."

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ELECTRICALLY OPERATED DAM

A NEW dam, of the swing bridge type, has just been completed at the Soo Locks by the United States Government, and is described in the *Electrical World* of New York. It is intended to be used in cases of emergency, should the gates of other locks fail. The structure is 308 ft. long, 25 ft. wide, and weighs 2,100 tons. It is pivoted on a central island pier, giving 108 ft. clear channel on each side. The deck of the dam is provided with 32 wickets, each 6½ ft. wide. These are mounted to slide on rollers between steel girders, hinged from the structure, but normally folded under the bridge. Before dropping the girder frames, the wickets are first run out to the hinged ends of the frames, which are lowered to the bottom of the channel, where they seat themselves against 12 in. square concrete-anchored oak sills. The sliding wickets are then lowered in the frames, gradually stopping the flow of water. The swing motion of the dam is operated by two 52 h.p. geared motors, one of which is sufficient to move the structure in a heavy wind. Either or both motors can be manipulated from one or both of the duplicate controllers provided, by means of a double throw switch. The sixteen frame and wicket mechanisms on each side of the dam are operated from a pair of line shafts extending across the spans from the central deck. Each shaft is driven through clutches by a 150 h.p. 440-volt induction motor, and a third clutch is provided to interconnect the other two, so that either or both motors can be utilised to work the entire mechanisms. The girders and wickets are operated from these shafts by lever-controlled switches.

The energy, which is three-phase at 60 cycles, is supplied from the water-power plant of the Edison Sault Electric Co. It is transmitted at 2,300 volts, and stepped down to 440 volts by three 100 kw. transformers. These are mounted on a concrete base near the centre pier. Instead of using submarine cables to convey the current, a tunnel is constructed under the north channel, through which the cables are brought. It is reached by vertical shafts, and is 3 ft. wide, 6 ft. high, and its floor is 33 ft. below the water. It is kept free from water by a float-controlled motor-driven pump. The structure has been tested under flood conditions with a 20 ft. head of water, and found capable of controlling and stopping the flow. It can be swung across the stream in less than 90 seconds, and it is estimated that all the wickets can be lowered in less than another 60 seconds.

THE SIMMER PAN (TRANSVAAL) GENERATING STATION

A DESCRIPTION of the Victoria Falls & Transvaal Power Co.'s station at Simmer Pan appears in the *Journal of the South African Institute of Electrical Engineers.* This station is situated on Victoria Lake, from which it obtains its water supply. There are sixteen Babcock & Wilcox boilers, fitted with chain-grate mechanical stokers, and the Pratt system of mechanical induced draught. The capacity of each boiler is 20,000 lbs. of water per hour at a steam pressure of 200 lbs. per sq. in. The steam is superheated to 300° C. The coal is carried to the boiler bunkers by motor-operated conveyors, and fed by gravitation to the stokers. The generating plant in the turbine house consists of six sets of 3,000 kw. A.E.G.-Curtis turbo-generators, which generate at 2,240 and 10,500 volts, stepping up to 40,000 volts. The auxiliary plant, such as condenser, pumps, &c., are all electrically driven.

The high pressure switchgear is fixed into fireproof brickwork cubicles. This apparatus is under remote control from a separate operating room by means of current at a low pressure. The main switchboard consists of six generator panels placed together; another panel for three station transformers; two more for three 40,000-volt line transformers; another six 40,000-volt line panels; and six 10,000-volt line panels. Each of these is provided with a small control switch for operating the main oil switches. Lamps for indicating whether the switches are open or closed are also provided. The generator panels have control switches for regulating the turbine governors and the generator rheostats, besides the usual ammeters, wattmeters, and reverse current relays. The feeder panels are supplied with overload and Merz-Price protective relays. The exciters are controlled from a separate board. A storage battery is used for the lighting and operation of the relays, and is charged by a motor-generator. A large diagram is provided, which indicates at a glance the arrangement of the switches at any point on the system. Lines for various voltages are differently coloured, the switches are represented by discs, and it is easy to see the position of the switch and the pressure of the line on which it is operating.

SILICA LAMPS

THE Westinghouse Cooper Hewitt Co., Ltd. (151-152 Great Saffron Hill, Holborn Circus, London, E.C.), has recently put upon the market a new type of silica lamp for direct current, taking only 1½ ampere at 200-250 volts, and giving, it is stated, 800 c.p. The light is obtained from the incandescence of mercury vapour in a short tube of transparent quartz. This tube (called the "burner" for convenience by the makers, although, of course, no consumption of material takes place) is provided with two electrodes of mercury, and is exhausted to a high degree of vacuum. The lamp is started by the tilting of the burner by an electromagnet, which is automatically cut out of circuit as soon as the lamp lights up, and allows the burner to fall back to its normal position by gravitation. At first the colour of the light emitted is blue, but after a very short time, owing to the high temperature of the quartz, the light becomes whiter. This allows of clear or very slightly opal glass globes being used, which increases the output of light. The lamp is self-contained, and totally enclosed, and the makers are recommending it for use in places where enclosed carbon arcs are at present employed. It will stand fluctuations of voltage 10 per cent. above or below the normal without giving any trouble. We are informed that the life of the burner is, on an average, between 2,000 and 3,000 hours, and a minimum of 1,000 hours is guaranteed. About 260 of these lamps have been installed in Messrs. Vickers' works in Sheffield, and other firms which are using them include Vickers, Ltd., Barrow-in-Furness; John Brown & Co., Ltd., Clydebank; Leith Harbour and Docks, Leith; Messenger & Co., Loughborough; and North British Loco. Works, Glasgow.

The firm is also introducing the new "light transformer" reflector, described in ELECTRICAL ENGINEERING of Sept. 29th last, which can be fitted to the tubular pattern of lamp for the purpose of overcoming the peculiar colour of the light. It is coated with a special fluorescent material, and mounted behind the tube of the lamp in such a manner that the redder rays from the reflector mingle with the direct rays from the lamp.

LOCAL NOTES

Australia: *Melbourne Electricity Accounts.*—The accounts of the municipal electrical department for the year to Feb. 28th show a net profit of £19,532 after meeting capital charges amounting to £44,402. The number of consumers added to the mains was 546, compared with 359 during the previous year, bringing the total to 3,758. The total number of units sold was 8,920,489, an increase of 760,526. A new contract for coal has been entered into at 10s. 7d. per ton, against 16s. 10d. previously paid. A new battery is to be installed at the power house at an estimated cost of £21,000.

Belfast: *Dispute with Corporation.*—Messrs. William Coates & Son, Ltd., electrical engineers, of Belfast, applied last week in the Irish King's Bench Division, Dublin, for an order requiring the Corporation to approve of certain plans of buildings which the Company are erecting. It appears that the buildings in question are being erected upon land which the Corporation have taken powers to acquire under an Act of Parliament, this session. For Messrs. Coates it was submitted that disapproval under such circumstances was *ultra vires.* After a little discussion, the case was ordered to stand over until next sittings.

Biddulph: *Wiring.*—The Local Government Board have

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refused to sanction a loan for the supply of fittings and installation work in consumers' premises.

Dublin: *Tramcar Accident.*—A short time ago a girl was burned to death whilst travelling on the top of an electric tramcar. It is not known how her clothes became alight, and several suggestions have been made that it was due to an electrical defect on the car. The Board of Trade have considered the circumstances, and have refused to order an inquiry, as they have no reason to believe that there was any electrical defect.

Gillingham: *Fire at Electricity Works.*—A serious fire occurred at the Gillingham Electricity Works last week, doing damage estimated to cost £2,000. The fire was in a building where lamps, radiators, and other electrical appliances were stored.

Greenock: *Electricity Profits.*—Satisfaction was expressed at the last meeting of the Corporation at the large surplus upon the electricity department last year, viz., £5,520, after meeting capital charges and setting aside a sum for depreciation. It was unanimously decided to place £1,500 to reserve fund. The question of dealing with the remainder will be discussed at the next meeting of the Council.

Halifax: *Electricity Accounts.*—The Electricity Accounts for the year to March 31st, 1911, show a net profit of £5,323, after meeting capital charges amounting to £6,600. After writing off the balance of the cost of No. 1 economiser and part of the cost of a rotary converter, the sum of £693 is handed over to relief of rates, and £3,673 transferred to renewals fund. The total number of units sold was 5,964,665, against 5,477,369, and the maximum supply demanded 2,960 kw. against 2,870 kw.

Heckmondwike: *Plant Extensions.*—The Council have sent a strongly worded request to the Local Government Board for a decision with regard to the recent inquiry for a loan for extensions at the electricity works. It is complained that decisions have been given in other inquiries held later than that at Heckmondwike, and that the efficient working of the undertaking is being interfered with by the absence of a decision regarding the loan in question.

Holmfirth: *Lighting.*—A poll of the ratepayers is to be taken with a view to an application being made for an electric lighting Provisional Order.

Ilford: *Accounts.*—The accounts of the electricity department for the year to March 31st, 1911, show a net profit of £1,400 compared with £1,569 in the previous year, after meeting capital charges. This balance has been carried to reserve and depreciation account. The number of units sold increased from 3,152,591 to 3,299,927. The total costs, exclusive of capital charges, were 1·02d. per unit, against 1·03d. in the previous year.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Burnham.—Mr. W. H. Trentham has been appointed consulting engineer by the Council in connection with a proposed electric lighting scheme.

Cleethorpes.—Tenders are invited for a system of vulcanised bitumen distribution and feeder cables on a low-pressure three-wire D.C. system at 460 volts on the outers. Consulting Engineers, Messrs. Vesey Brown & Hall, Milburn House, Newcastle-on-Tyne. Tenders to Town Clerk by Sept. 2nd.

Ireland.—A Local Government Board inquiry has just been held at Killeshandra (County Cavan) in connection with a proposed electric lighting scheme. The Cavan Rural District Council are the authority.

London.—The Westminster Electric Supply Corporation require battery boosters and switchboards. Consulting Engineers, Messrs. Kennedy & Jenkin, 17 Victoria Street, S.W. Tenders by Sept. 2nd.

South Africa.—The Roodepoort-Maraisburg Municipality contemplate an expenditure of £8,000 upon an electric lighting scheme. According to the *Board of Trade Journal*, the Potchefstroom Municipality has been authorised to spend £20,000 upon an electric lighting scheme.

Worksop.—The Borough Electrical Engineer has prepared a report dealing with overhead wires, extensions to plant, street lighting, &c.

OSRAM·LAMPS

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

London.—Additions to the Western Fever Hospital, Seagrave Road, Fulham. W. T. Hatch, Engineer in Chief, Metropolitan Asylums Board.

PROVINCES.

Aberdeen.—Proposed new City baths.

Brighton.—Four new receiving homes and Infirmary at Warren Farm schools. Builders, Messrs. Mark Martin & Sons, Eastbourne.

Derby.—Electric lighting of Melbourne Church.

Dumfermline.—Drill hall for Fife Territorial Association. Women's Institute in Bath Street.

Glasgow.—Extensions to head offices of Caledonian Railway Co.

Extensions to the General Post Office. H.M. Office of Works, 3 Parliament Square, Edinburgh.—Buildings at North East Corner of Gallowgate and Graham Square. Architects, Burnet & Boston.

Warrington.—Tenders are invited for the electric lighting of the Evelyn Street Council school. Architect, Mr. A. Buttery, Exchange Place, Queen Street, Morley.

Warwick.—Children's Homes for the Guardians. Architect, F. G. Cundall, 4 Parade, Leamington Spa.

Worksop.—Additions to children's and males' wards, new kitchens, &c., at Victoria Hospital. Architect, A. H. Richardson, Market Place.

MISCELLANEOUS

Dublin.—The Electricity Committee invite tenders for 750 single-phase and 200 three-phase meters. Tenders to Chairman of Electricity Committee by September 7th.

TENDERS RECEIVED AND ACCEPTED

Australia.—A contract has been placed by the Sydney Council with Messrs. Noyes Bros. for a supply of electric motors. Orders for Ferranti and A.E.G. meters have also been placed.

Barnstaple.—A contract has been entered into with the D.P. Battery Co. for the supply and maintenance of a new battery at the Council's electricity works.

Belfast.—Messrs. J. Dowling & Sons, Queen Street, have secured the contract for the wiring and fitting of the new Argyle Place Presbyterian Church. Current will be taken from the Corporation mains.

Blackburn.—The tender of Messrs. J. W. Garsden & Co., electricians, Blackburn, has been accepted for the new fire alarm installation at the local workhouse, at £192 10s.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 10s. (last week, £58 5s. to £58 15s.).

Plant for Sale.—The Great Northern Railway Co. of Ireland have two Crossley gas engines and two shunt-wound dynamos and switchgear for sale. Full particulars from the Secretary, Amiens Street, Dublin.

Liquidations.—A meeting of creditors of the Havana Telephone Securities Co., Ltd., will be held at New Broad Street House, London, E.C., on August 31st, at 2.30 p.m.

APPOINTMENTS AND PERSONAL NOTES

Mr. A. E. McKenzie, who has held the position of resident engineer at the Stuart Street (Manchester) Electricity Works since 1903, has been promoted to chief assistant electrical engineer to the Manchester Electricity Department.

Mr. David Smith has severed his connection with the Foster Engineering Co., Ltd.

Mr. F. Swarbrick, for the past six years engaged at the Leigh (Lancs.) Electricity Works, has commenced his duties as Chief Engineer at the Galway (Ireland) Electricity Works.

Draughtsmen used to switchgear design are required by a large electrical firm. (See an advertisement.)

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

ALUMINIUM.—Two leaflets are to hand from the British Aluminium Company (109 Queen Victoria Street, London, E.C.) illustrating aluminium plant in chemical works, and aluminium trolley heads.

BATTERIES.—We have received from the Hart Accumulator Co. (Stratford, London) a neat advertising novelty in the form of a small celluloid case containing court plaster. It also provides a calendar for 1911 and 1912 on the back.

THE RUPING PROCESS OF CREOSOTING.—A pamphlet dealing with the antiseptic treatment of timber has been issued by Richard Wade, Sons & Co., Ltd. (Garrison Side, Hull). That creosote is the best preservative known is shown by its great export to America for this purpose, and the increasing demand for timber-preserving in this country. From 80 to 85 per cent. of the timber used is lost from decay. This is due to fungi, which are always present in the air and ready to lodge on unprotected timber. They, however, require moisture, air, and warmth, and if these are absent they cannot live. Hitherto the practice was to inject so many pounds of creosote per cubic foot of timber. It has been proved by test that moisture is not excluded by the method now in use. The aim of this process is to thoroughly saturate the fibre and cell walls with the preserving liquid, without leaving any in the interior of the cells. No new substances are used, the only thing new being the method of putting them into the wood. The cost of this process is said to be greatly reduced compared to the existing method.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ELECTRIC CLOCKS.—The Silent Electric Clock Co. (192 Goswell Road, London, E.C.) has published a "catechism" fully describing a system in which any number of clocks in an installation can be controlled and kept in time by electric impulses sent from a master clock. These are sent every half-minute, and are used to rotate a circular armature instead of using a steel claw to engage a ratchet wheel. The company also make a special worm-driven movement for turret clocks up to 6 ft. or 8 ft. diameter. Various types of "programme ringing" attachments are also described. These consist of an arrangement for ringing bells throughout the installation at predetermined times, and include an automatic switch, which cuts off the bells during the week end.

ELECTRIC COOKING APPLIANCES.—A card has reached us from Simplex Conduits, Ltd. (Garrison Lane, Birmingham), illustrating an improved pattern nickel-plated toaster, and a two-pint copper kettle, which boils in ten minutes at 500 watts.

CARBONS.—A catalogue, published in English, has been issued by Rylander & Rudolphs (Henriksdal, Sweden), and sent to us by James McMillan & Co. (Clun House, Surrey Street, Strand, London, W.C.). It relates chiefly to carbons for brushes, telegraphs, and telephones, and several particulars are given of the various patterns of carbon brush in which the firm specialises.

NEW COMPANIES

TAYLOR & FRASER, 31 Argyle Street, Glasgow. Capital £4,000. Heating and ventilating engineers.

SKELMORLIE ELECTRIC SUPPLY CO., 13 St. James Place, Paisley. Capital £10,000.

BRAUNTON ELECTRIC LIGHT & POWER CO.—Registered by Jordan & Son, 115 Chancery Lane. Capital £5,000. Messrs. Crompton & Co. are interested in this promotion.

ARDROSSAN & SALTCOATS ELECTRIC LIGHT & POWER CO., 63 Castle Street, Edinburgh. Capital £20,000. The first directors are G. Balfour and H. A. Beatty.

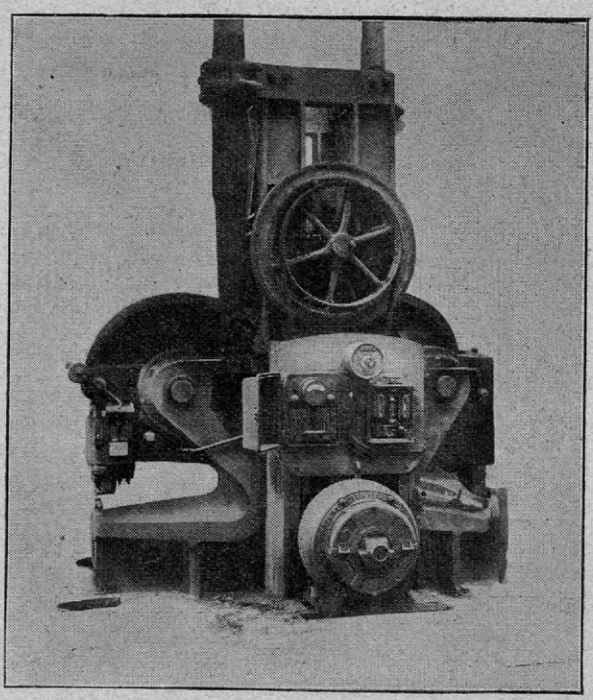
COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Jandus Arc Lamp & Electric Co.—The result of the trading for 1910 allows of the payment of a 10 per cent. dividend on the ordinary shares, the transfer of £2,500 to reserve, and the carrying forward of £3,289.

Northern Light, Power & Coal Co.—A special meeting was held in London last week at which the creation of $1,000,000 debentures, to rank in priority to the existing first mortgage gold bonds, was sanctioned. The company supply electricity in the city of Dawson, and for the half-year to June 30th the profits amounted to £14,400.



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ACCESSORIES (Electric Light and General Supplies).
Cable Accessories Co., Ltd., Britannia St. Works, Tividale, Staffs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Electrical Power Storage Co., Ltd., 4, Great Winchester St., E.C.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Tudor Accumulator Co. Ltd., 119, Victoria St., S.W.

AIR COMPRESSORS.
Belliss & Morcom, Ltd., Birmingham.

AUCTIONEERS AND VALUERS.
Wheatley Kirk Price & Co., 46, Watling St., E.C.

ALUMINIUM.
British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

ARC LAMPS AND ACCESSORIES.
Beck Flame Lamp, Ltd., Suffolk House, Laurence Pountney Hill, E.C.
British Thomson-Houston Co., Ltd., Rugby.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.
Jandus Arc Lamp and Electric Co., Ltd., Hartham Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Union Electric Co., Ltd., Park Street, Southwark, S.E.

ARMATURE REPAIRS.
Marryat & Place, 28, Hatton Garden, E.C.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
India-Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Rickard (Wm.), Ltd., Ashbourne Road Mills, Derby.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Willans & Robinson, Ltd., Rugby.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

EXHIBITION STANDS.
Erdman (M.) & Son, 26a, Theberton Street, N.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.
M.A.N. Co., Caxton House, Westminster, S.W.

GAUGES AND GAUGE GLASSES.
Tomey (Joseph) & Sons, Ltd., Catherine St., Aston, Birmingham.

HEATING AND COOKING APPARATUS.
Bastian Electric Heating Syndicate, Ltd., Palmerston House, Old Broad St., E.C.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87–89, Cleveland Street, W.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Eversheds & Vignoles, Ltd., Acton Lane Works, Chiswick.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.

INSULATING MATERIAL.
Weidmann (H.), Rapperswil, Switzerland.

INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
The Fredk. Crane Chemical Co., 22 & 23, Newhall Hill, Birmingham.

LAMPS (Incandescent).
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Brush Electrical Engineering Co., Ltd., 1, Kingsway, W.C.
Cryselco, Ltd., Kempston Works, Bedford.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
Electrical Co., Ltd., 122/4, Charing Cross Rd., London, W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Krupka & Jacoby, 11, Queen Victoria St., E.C.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

METERS.
Aron Meter Co., Ltd., 80A, Salusbury Road, Kilburn, N.W.
Bastian Meter Co., Ltd., Kentish Town, N.W.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Co., Ltd., 122/4, Charing Cross Rd., London, W.C.
Ferranti, Ltd., Hollinwood, Lancs.

MINE EQUIPMENTS AND APPARATUS.
British-Thomson Houston Co. Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
Adnil Electric Co., Artillery Lane, London, E.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Electromoters, Ltd., Louisa St., Openshaw, Manchester.
General Electric Co., Ltd., 67, Queen Victoria St. E.C.
Ingleby & Co., Elland Road, Leeds.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Ltd., River Don Works, Sheffield.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
Willans & Robinson, Ltd., Rugby.

STEAM CONSUMPTION RECORDERS.
Lea Recorder Co., 28, Deansgate, Manchester.

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Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
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Constable (Archibald) & Co., Ltd., 10 Orange St., Haymarket, W.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W.
Electric Journal, 422, Mansion House Chambers, E.C.
Electrical Engineering Abstracts, 57–58, Chancery Lane, London, W.C.
Griffin (Charles) & Co., Ltd., 12, Exeter Street, Strand, W.C.
Indian Industries and Power, 204, Temple Chambers, E.C.
International Institute of Technical Bibliography, 57 & 58, Chancery Lane, E.C.
Lewis's Scientific Circulating Library, 136, Gower Street, W.C.
Longmans, Green & Co., 39, Paternoster Row, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.
Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Graham (Alfred) & Co., St. Andrew's Works, Crofton Park, London, S.E.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.
Western Electric Co., Ltd., North Woolwich, E.

TESTING LABORATORIES.
Electrical Standardizing & Testing Institution (Faraday House), 62–70, Southampton Row, W.C.

VACUUM CLEANERS.
Duncan Watson & Co., 62, Berners St., W.

VULCANISED FIBRE.
Mosses & Mitchell, 122–124, Golden Lane, E.C.

WATCHES.
Leecla Watch Co., 215, Old Street, Ashton-under-Lyne.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

No. 244 [Vol. VII., No. 35] THURSDAY, AUGUST 31, 1911. [Price One Penny.
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SUMMARY

The Liverpool tramway strike has been settled; the Committee has agreed to take back the strikers "as and when required." In London, the chief officers of the L.C.C. tramways department have met the officials of the men's union, and there seems every prospect of an amicable settlement. (Page 482.)

Electric power is transmitted from Niagara to several Canadian towns by a 110,000-volt transmission line. Particulars of the arrangements are given, and details with regard to the construction of the line. Aluminium cable is employed, and the cost of this is compared with the relative cost of copper; with due allowance for the additional cost of the supporting towers, there has still been a large gain in the use of aluminium. (Page 483.)

We are in a position to state that when the allocation of the grant by the Board of Agriculture of £50,000 annually for research work comes to be determined, the use of electricity in agriculture will receive serious consideration, and it is anticipated that a sum of money will be applied to experimental work in this connection. (Page 485.)

A new back geared screw limit switch for lifts and similar cases as a substitute for a tappet switch is described on p. 485.

"Graphic" instruments is a new name for recording instruments suggested by Messrs. Everett, Edgcumbe & Co., who have also sent us a description of their new instruments of this class. (Page 486.)

Sir William Ramsey's Presidential Address to the British Association contained some caustic criticisms on the present organisation of technical education in this country, and also dealt with the problem which arises in view of the ultimate exhaustion of our coal supplies. (Page 487.)

Letters from the "Z" Electric Lamp Manufacturing Co. with regard to patent litigation, and from the Sandycroft Foundry Co., on the Dundalk storage battery contract, appear on p. 488.

In our "Notes on Telephony and Telegraphy (Including Wireless)" we refer to a novel prosecution in California for publication of a stolen wireless message, and a wireless telegraph installation for the American Navy having a range of 3,200 miles. (Page 489.)

Alterations and extensions in connection with the Walsall electricity undertaking are described on p. 489.

In a review of an illustrated book on meters issued by the Electrical Co., we describe an automatic brush-shifting device to compensate for the friction at light loads, and a D.C. meter of the oscillating type without brushes, and mention a suggestion for determining the "life factor" of meters. (Page 489.)

The British Thomson-Houston Co. have patented a new insulating material formed by the impregnation of soft absorbent paper with a liquid formed by the reaction between phenolic bodies and aldehydes. Another specification published by the Patent Office

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last week describes a reversing controller for A.C. commutator motors, in which the field coils are connected in series with one half of the primary of a transformer, and the armature is connected to the secondary. A patent taken out by Siemens & Halske describes a method of hardening the surface of tantalum. Opposition to a patent by J. Keith describing a new design of runner for centrifugal fans has been unsuccessful. (Page 490.)

The Lancashire Electric Power Co. are making another effort to secure powers to supply electricity in Radcliffe in competition with the Council.—In his annual report, Mr. A. Ellis, Borough Electrical Engineer at Cardiff, deplores the absence of powers to carry out installation work.—A new street lighting scheme, which substitutes clusters of metal filament lamps for arc lamps, has been drawn up at Maidstone.—The Dolcoath mine, in Cornwall, is being electrically equipped. (Page 492.)

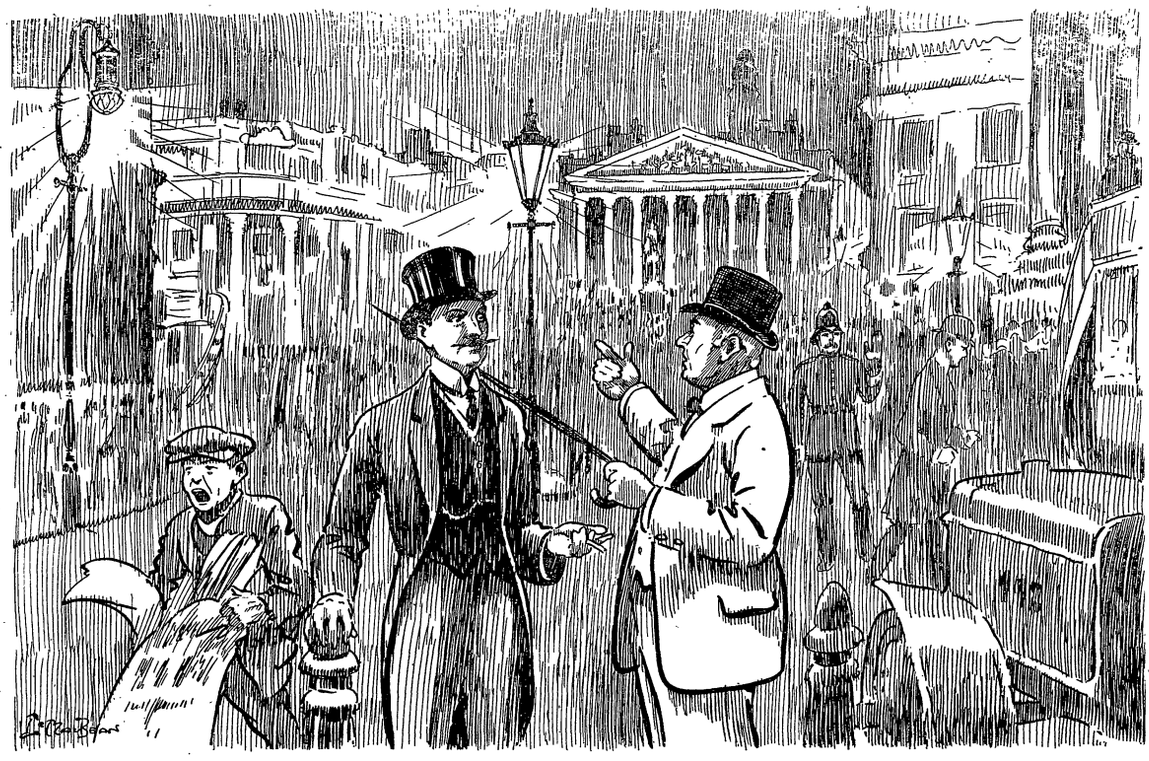
Local Government Board inquiries have been held at Bangor (£2,000); Barnsley (£16,000); Darwen (£7,600); Rawtenstall (£2,000); and the Llandudno Council are to apply for a loan of £500 for mains. The Eccles Electricity Department require a H.T. single-phase switchboard, and the Swinton Council cables, &c. (Page 492.)

THE STRIKE

THE dispute between the Liverpool Strike Committee and the Liverpool Tramways Committee with regard to the reinstatement of the tramway men who struck, referred to in our article last week dealing with the strike, was settled on Thursday. At first the Liverpool Tramways Committee had refused to guarantee to reinstate these men, with the result that the whole of the dock workers were kept on strike by the Strike Committee. After a long meeting of the Tramways Committee on Thursday, a resolution was passed agreeing to reinstate the men in question "as and when required." This was the most which the Committee would do to meet the demands of the Strike Committee, in spite of the fact that the strike leaders had threatened to bring about another national railway strike if the tramway strikers were not reinstated at once, and the Strike Committee had no option but to accept these terms. With the settlement of the tramway dispute, work all round Liverpool was immediately recommenced, and the city is gradually getting back to its normal state.

Whilst the Liverpool dispute was being settled, the London tramway men were still persisting in their demand for consideration of their grievances, and for these to be discussed through the medium of their Trade Union officials. On Saturday, however, Mr. A. L. C. Fell, Chief Officer of the Tramways, Mr. Bruce, Deputy Chief Officer, and Mr. Slattery, Traffic Superintendent, received the men's representatives, and it is stated that a number of the grievances were adjusted, and several minor concessions made which it is hoped will lead to a satisfactory settlement of the trouble. At any rate for the moment, all thought of a strike of the London tramway men has been put on one side, the ballot on the question not having been completed.

Faraday House.—The training of the electrical engineer is fully discussed in a pamphlet received from Faraday House. It is well illustrated with views of all the departments of the Institution, as well as a few of the more important firms with which the college is affiliated. The great respect with which the course is held is evident from a list of testimonials, showing the great appreciation of both students and parents for the way in which the former have been trained and turned out fully equipped for taking up important positions. Assistance in placing students who have finished their courses is given by the energetic secretary, who, being in touch with most of the best men of business, spares no efforts to place his students in a satisfactory position for their future welfare. Besides this, applications are always being received from firms, and other branches of the profession, for men "such as you have sent us before." The next term commences on September 25th, and a prospectus giving every detail of the four years' course, which includes two years pupilage at a manufacturing works or electricity supply station, can be had on application.



LONDONER (*to his friend from the Country*): There are two companies supplying electric lighting in the City.
THE OBSERVANT FRIEND FROM THE COUNTRY (*pointing to the open and flame arc lamps*): Yes, I had already noticed that their two electricities have different colours.

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THE 110,000-VOLT TRANSMISSION LINES OF THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO

THE Hydro-Electric Power Commission of Ontario, Canada, is the outcome of an agitation started in various towns in the Province for a supply of cheap power from Niagara. The movement dates back to the years between 1900 and 1902; in 1903 a Commission representing seven municipal authorities was formed, and this was replaced by a permanent Commission nominated by the Government in 1906. This Commission consists of three members, who are invested with powers to control the rates charged for light and power in the Province, to construct works, and generally to further the utilisation of electric power for industrial purposes. The Commission has worked for the last five years in conjunction with the municipalities of the Province, and has now a transmission system of some 100,000 h.p. capacity, supplying power to over twenty large towns, and having overhead lines aggregating 283 miles.

As there were already a number of companies with large power stations at Niagara Falls, it was decided that, for the present at any rate, the Commission would buy power from one of these, and confine itself to the transmission of the energy to the various towns, and to a general control of the system. Tenders were therefore invited from the several power companies, and an agreement was ultimately made with the Ontario Power Company, whose enormous station at Niagara was described in ELECTRICAL ENGINEERING, Jan. 13th, 1910 (Vol. VI., p. 21). The power is bought at the generated pressure of 12,000 volts, and transformed to 110,000 volts by the Commission. Originally it was intended to require delivery of the power at 60,000 volts, and to transmit it at that pressure, but it was thought that a still higher transmission voltage would be feasible. The company has agreed to provide power up to 100,000 h.p., but the Commission may purchase from other sources also after a certain amount is reached. The contract price is £1·875 per horse-power per annum, and this enables the Commission to supply the various municipalities at charges ranging from £3·65 to £8·6 per horse-power per annum, according to the distance away from Niagara.

The 12,000 : 110,000-volt transforming station at Niagara is connected to the generating station by an underground cable conduit, 2,500 feet long, and containing six 3-core paper-insulated cables of 0·236 sq. in. section. These cables, which were tested up to 50,000 volts between cores, were manufactured and supplied by Messrs. Siemens Bros. & Co., of London. The transforming sub-station is equipped with oil circuit-breakers with overload relays, and, at present, nine star-connected 3,000 K.V.A. single-phase transformers, which can be regulated to give a secondary pressure of from 110,000 to 132,000 volts. On the high-tension side, the current passes through disconnecting switches and oil-switches to the 110,000-volt 'bus-bars, which consist of one-inch copper tubes spaced 6 feet apart. From these the current passes through further switches and oil circuit-breakers to the line exits, which are built up of heavy porcelain tubes supported in the centre of a 5-foot square opening in the wall filled in with four sheets of plate glass. Choking coils and horn-gaps with electrolytic lightning-arresters are provided at this end of the line. All this equipment was supplied by the Canadian Westinghouse Co. The transformers are oil-insulated, water-cooled, and the terminals of these and of the circuit-breakers are provided with the Westinghouse condenser bushing.

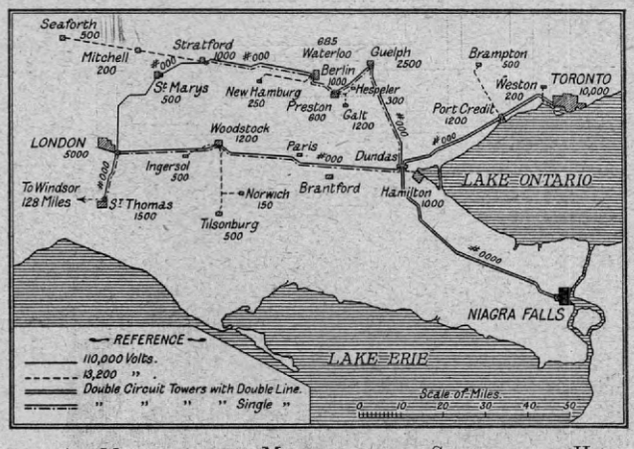


FIG. 1.—MAP SHOWING MUNICIPALITIES SERVED AND HORSE-POWER TAKEN BY EACH.

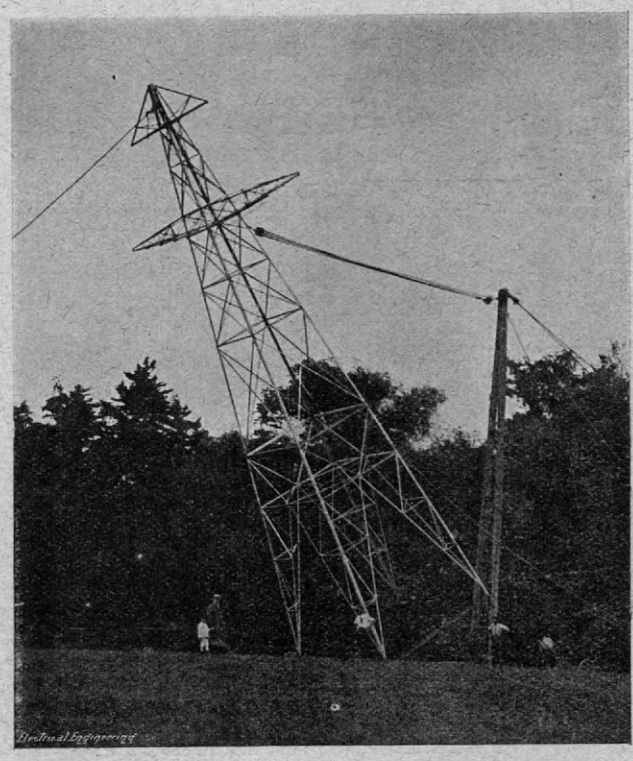


FIG. 2.—ONE OF THE STANDARD TOWERS FOR THE LINE IN PROCESS OF ERECTION.

Fig. 1 shows the extent of the system and the municipalities served. The main line from Niagara Falls to Dundas is erected on steel towers, spaced about 550 feet apart, and each carrying two three-phase circuits of stranded aluminium cable of 0·1662 sq. in. section. An illustration of one of the standard towers is given in Fig. 2, and Fig. 3 gives the dimensions. The actual cost of this line, including towers, cables, insulators, telephone lines, and cost of carriage and erection was £1,180 per mile, of which the six aluminium cables accounted for some £302 per mile, and the insulators £90 per mile. The alternative tender for a copper line was £1,250 per mile, of which the copper cables accounted for £428 per mile. These relative costs are on the basis of aluminium ingots at £80 per ton (aluminium wire about £105 per ton), and copper bars at £60 per ton (copper wire at £75). It will be seen that

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an actual saving of £70 per mile of line, or some 5·6 per cent. of the total cost of a copper line, was effected by employing aluminium cables. Thus on the 52 miles of line between Niagara and Dundas alone a saving of £3,640 has been obtained. If a comparison is made of the cost of the aluminium and copper cables only, there is, of course, a still larger difference—in fact, the gain then shows as 29 per cent. of the cost of the copper cables. Owing to the small proportion of the cost of the cables to the total cost, however, and the necessity for somewhat higher and therefore more costly towers due to the greater sag of aluminium cables, this saving is reduced to 5·6 per cent. of the total cost of the line. The tendered and accepted costs referred to above have been extracted from a report of the Commission, and the figures deduced from these form, therefore, a practical example of the actual saving to be effected by the use of aluminium for extra high-tension transmission lines.

The line from Dundas to Toronto is 36 miles in length, and consists of towers with two three-phase circuits of stranded aluminium cable of 0·1318 sq. in. section. The cost of this line was £1,096 per mile, of

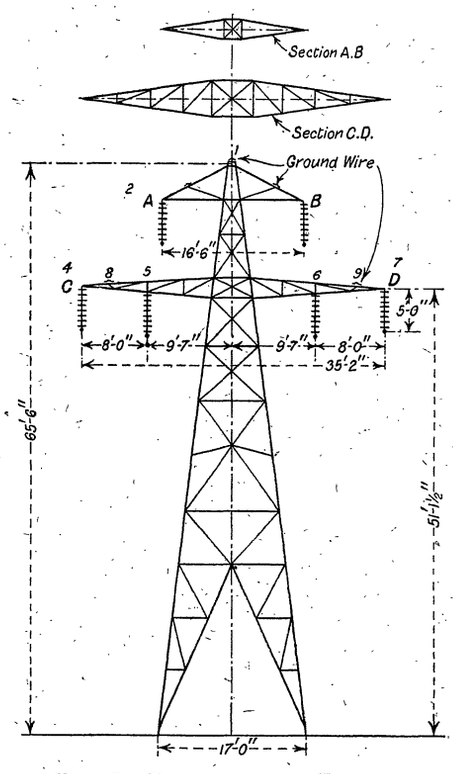


Fig. 3.—Dimensions of Towers.

which the cables accounted for some £240. The alternative tender for a copper line was £1,142 per mile, so that the saving consequent upon the adoption of aluminium conductors amounted to £46 per mile, or about 4 per cent. only, due to the smaller proportion of the cost of the cables to the total cost.

The steel towers were constructed by the Canadian Bridge Co., according to the designs of the Power Commission's engineers, and a test tower withstood a horizontal pull near the top of over 20,000 lbs. before buckling. About 3,000 towers were required for the 283 miles of line already constructed, there being about 10 towers to the mile. All the steelwork, except the footings, were hot galvanised. The steel footings were painted with a special preservative, and concrete footings were provided only in a few cases. The whole line is protected by overhead earthed steel cables, two on the double-circuit towers and one on the single-circuit towers. The minimum distance between the conductors is 8 feet, but this is increased to 14 feet in the case of a very long span of 1,100 feet. Special towers 140 feet high are used for one long span over a canal. The standard double-circuit towers, of which there are 2,305, are 65·6 feet in height, and weigh 1·78 tons each. The other dimensions are shown in Fig. 3.

The insulators are of the suspension type, and were supplied by the Ohio Brass Co. As shown in Fig. 4, each insulator consists of eight pieces, each 10½ in. diameter, and is 5 feet 2 in. in length overall. The lowest piece is provided with a special malleable cast-iron clamp with grooves for gripping the cable, which is protected by an aluminium sleeve. Two sheet-iron covers project over the cable on each side to protect it from burning in the event of a flash-over. At all

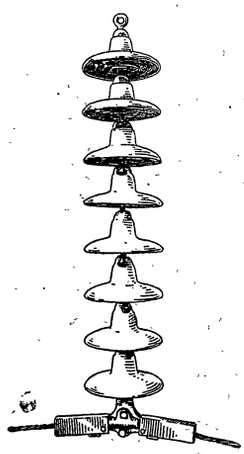


Fig. 4.—Suspension Insulator.

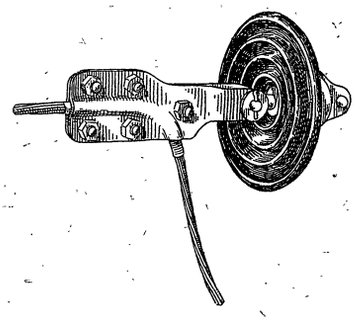


Fig. 5.—Strain Clamp.

angles and also at about every 1½ mile along the line, the cables are strung up to the towers by special strain insulators (Fig. 5) of ten pieces each, with a clamp formed of two ¼ in. steel plates, which grip the cable in an aluminium sleeve. All clamps are heavily galvanised. The price of the insulators was £1 9s. 3d. each for the complete 8-unit ordinary pattern, and just over £2 each for the 10-unit strain type. Over 6,000 of the former and 2,000 of the latter have been supplied. These figures do not include the cost of the clamps. The specification demanded that the complete insulator should withstand a pressure of 330,000 volts (three times normal) dry, and 220,000 volts under a heavy rainfall combined with a wind strong enough to

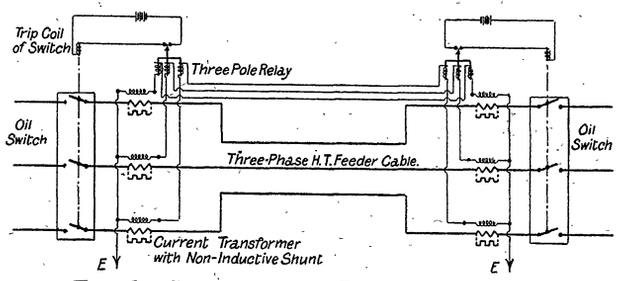


Fig. 6.—Connections of Protecting Device.

blow the rain at an angle of 45° towards the insulator. Mechanically, the ordinary insulator was required to withstand a pull of 8,000 lbs., while the strain insulator was required to withstand a 10,000 lbs. pull. The Ohio Brass Co.'s insulator was chosen from seven different types submitted by five different makers. Owing to the high test pressure specified, the insulators are suitable for a working pressure of 150,000 volts should the Commission decide to raise the transmission line pressure to this amount.

The aluminium cables are jointed by the torsion sleeve joint.

The system of protection employed is illustrated in Fig. 6. A triple-pole relay at each end of the section closes the local battery trip-coil circuit of the main

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oil-switch, and completely disconnects the section on the balance being disturbed. It will be seen that the relay coils at each end of the section are connected in series with current transformers to an earthed neutral point on one side, and are joined to the corresponding relay coils of the other station by three pilot wires which are strung alongside the telephone wires. In the event of a break or short-circuit in any section, that section is cut out immediately by the action of the relays. As all the important sub-stations are connected on a ring main, however, the shut-down of any one section will not interrupt the supply.

For intercommunication between the different sub-stations and switching stations, a comprehensive telephone system has been provided. A separate pole line parallels the whole of the transmission line network, and the patrol men are provided with means for connecting to the line at any point. The two main exchanges, at Dundas and London respectively, are equipped with boards wired for twenty lines, and provided with six-cord equipments. Special impedance coils are provided to drain off any static charges which may be induced in the lines.

The Dundas station is mainly an interswitching station, but contains also transformers for a local supply at 13,200 volts. The electrical equipment of this station was supplied by the Canadian Westinghouse Co., and includes six 110,000-volt electrically-operated circuit-breakers, lightning arresters, operating switchboard, &c. Toronto has the largest terminal sub-station in the system; the capacity of the transformers is 7,500 kw., divided amongst six 1,250 kw. units. Power is distributed locally at 13,200 volts to numerous sub-stations forming a ring round the outskirts of the city. The distribution systems are mainly overhead, some 30,000 pin insulators being employed. The chief municipalities taking power from the Commission are those of Toronto, London, Guelph, St. Thomas, Woodstock, Galt, Berlin, Stratford, Hamilton, and Brampton, but numerous smaller municipalities also take power to the amount of several hundred horse-power. In all of the sub-stations the leading-in and switching arrangements for the 110,000-volt line show carefully thought-out design for the special circumstances of the case. The apparatus has been mostly supplied by the Canadian Westinghouse Co. and the Canadian General Electric Co.

It is interesting to note that in all about 2,000 tons of aluminium cable is in use in the transmission and distribution systems. Some 500 miles of this cable was supplied by the British Aluminium Co.

The chief engineer appointed by the Commission to superintend the construction and organisation of the whole system is Mr. P. W. Sothman, who has had considerable experience in Germany, Russia, and South Africa, and was at one time manager of the large power distribution system of Strasburg, which includes 97 municipalities.

In the preparation of the above article we have been assisted by the published reports of the Hydro-Electric Power Commission, and also by information contained in the *Canadian Electrical News*.

In concluding, it will not be without interest to give our readers an idea of the enormous amount of electric power generated from the Niagara Falls. There are five large power companies. The Ontario Power Co. has already been mentioned; its power house (whose ultimate capacity will, it is said, be 200,000 h.p.) is now equipped with eight 12,000 h.p. sets. The Hydraulic Power Co. has three stations, the largest of which has ten units of 10,000 h.p. each; the Niagara Falls Power Co. has two stations, one containing ten 5,000 h.p. units and the other eleven 5,500 sets; the Canadian Niagara Co., which is interconnected with the Niagara Falls Co.'s station, has six units of 10,000 h.p.; and lastly a station of somewhat smaller size is owned by the Toronto Power Co., which is, however, nearly doubling its capacity this year. The total capacity of the power houses at Niagara is therefore approximately 400,000 h.p., which, it may be added, represents but 4 per cent. of the estimated power which would be available if the total flow of water were utilised.

ELECTRICITY IN AGRICULTURE

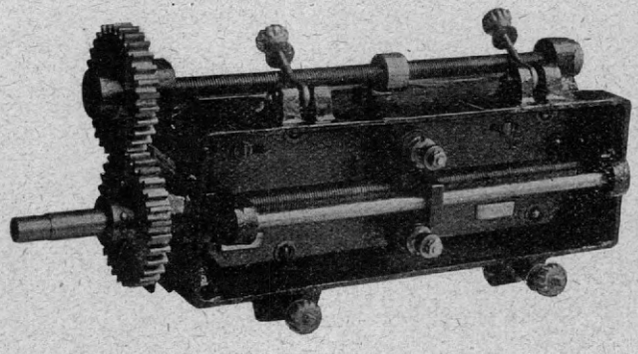
THE announcement is made that the Board of Agriculture have adopted a scheme which has been formulated by the Development Commissioners for considerable agricultural research work. For this purpose the Treasury has sanctioned an annual expenditure of £50,000. The scheme, which is at present in the earliest stages, provides for the carrying out of research work in practically all branches of agriculture, including plant nutrition and soil problems.

We are in a position to state that the question of the use of electricity in agriculture will receive serious consideration, and it is to be anticipated that a sum of money will be allocated to this purpose. Any experiments of this nature which may be carried out, even if placed in the hands of private individuals, will, of course, be under Government control, and it is not unlikely that the Bristol University, where Dr. J. H. Priestley has done so much valuable pioneer work, will receive a substantial grant for the continuation of that work. At the same time it will be several months before any actual grants are made, as a large amount of preliminary work, in the way of co-ordinating the past efforts of private individuals, has to be done. It is certainly to be hoped that the practical experimental work started by Mr. J. E. Newman independently at first, and later with the assistance of Sir Oliver Lodge and Mr. Lionel Lodge, will be extended, and that further valuable results will be obtained. A *résumé* of the work carried out to date will be found in Electrical Engineering of July 21st, 1910, and April 6th, 1911.

A BACK-GEARED SCREW LIMIT SWITCH

THE illustration below shows a back-geared screw limit switch for valve control, and for use with lifts or machine tools, which has been introduced by the Adams Manufacturing Co., Ltd. (106 New Bond Street, W.).

It is not always convenient or desirable to instal limit switches of the tappet-operated type in the well of a lift or hoist, and in such a case it becomes necessary to employ



limit switches of the travelling-nut or equivalent type. The switch illustrated above is adapted to be driven directly from a lift or valve mechanism, either by means of back gear, sprocket wheel and chain, or other positive drive. Protecting covers, or completely enclosed, or water-tight cases and covers can, of course, be provided if required, and for use in connection with electrically-controlled motor-driven valves or slow-moving reciprocating machine tools, similar screw-actuated limit switches can be fitted with contacts opening with a snap action.

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"GRAPHIC" INSTRUMENTS

An instrument which records kilowatt hours or Board of Trade units is called a meter. Instruments which indicate volts, amperes, or watts respectively, are called ammeters, voltmeters, or wattmeters. If the instrument records on a chart the current, voltage, or watts at any moment, it should be called a recording ammeter, voltmeter, or wattmeter as the case may be. But some people follow a practice initiated in America, and call a meter that measures kilowatt hours a recording wattmeter. Messrs. Everett, Edgcumbe & Co. suggest, therefore, that to avoid confusion, the word "recording," as applied to electrical instruments should be dropped, and that it should be replaced by the word "graphic."



Fig. 1.

The firm at the same time are introducing some new recording instruments to which this name will doubtless be given on their trade literature.

Fig. 1 shows the general appearance of the new recording voltmeter. Externally, the instrument calls for little remark beyond drawing attention to the exceptionally large glass window through which a long length of record can be clearly seen, and to the special spring fastening which affords an absolutely dust-tight joint, and yet can be opened with one hand. It is also so arranged that a padlock or seal can be employed if desired.

Fig. 2 shows the internal appearance of a moving coil recording ammeter. Covering the permanent magnet, and shielding it from stray magnetic fields, is a detachable hood which is seen as a "ghost" in the figure. As will be gathered

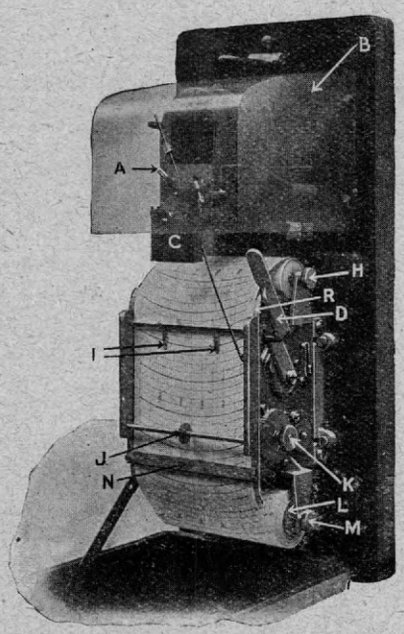


Fig. 2.

from the illustration, a roll of chart is inserted between spring centres above the clock, and passes down under two springs and a toothed guiding wheel in the centre. Under this latter lies the driving wheel of the clock mechanism. The arrangement is devised with a view to rendering any slipping of the chart impossible, and also to avoid any troublesome tendency to creep to one side or the other. Below the clock is a roller on which the chart can be made to wind itself up, if required, as it is passed through the recorder. On the right hand side will be noticed the winding lever which, owing to the construction of the case, is accessible and conveniently placed. Below this lever are the change wheels whereby any desired paper speed can be provided. These wheels are also readily accessible, and any subsequent change in the chart speed can be carried out without returning the recorder to the factory. Further, by means of a simple gear-changing device, two or more speeds can be provided on a single instrument, so that the same recorder can be used for widely different purposes. For example, a speed of 1 in. per hour can be provided for ordinary work, and this can instantly be altered to, say, 1 in. per minute for use in connection with machine tool driving.

The makers make a special feature of a hinged pen arm which can be instantly removed for cleaning or replacement. The operation is shown in Fig. 3, which indicates the method of removing the pen by merely pressing together the two arms of the spring fork between the finger and thumb. Amongst the advantages claimed for this construction of pen, are, besides ease of removal, a constant and readily adjustable pressure on the paper, and the maintenance of a very high insulation resistance between the electrical winding and the pen, which last is a most important point, particularly in connection with traction and other earthed systems. It will also be noticed that the pen moves over the surface of the chart between the two rollers, and not on the curved portion. Oil bath damping is employed, and this is adjustable so that any required amount of dead-beatness can be obtained.

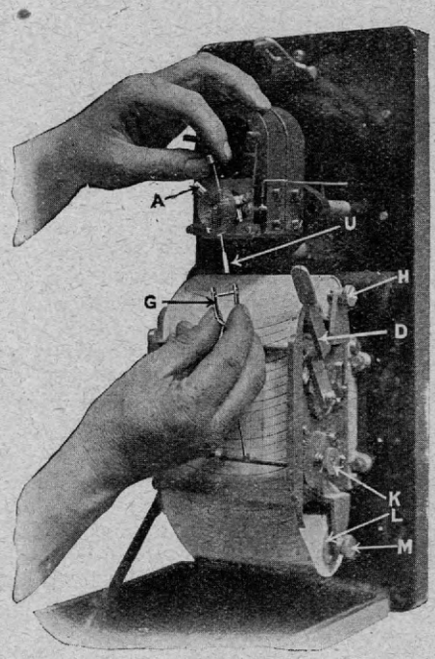


Fig. 3.

Further particulars as to the ranges of the instruments, &c., may be obtained from Messrs. Everett, Edgcumbe & Co. (117 Victoria Street, Westminster, S.W.).

Record Summer Peak Load on New York Power Station.—A severe electrical storm occurred in New York on August 15th, and was responsible for a very heavy and sudden demand upon the power stations of the New York Edison Company. *The Electrical World* of New York states that the approach of the storm was reported by the weather observer of the company, and preparations were made for carrying the expected increase in load. Before the storm came, the normal summer load, aggregating some 60,000 kw. was being carried by the stations. At two o'clock, when the skies darkened, this reached 73,000 kw. At 2.45 intense darkness became widespread, and the peak on the stations finally reached 105,000 kw. in two sudden jumps, which was the highest summer load ever carried, and it was maintained for fifteen minutes. At Waterside No. 1 two 10,000-kw. units, six 4000-kw. units, and one 5,000-kw. unit were used, and at Waterside No. 2 one 14,000-kw. unit, six 10,000-kw. units, and one 8,000-kw. unit were in operation to meet the conditions. So efficient were the preparations for meeting the storm that not the least drop occurred in the supply voltage, and it was not necessary to fall back upon storage batteries while placing any of the units on the lines.

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THE BRITISH ASSOCIATION AT PORTSMOUTH

THE meeting of the British Association for the Advancement of Science was opened at Portsmouth last evening, when Sir William Ramsay, K.C.B., F.R.S., delivered his Presidential Address in the presence of the usual distinguished audience. The meeting continues until Wednesday next, Sept. 6th. This (Thursday) morning the work of the sections begins with the reading of the Sectional Presidential Addresses.

The interest of our readers will mainly be in Section G (Engineering), where a number of electrical Papers will be read. Mr. H. A. Mavor will give a Paper on "Electrical Drives for Screw Propellers," and "Electrical Steering" will be dealt with by Mr. B. P. Haigh. Prof. G. W. O. Howe has a Paper on recent developments in wireless telegraphy, and Capt. H. Riall Sankey will exhibit a portable equipment. Mr. W. Worby Beaumont will read a Paper "On the Origin and Production of Corrugation on Tramway Rails," and Mr. T. F. Wall will read one on "The Single-phase Repulsion Motor." A general discussion will take place upon the relative efficiency of steam, gas, and oil engines in connection with the following Papers:—(1) "Economical and Reliable Power Generation by Over-type Superheated Steam Engines," by Captain H. Riall Sankey and W. J. Marshall; (2) "Suction Gas Engines and Producers," by W. A. Tookey; (3) "Diesel Engines," by C. Day. Among the other Papers to be read in Section G are:—"Some Preliminary Notes on a Study as to Human Susceptibility to Vibration," by W. Pollard Digby and Capt. H. Riall Sankey; "Smoke Abatement: the Possibility of fixing a New Standard of Smoke Emission from Factory Chimneys," by Dr. J. S. Owen, and "The Electrical Conductivity of Light Aluminium Alloys," by Prof. E. Wilson.

A report on "Electric Steel Furnaces" will be presented to Section B (Chemistry) by Prof. McWilliam, of Sheffield University, and in Sub-Section K (Agriculture) Messrs. J. H. Priestley and R. C. Knight will read a Paper on "The Effect of High-Tension Electric Discharges and Current Electricity on Plant Respiration." A report by the Electrical Standards Committee will be presented to Section A (Mathematical and Physical Science).

The greater part of Sir William Ramsay's address was on ancient and modern views regarding the chemical elements, but our readers will be most interested in his remarks on technical education, and on the problem that will be raised by the early exhaustion of our coal supplies.

Referring generally to the advances made in engineering, Sir William said that the question "Can it be done?" hardly arises, but rather "Will it pay to do it?" In a word, the human race has been familiarised with the applications of science; and men are ready to believe almost anything, if brought forward in its name.

His criticism of the organisation of technical education in this country was that in England we have made technical educational a local, not an Imperial question; instead of half a dozen first-rate institutions of University rank, we have a hundred, in which the institutions are necessarily understaffed, in which the staffs are mostly overworked and underpaid; and the training given is that not for captains of industry, but for workmen and foremen. "Efficient captains cannot be replaced by a large number of fairly good corporals." Moreover, to induce scholars to enter these institutions, they are bribed by scholarships, a form of pauperisation practically unknown in every country but our own; and to crown the edifice, we test results by examinations of a kind not adapted to gauge originality and character (if, indeed, these can ever be tested by examination), instead of, as on the Continent and in America, trusting the teachers to form an honest estimate of the capacity and ability of each student, and awarding honours accordingly.

The remedy, Sir William suggests, is that an undertaking should be exacted from all gainers of University scholarships that, if and when circumstances permit, they will repay the sum which they have received. It would then be possible for an insurance company to advance a sum representing the capital value, viz., £7,464,931, of the scholarships, reserving, say, 20 per cent. for non-payment, the result of mishap or death. A large part of the income of this sum, he suggests, should be spent in increasing the emoluments of the chairs; for, unless the income of a professor is made in some degree commensurate with the earnings of a professional man who has succeeded in his profession, it is idle to suppose that the best brains will be attracted to the teaching profession.

Having made the profession of a teacher so lucrative as to tempt the best intellects in the country to enter it, it is clear that such men are alone capable of testing their pupils. The modern system of "external examinations" would disappear; schools of thought would arise in all subjects, and the intellectual as well as the industrial prosperity of our nation would be assured.

In the concluding part of his address, Sir William Ramsay quoted from the General Report of the Royal Commission on Coal Supplies (1906), pointing out that, in 1870, 110 million tons of coal were mined in Great Britain, and ever since the amount has increased by three and a third million tons a year. The available quantity of coal in the proved coalfields is very nearly 100,000 million tons, and if the rate of working increases as it is doing our coal will be completely exhausted in 175 years. Between 1905 and 1907 the amount of coal raised in the United Kingdom increased from 236 to 268 million tons, equal to six tons per head of the population, against three and a half tons in Belgium, two and a half tons in Germany, and one ton in France. Our commercial supremacy and our power of competing with other European nations are obviously governed, so far as we can see, by the relative price of coal; and when our prices rise, owing to the approaching exhaustion of our supplies, we may look forward to the near approach of famine and misery.

At Sir William Ramsay's suggestion a committee of the British Science Guild was formed to investigate our available sources of energy. This Guild is an organisation for the purpose of endeavouring to impress on the people and the Government the necessity of viewing problems affecting the race and the State from the standpoint of science. The Science Guild enlisted the services of a number of men, each eminent in his own department, and each has now reported on the particular source of energy of which he has special knowledge. The Hon. R. J. Strutt has shown that in this country at least it would be impracticable to attempt to utilise terrestrial heat from bore-holes; others have deduced that from the tides, the winds, and water-power small supplies of energy are no doubt obtainable, but that, in comparison with that derived from the combustion of coal, they are negligible; nothing is to be hoped for from the direct utilisation of solar heat in this temperate and uncertain climate; and it would be folly to consider seriously a possible supply of energy in a conceivable acceleration of the liberation of energy by atomic change. It looks utterly improbable, too, that we shall ever be able to utilise the energy due to the revolution of the earth on her axis, or to her proper motion round the sun. Attention should, however, undoubtedly be paid to forestry, and to the utilisation of our stores of peat. Sir William also attached importance to the increase in our water-power, which an increase in our forests would bring with it, since, without forest land rain rapidly reaches the sea, instead of distributing itself so as to keep the supply of water regular and more easily utilised.

We must therefore rely chiefly on our coal reserve for our supply of energy, and for the means of supporting our population; and it is to the more economical use of coal that we must look, in order that our life as a nation may be prolonged. We can economise in many ways: By the substitution of turbine engines for reciprocating engines, thereby reducing the coal required per horse-power from 4 to 5 lbs. to 1½ or 2 lbs.; by the further replacement of turbines by gas engines, raising the economyto 30 per cent. of the total energy available in the coal, that is, lowering the coal consumption per horse-power to 1 or 1¼ lb.; by creating the power at the pit-mouth, and distributing it electrically, as is already done in the Tyne district. Economy can also be effected in replacing "bee-hive" coke ovens by recovery ovens; this is rapidly being done; and Dr. Beilby calculates that in 1909 nearly six million tons of coal, out of a total of sixteen to eighteen millions, were coked in recovery ovens, thus effecting a saving of two to three million tons of fuel annually. Progress is

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also being made in substituting gas for coal or coke in metallurgical, chemical, and other works. But it must be remembered that for economic use, gaseous fuel must not be charged with the heavy costs of piping and distribution.

It is true, Sir William continued, that the self-interest of coal consumers is slowly leading them to adopt more economical means of turning coal into energy. But I have noticed, and frequently publicly announced, a fact which cannot but strike even the most unobservant. When trade is good, as it appears to be at present, manufacturers are making money; they are overwhelmed with orders, and have no inclination to adopt economies which do not appear to them to be essential, and the introduction of which would take thought and time, and which would withdraw the attention of their employés from the chief object of the business—how to make the most of the present opportunities. Hence improvements are postponed. When bad times come, then there is no money to spend on improvements; they are again postponed until better times arrive. What can be done? I would answer: Do as other nations have done and are doing; take stock annually. The Americans have a permanent Commission initiated by Mr. Roosevelt, consisting of three representatives from each State, the sole object of which is to keep abreast with the diminution of the stores of natural energy, and to take steps to lessen its rate. This is a non-political undertaking, and one worthy of being initiated by the ruler of a great country. If the example is followed here the question will become a national one.

The two great principles which I have alluded to in an earlier part of this address must not, however, be lost sight of; they should guide all our efforts to use energy economically. Concentration of energy in the form of electric current at high potential makes it possible to convey it for long distances through thin and therefore comparatively inexpensive wires; and the economic coefficient of the conversion of mechanical into electrical, and of electrical into mechanical energy is a high one; the useless expenditure does not much exceed one-twentieth part of the energy which can be utilised. These considerations would point to the conversion at the pit-mouth of the energy of the fuel into electrical energy, using as an intermediary, turbines, or preferably gas engines; and distributing the electrical energy to where it is wanted. The use of gas engines may, if desired, be accompanied by the production of half-distilled coal, a fuel which burns nearly without smoke, and one which is suitable for domestic fires, if it is found too difficult to displace them, and to induce our population to adopt the more efficient and economical systems of domestic heating which are used in America and on the Continent. The increasing use of gas for factory, metallurgical, and chemical purposes points to the gradual concentration of works near the coal mines, in order that the laying-down of expensive piping may be avoided.

An invention which would enable us to convert the energy of coal directly into electrical energy would revolutionise our ideas and methods, yet it is not unthinkable. The nearest practical approach to this is the Mond gas-battery, which, however, has not succeeded, owing to the imperfection of the machine.

The President concluded his address with a plea for the study of pure science, without regard to its applications.

CORRESPONDENCE

METAL FILAMENT LAMP PATENTS.

To the Editor of Electrical Engineering.

Sir,—Our attention has been called to a statement under the above heading appearing in your journal of the 17th inst., addressed to you by the Osram Lamp Works, Ltd., to which is appended a notice of an order made in reference to an action brought by that company against the British Tungsten Lamp Co., Ltd.

As one of the various manufacturers referred to in that letter against whom litigation has been commenced, we desire to call your attention to the fact that the order referred to was made with the consent of the defendants, who took no steps to defend the action.

The business of the British Tungsten Lamp Co., Ltd., was in the hands of a receiver for the debenture-holders, who did not feel justified in contesting the proceedings. The point is material, as your correspondent's letter might convey the impression that the order was the outcome of an investigation by the Court.

We may add that the proceedings instituted against us are being defended, and we are content to await the decision of the Court.

Yours faithfully,
The "Z" Electric Lamp Manufacturing Co., Ltd.
Kilburn, Brown & Co.,
August 23rd, 1911. Managers.

THE DUNDALK STORAGE BATTERY CONTRACT.

To the Editor of Electrical Engineering.

Sir,—*Dundalk U.D.C.*—We notice an announcement in Electrical Engineering of the 10th inst. that we have been favoured with the order for the storage battery required for the above. This is quite correct; but you state that the plates are to be of the Tudor Accumulator Co.'s make, which is incorrect. The plates will be of our own manufacture—manufactured at Sandycroft; we have taken over the business of Messrs. W. O. Rooper & Co. and the Epstein Accumulator Company over twelve months ago.

We might mention the Tudor Accumulator Co.'s name was not referred to by us in connection with the tender, and the Consulting Engineers, Messrs. Miller, Wilson & Pegg, are certainly under no misapprehension. In fact, one partner, prior to the order being placed, had been over our new accumulator factory at Sandycroft.

Trusting you will be able to insert this in your next issue.

Yours faithfully,
August 26, 1911. The Sandycroft Foundry Co., Ltd.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Some radio-telegraphic apparatus, in use at the City and Guilds Engineering College, was described in a Paper read by Prof. G. W. O. Howe before the Physical Society last March. We referred to this briefly at the time, but we now have before us the complete paper, which has just been issued. Mr. Howe mentions that the signals from the Marconi station at Glace Bay, Nova Scotia, can be picked up. The antenna employed consists of a single No. 14 copper-coated steel wire, the upper end of which is attached to the central tower of the Imperial Institute, 260 ft. above the ground. It is brought across in a single span of 530 ft. to a chimney stack on the college, from whence a wire passes down into the laboratory. For demonstrating purposes another wire is connected to the antenna, and brought into the lecture theatre. The fundamental wave-length of this antenna is about 900 metres. In addition to this a T antenna is suspended horizontally above the roof of the college, consisting of five parallel wires 190 ft. long and 110 ft. high. A single wire connects the mid point to the laboratory. The fundamental wave-length is about 520 metres. The wave-length of the waves sent out from Clifden (Ireland) and Glace Bay is over 6 km.

A special transformer for receiving these low-frequency waves consists of square coils, supported at the corners on ebonite strips fitted to a wooden frame. The primary coil is movable, and can be raised 4 ft. above the secondary by turning a handle. Each coil is subdivided into three parts, and the ends brought to a plug board. The coil is wound with a cable made up of 27 wires, No. 36, each being single silk covered, and the whole covered with double silk. The primary has 160 turns 13·5 in. square, the winding length is 16 in., and the inductance of the coil is 6·45 millihenries. The fixed secondary has 187 turns 15 in. square, with a winding length of 13 in. and an inductance of 12·9 millihenries. If the inductance placed in series with the aerial for tuning it be plotted against the square of the wave-length, the result will be a straight line through the origin, except for short wave-lengths, where the inductance of the aerial is comparable with that placed in series with it. The slope, therefore, depends only on the capacity of the aerial. The exact inductance required for any wave-length is obtained by using suitable coils of the transformer primary and by adjusting the tuning coils, but for shorter wave-lengths than 1,200 metres, capacity must be inserted in the aerial tuning condenser. In the receiving circuit there are two alternative detectors. These consist of a light contact be-

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tween small pieces of zincite and copper pyrites. This is very sensitive, but requires frequent adjustment, and is apt to be rendered inoperative by a bad "atmospheric." The telephone head set used with the detectors has 7,000 ohms resistance. By means of a switch this telephone can be cut out, and a Brown telephone relay inserted. This operates a 40-ohm head set with trumpets instead of the ordinary ear-pieces. With this arrangement, the messages and time signals sent out from the Eiffel Tower and from Norddeich, near Wilhelmshaven, can be distinctly heard all over the large lecture theatre. The relay, unfortunately, does not discriminate between radio-telegrams and atmospheric disturbances, but this could be improved by tuning the reed to the spark frequency.

The National Telephone Co. have erected a new exchange in Glasgow, at the corner of Renfrew Street and Hope Street, which will take the place of the existing "Douglas" Exchange. This was taken into use on Saturday, August 19th, when all the subscribers' lines were transferred from the old exchange to the new one. The new exchange is equipped for 4,000 lines, and has an ultimate capacity of 7,000. It is on the usual central battery system, the equipment being supplied by the Western Electric Co., Ltd.

The question of local rating in respect of the telephone system of the country after it has been taken over by the State at the end of this year, was discussed at a conference of representatives of important rating authorities in Glasgow last week. This conference was convened by the Corporation of Glasgow, and it was resolved to approach the Government and ask them to continue to pay local rates on the National Telephone Company's undertaking after the transfer, or to pay an equivalent annual contribution. English, Irish, and Welsh rating authorities are being communicated with.

According to the *Electrical World* of New York, the new wireless station now being installed at the Charlestown Navy Yard, Boston, Mass., will be among the most powerful in the world, having a maximum range under favourable conditions of about 3,200 miles. The building will be erected of stone, and there will be two aerial poles, each 170 ft. high. The old equipment, mostly Stone wireless apparatus, will be supplanted by modern Telefunken sending apparatus, with a Pickard receiver. There will be a 5-kw. Telefunken high-frequency, quench-gap machine, the old sending equipment being a 2-kw. Stone low-tone spark machine.

The New York correspondent of the *Yorkshire Post* gives some details of a novel prosecution in Los Angeles, California, where a newspaper editor has been arrested on the charge of publishing a stolen wireless message. The message was sent from Los Angeles to Mr. Peard, editor of the *Los Angeles Herald*, who was holiday-making at Avalon, and was intercepted by some amateur wireless operators. Three young fellows who were experimenting with Marconi apparatus picked up the message on its way to Avalon, and took it to Mr. Earl, editor of the *Los Angeles Tribune*, who published it without asking questions. General Otis, the sender of the message, who has been waging a bitter newspaper war on the *Tribune*, promptly secured the arrest of Mr. Earl, against whom a formal indictment was returned. There was some argument on the technical point as to whether the message could be called "stolen," as it was contended on behalf of Mr. Earl that messages sent through the air which could be read by anyone possessing a receiver, could not be called private or copyright. There is no case to go upon for "tampering with United States mails," for the message was not despatched by a Government operator. Mr. Earl has been released upon bail, and the case is being watched with the greatest interest by newspaper proprietors and people owning private wireless apparatus.

We have received the first number of the *Telefunken Zeitung*, a journal which will be issued by the Gesellschaft für drahtlose Telegraphie once every two months. The first number contains several interesting articles and notes, and commences with a short history of the Telefunken Co. (with excellent portraits of Dr. Slaby and Professor Braun), which will be continued in future numbers. There is a note on the founding of the Australasian Wireless Telegraph Co., in which the Telefunken Co. have an interest; several contracts have apparently already been made for wireless stations in Australia. Some notes on wireless telegraphy in the Philippines are given, illustrated with a map. There is a description of a model wireless telegraph station for demonstration purposes, a list of recent wireless telegraph stations for overland routes, and a short illustrated description of the large Nauen wireless station. The Company (whose address is 9 Tempelhofer Ufer, Berlin, S.W.) will doubtless be pleased to send copies of this journal to any of our readers who may be interested in it.

The cable between Saigon and Pontianak was interrupted on Wednesday and Thursday last week. The failure took place between Ponlocondore and Pontianak. The cable between Cotonon and Grand Bassam also gave out on 23rd inst., and telegrams for the Ivory Coast are being forwarded by the best means. The Persian landlines were interrupted between Teheran and Tauris on the 23rd inst., and telegrams for the latter place are being sent via Djoulfa.

ALTERATIONS AND EXTENSIONS AT THE WALSALL ELECTRICITY WORKS

THE Walsall electricity works is one of the few in this country on the high-tension D.-C. system. Eight generators, varying in size from 80 to 400 kw., furnish current at 2,000 volts to motor-transformers in 15 sub-stations scattered about the area of supply. The boiler house, which was placed end on to the engine room, contains two Lancashire, one Stirling, and four B. & W. boilers. In November, 1909, a scheme for an entirely new works, to cost £35,000, was brought forward by Mr. Barnard, the Borough Electrical Engineer, but the Local Government Board refused to sanction the necessary loan, and suggested a modified scheme to cost £23,000. This latter was the subject of an enquiry last September, and the sanction to this loan, long withheld, was finally given in May last. The extensions are now well on the way towards completion. Owing to Mr. Barnard's ill-health, and the necessity for him to have six months' leave of absence, Mr. Ashton Bremner, late Borough Electrical Engineer to the Borough of Burslem, was appointed to act during this period, and upon him has devolved the entire responsibility of carrying on the works, and at the same time carrying out the alterations which, besides involving the laying down of new plant, have included the working out of the new arrangement of the whole of the condensing plant and the A.-C. switchgear.

The original engine room has been taken down, a new roof of wider span and greater height has been built over it, a three-ton crane and the steam pipes and pipe supports have had to be removed, and all this had necessarily to be done whilst a supply of electricity was being given to a large area and to the tramways.

The new plant consists of a B. & W. boiler to evaporate 14,000 lb. of steam per hour, a Lee-Howl feed pump to deliver 4,000 gallons of water per hour against 160 lb. steam pressure, and the necessary steam and feed pipes, mechanical stoker, and coal elevator. In the engine room will be two Richardson-Westgarth steam turbines coupled to British Westinghouse generators, each capable of developing 500 kw. three-phase current at a pressure of 3,300 volts, and a frequency of fifty cycles per second, and two low-level counter-current jet condensers by Isaac Storey, Ltd. The switchboards, both in the generating station and at the Bloxwich substation, are being supplied by the British Westinghouse Co.

It is intended to supply electricity to Bloxwich, an outlying portion of the Borough of Walsall, and an industrial and residential neighbourhood, on the three-phase four-wire system, and it will be interesting to notice how the supply of power to large works in this area will affect the lighting pressure, as it has been decided not to instal a voltage regulator but to rely solely upon the regulation of the Westinghouse generators.

THE ELECTRICAL COMPANY'S METERS

THE Electrical Co., Ltd. (122-4 Charing Cross Road, London, W.C.) are to be congratulated on the production of an exceedingly fine illustrated description of their electricity meters. It is not a mere catalogue, and in fact does not embody a price list, but is a beautifully illustrated volume dealing in detail with the design and methods of manufacture, and concluding with some practical notes on testing. Of the 67 illustrations, the most striking are six beautifully executed full-size coloured plates showing the working mechanisms distinctly. Space will only permit us to deal in detail with some of the contents and to mention some of the points that seem to be of novelty.

A self-adjusting brush device has been designed for D.C. ampere-hour meters, by means of which an additional torque is produced at low loads to counterbalance friction at the brushes and in the counter bearings. The brushes are mounted on one arm of a metal lever pivoted to move vertically, and a coil is fixed to the other arm of the lever. This coil is connected in series with the armature winding, and lies in the stray field zone of the permanent magnet of the meter. It is wound so that the greater the current

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published August 24, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

12,931/10. **Joint Boxes.** A. Friedmann. For wiring boxes a core is made the shape of the box, and consists of paper compressed with the aid of a suitable binding agent. It is hardened by impregnation and rendered proof from water, acid, and oil. It is then coated with a conductive substance and electrically plated with metal in a bath.

18,780/10. **Tantalum.** E. C. R. Marks (*Siemens & Halske Akt.-Ges.*). This relates to a process for hardening the surface of tantalum. It is first roughened by means of a sand-blast in order to increase the surface for the hardening agent to act upon. The hardening is done by treating it with oxygen either electrically or by heating in air, and forming a very hard layer on its surface. In the former method the metal forms the anode in an aqueous solution.

1,028/11. **Ignition Plug.** T. G. Smith and F. J. Platt. In combustion engines, in which ignition is produced by a make-and-break spark, a convenient arrangement for examining the spark consists in constructing the fixed terminal of the spark producer in the form of a hollow observation tube. A glass window is provided at the inner end, and the sparking pin is formed eccentrically in the hollow terminal, so that the point of contact between the moving terminal and the pin is visible through the window.

5,167/11. **Insulating Material.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*) A hard and tough material with a high insulating power is obtained by treating paper or other material with a liquid condensation product. This is formed by the reaction between phenolic bodies and aldehydes. Sheets of a soft obsorbent paper are soaked in the liquid, and when they are thoroughly impregnated, they are withdrawn, drained, and dried in air. A number of these sheets is then subjected to a heat treatment under a pressure of 1,000 to 1,500 lbs. per square inch. Asbestos fibre and Portland cement or plaster of Paris can be treated in the same way.

8,783/11. **Motor Control.** L. V. Lewis. In a system of control of one or more A.-C. motors of the commutator type, The field winding is connected between one of the live conductors and the middle point of the primary winding of a transformer. The other live conductor can be connected by means of a control switch to either end of the primary winding, depending on the direction of rotation desired. The armature winding is connected across the secondary winding. Six figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Lewis [Electrodes for] 22,803/10; Siemens Bros. Dynamo Works, Ltd. (*Siemens Schuckertwerke*), 12,735/11.

Dynamos, Motors, &c.: Allgemeine Elektricitäts-Ges. [Means for varying voltage] 20,759/10; Merryweather [Driving magneto-electric machines] 26,409/10; Vickers, Ltd., Williamson, and Brown [Commutators] 29,161/10; Golby (*Draper Latham Magneto Co.*) [Magneto generator] 30,166/10 and 30,167/10; Otis Elevator Co. (*Otis Elevator Co.*) [Controlling apparatus] 498/11; Sire, 2,903/11; Siemens Bros. Dynamo Works, Ltd. (*Siemens-Schuckertwerke*) [Braking polyphase series motors] 7,631/11.

Electric Ignition: Hall, 16,093/10.

Electrometallurgy: Ruthenburg [Furnace electrodes] 28,536/10; Rodeck, 13,808/11.

Heating and Cooking: Schmidt [Thermostats] 616/11.

Incandescent Lamps: Hailwood [For miners] 18,415/10; Etablissements, Paz, and Silva [Sockets for] 20,040/10; Harrison [Means for supporting] 22,775/10; Schilling [Metallic filaments] 23,639/10; Schwab [Incandescing bodies for] 8,004/11.

Instruments and Meters: Johnson and Billington [Meters] 18,470/10.

Telephony and Telegraphy: Crowe and British L. M. Ericsson Manufacturing Co. [Contact keys] 5,564/11; Fessenden [Wireless signalling] 11,154/10; Smith and Lyon [Detectors for electro-magnetic waves] 22,164/10; Girardeau [Emission of Hertz oscillation] 27,247/10; Bellini [Transmitters and receivers for wireless] 11,339/11.

Traction: Mittelhausen and Williams [Supporting and insulating overhead wires] 22,735/10; Lefebvre [Automatic tractors] 11,307/11; Allgemeine Elektricitäts-Ges. [Railway signals] 13,985/11.

Miscellaneous: Reeve [Electrical apparatus] 16,172/10; Henri, Helbronner, and Von Recklinghausen [Treatment of liquids by ultra violet rays] 18,768/10; Clark (*Telelectric Co.*) [Electrically operated playing apparatus] 20,095/10; Meigh [Conductor terminal] 23,891/10; Walker and R. Waygood & Co. [Lifts, hoists, etc.] 13,183/11; Süchting and Oloff [Thermo-electric batteries] 13,715/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution, &c.: Müller [Protecting insulated wires from fire] 16,533/11.

Dynamos and Motors: Siemens Schuckertwerke-Ges. [Induction motors] 17,768/11.

Incandescent Lamps: Houskeeper [Filaments] 17,480/11.

Switchgear, &c.: Larzelere [Electro-magnetic switch] 17,142/11.

Telephony and Telegraphy: Girardeau [Automatic commutator for wireless plant] 3,946/11; Faiella [Telegraphic systems] 17,151/11; Schepeler [Receiver for signal transmission] 17,978/11.

Traction: Pintner [Trolley wheels] 10,038/11.

Miscellaneous: Rümpler [Formation of metallic coatings on aluminium] 11,215/11; Chemische Fabrik Griesheim-Elektron [Batteries for lamps] 15,447/11; Felten and Guilleaume Carlswerk Akt.-Ges. [Electro-osmosis treatment] 17,597/11.

Opposition to Grant of Patent

23,096/10. **Centrifugal Fans.** J. Keith. This patent has been granted in spite of opposition. The specification describes an improved design of fan-runner. A number of tapered blades have the outer and inner edges lying on conical surfaces differently inclined to the axis of the runner. The outer cone is less inclined than the inner, both of which are truncated. The narrow ends of the blades, where the internal and external diameter of the runner is a maximum, are held by a ring, whilst the wider ends, where the diameter is least, are fitted to a disc.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

20,536 of September 7th, 1897. **Steam Turbines.** C. K. Mills (*C. G. Curtis, U.S.A.*). This invention relates to fluid turbines such as described in Patents 19,246-7-8 of September 1st, 1896, which were abstracted in Electrical Engineering of August 25th, 1910, page 554. It is constructed to operate either condensing or non-condensing or with different boiler pressures, by the combination of a delivery nozzle and a working passage through movable vanes, adjustable to vary the ratio of expansion. It is also arranged to vary the volume of the fluid jet without any great variation in its velocity.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, &c.: J. M. Locke [Insulators for H.-T. conductors] 10,694/07; R. Brown [Cable coupling] 10,943/07; O. T. Hungerford [Conductors] 11,123/07.

Dynamos, &c.: British Thomson-Houston Co. and H. M. Hobart [Induction] 8,476/00; Allgemeine Elektricitäts-Ges. [Regulation and control] 11,071/07.

Electrometallurgy, &c.: Chemische Fabrik Buckan [Production of chromic acid] 9,636/07, and [Treating carbon electrodes for durability] 9,637/07.

Incandescent Lamps: M. Stern [Electroliers] 10,837/07.

Storage Batteries: M. Margulis, 11,072/07.

Switchgear, &c.: S. Z. de Ferranti and C. C. Garrard [Cut-outs] 10,899/02; British Thomson-Houston Co. (*Allgemeine Electricitäts-Ges.*) [Combined switch and fuse] 10,665/07 and [Oil switch] 10,666/07; E. F. Woodman, T. A. Kelley, and G. W. Varney [Thermal switch] 11,078/07.

Telephony, &c.: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Order telegraphs, transmitter for] 10,786/07.

Traction: P. B. and T. H. Black [Stud contact system] 10,636/07; E. A. Mitchell [Leakage detector for surface contact systems] 10,641/07; E. Dewhurst [Railway signalling] 10,991/07.

Miscellaneous: P. C. Hewitt [Vapour converter] 8,973/05; J. Schiele [Electro-deposition of metals] 10,120/05; W. Dixon [Cranes] 10,630/06; W. Smith [Lifts for mines] 10,671/07; W. Gifford and E. M. Dixon [Lightning arresters] 11,163/07; H. J. Haddan (*Polyphos Electricitäts-Ges.*) [Röntgen-ray apparatus] 11,177/07.

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flowing through it, the more it will be repelled from the stray field. The commutator segments are made straight up to a certain point, and are then twisted spirally, so that the brushes will take up a position on the commutator according to the current consumption. In this way commutation at full load will take place when the brushes are away from the neutral zone of the magnet, when the torque is not a maximum, whilst, as the load decreases, the brushes will move higher up on to the spiral portion of the segments, and commutation will be shifted more and more towards the neutral zone, when the torque will increase in proportion as the load decreases. The meter is guaranteed to start at 0·8 per cent. of full load, and to record correctly within 2½ per cent. at from 1/20th to full load.

The oscillating D.C. meter, in which neither commutator nor brushes are used, is of considerable interest. The shunt current coil is caused to oscillate by means of the field produced in the fixed main coils. The oscillating motion, which is limited by contact pins, is set up by means of a relay, which, directly contact is made, reverses the current in the shunt coil, and changes the direction of rotation. To prevent burning at the contacts, a resistance is inserted in parallel with the pressure coil, and the relay is so adjusted that, although the contact pins are approached at full pressure, the pressure at the contacts at the moment of reversal is only 6 or 7 volts.

Another interesting instrument is the type "LIa" alternating-current watt-hour meter. It is of the induction type, with two magnetic alternating fields placed radially and at right angles to each other, which set up eddy currents in a disc. One field is produced by the main current winding, and is proportional to and in phase with the current. The second field must be proportional to the voltage, but differing in phase by exactly 90°. The driving system consists of a laminated iron core having three limbs; the middle one carries the main current coil, and on the outers the pressure coils are connected in series. An adjustable laminated yoke is mounted above the iron core, to form an air gap up to about 10 mm., in which an aluminium disc rotates, and is braked by a magnet. The latter, the inductive load, and the low load adjustments, are regulated by means of one screw.

Mention may also be made of the company's maximum demand attachments to indicate the average maximum demand during a working period.

Some description of testing apparatus and notes on testing and calibrating will be found useful, and the determination of the "life factor" of a meter, viz.,

$$\frac{\text{Torque} \times 1000}{\text{Weight of moving system} \times \text{Speed}}$$

is suggested as an indication of the durability of the meter.

CATALOGUES AND PAMPHLETS RECEIVED

GEAR CASES.—The British Thomson-Houston Co. (Rugby) have designed a gear case for tramway motors. It is made from pressed steel, in which each half is jointless, being pressed from a single sheet of steel. The supporting lugs are very stiff, and are fastened in such a way that fracture is almost impossible. It is lighter than those hitherto made from malleable cast iron.

WATT-HOUR METER.—The same firm have issued a pamphlet describing their high torque A.C. meter. It operates on the two-wattmeter method of measuring power. It is of the single-disc type, and two single-phase meter driving elements are arranged in diametrically opposite positions near the edge of the disc. Each element produces a torque on the disc proportional to the watts impressed upon it, so that the total torque at any instant is equal to the sum of the torques due to the two elements.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

CONTROLLERS.—Another pamphlet from the Rugby firm relates to a new feature in the design of tramway controllers, enabling rheostatic braking to be obtained, regardless of the direction of motion of the car or of the position of the reversing handle, by simply moving the main controller handle on to the braking notches. Another feature is the mechanism for cutting out a defective motor. This takes the form of a switch, which is operated by removing the reversing switch handle on to the spindle of the cut-out switch.

RHEOSTATS.—Automatic starting rheostats for induction motors with slip-ring rotors are also being introduced by the above firm. They are supplied in capacities from 1 to 500 h.p., 110 to 550 volts, and are designed for use chiefly with motor-driven pumps, air compressors, &c., where automatic starting and stopping are required.

ENAMEL-INSULATED WIRES.—The enamel-insulated wire made by Connolly Bros., Ltd. (Blackley, Manchester) for coil winding has long been known. So satisfactory have been the tests upon it, that the makers have now introduced wires with thicker insulation of this character for electric lighting circuits. Among the tests described on this latter class is one on a twin 18 S.W.G. wire with 4 mils thickness of enamel on each wire, which is then double cotton-covered, vacuum-dried, and impregnated, and, after the two wires were laid up together, braided, and impregnated with flame-resisting compound. A sample of this was immersed in water and tested daily for 30 minutes at 2,000 volts A.C. for 8 days before it broke down. Enamelled wire made to the above specification for house wiring is listed in sizes up to 3/18, and the firm inform us that its adoption for running in conduits for this purpose has been recommended by the Bradford Corporation engineers. For overhead cables the wire is made in sizes from single 20 to 19/12, and its employment for electric bell and telephone line wires is also suggested.

ELECTRIC CLOCKS.—A catalogue of electric clocks, finely illustrated in colours, has been issued by the Electrical Co., Ltd. (122-124 Charing Cross Road, London, W.C.). It describes an electrically-wound self-contained clock, which is intended to form a substitute for the system controlled by a master clock. These can be supplied with current from a dry battery or from a D.C. or A.C. supply up to a pressure of 150 volts. If the mains are used, in order to provide for an interruption in the supply, an auxiliary spring is fitted, which has always a reserve tension sufficient for a run of twelve hours. It is claimed that accurate timekeeping is ensured, because, owing to the frequency of the electric impulses imparted to the driving spring, the tension is always constant. The cost of running is exceedingly small, the consumption being only 0·16 unit at 110 volts per year. Particular attention has been given to the design and finish of the cases, to which the illustrations certainly do justice. The company is certainly doing its best to remove the reproach, frequently levelled at electrical clocks, that they are ugly.

LOCAL NOTES

Cardiff: *Electric Lighting Accounts.*—There was a net profit of £909 upon the electric lighting accounts last year, after meeting capital charges. The number of units sold increased by 287,193, an additional 247 consumers being connected to the mains. The power load at present amounts to 3,688 h.p. Mr. Ellis points out in his report that the undertaking is very much restricted owing to the absence of powers to carry out installation work on the hire-purchase system, and expresses the hope that the Corporation will apply for these powers, despite the refusal of Parliament to grant them in 1908. He points to the anomaly that whilst Newport have these powers Cardiff have been refused them.

Cornwall: *Equipment of Mines.*—Electric haulage plant has been installed at the Williams shaft of the Dolcoath mine. The necessary overhead electric transmission lines have been completed, and the steam engines driving sundry plant are gradually being superseded by electric motors.

Dungiven: *Electric Lighting.*—The Council's electric lighting installation was put into successful operation last week. The station contains a 46-b.h.p. Fielding & Platt suction gas with Siemen's generator, and a 360 ampere-hour battery.

India: *Electric Supply.*—According to the *Times of India*, the People's Bank of India, Ltd., of Lahore, has applied to the Punjab Government for a licence to supply electrical energy for all purposes within the municipal area of Lahore.

Llangollen: *Electric Lighting.*—The Council have appointed a committee to consider their position with regard to the Llangollen Electric Lighting Co. It appears that a few years ago the Council obtained an electric lighting provisional order which has not been put into force, the local company at present supplying without any statutory powers. In these circumstances, of course, the Council have no control over the supply, and it is the general desire that the Company and the Council should work in greater co-operation. The present position is that if the Company were to cease to supply,

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consumers could not call upon the Council to maintain it, for the latter would have no authority to take over the Company's undertaking.

Maidstone: *Street Lighting.*—A joint sub-committee of the Highways and Electricity Committees have presented a report re-arranging the street lighting, thereby bringing about a saving of nearly £300 per annum. The scheme provides for the abolition of 19 arc lamps and the substitution of clusters of three 100 c.p. Osram lamps; also the substitution of clusters of four 100 c.p. Osram lamps for a number of Brockie-Pell arc lamps.

Radcliffe: *Electricity Supply.*—The Lancashire Electric Power Co. have given the Council notice that they intend to apply for an electric lighting provisional order, authorising the Company to supply electricity for all public and private purposes in the urban district. The Company's power station is situated in Radcliffe, and for several years they have made efforts to supply certain people in Radcliffe by whom they have been approached. The Company claim to be able to supply at cheaper rates than the Council, but were unsuccessful in an application to the Board of Trade some time ago for an electric lighting provisional order. In giving their decision on that occasion, the Board of Trade expressed the opinion that the facilities in Radcliffe for a cheap supply of electric power were inadequate, and urged the Council to take the necessary steps to remedy this state of things. The Board added that in the event of the Company making a fresh application at a later date, they might find it necessary to arrive at a different conclusion if it were again shown that the demand was not being adequately met.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bangor.—A Local Government Board inquiry was held last week concerning an application for sanction to borrow £2,000 for additional machinery at the electricity works. There was no opposition.

Barnsley.—A Local Government Board inquiry was held last week concerning a loan of £16,000 for extensions at the electricity works. The loan is necessitated by the growing general demand, in addition to a proposal by the Corporation for substituting electricity for the remaining 500 street gas lamps.

Darwen.—A Local Government Board inquiry was held last week into an application for a loan of £7,600 for additional generating machinery. There was some opposition.

Eccles.—The Electricity Supply Committee invite tenders for the supply and installation of a high-tension, single-phase switchboard, consisting of three-generator and five-feeder panels. Particulars from Borough Electrical Engineer, and tenders by September 12th.

Gourock.—The question of an electric lighting scheme is under consideration.

Llandudno.—A loan of £500 is to be applied for to cover the estimated cost of additional mains during the next two years.

Montenegro.—According to *Commercial Intelligence*, Messrs. Boulton of London are reported to be interested in a project for the establishment of electric power works on the river Tara, and also on the river Moracha in Montenegro, for which the Government have granted concessions.

Moseley.—This district is now incorporated in Birmingham, and the City Electric Supply Department have arranged to lay mains immediately for the supply of electricity.

Rawtenstall.—A Local Government Board inquiry was held last week concerning a loan of £2,000 for street electric lighting. The Corporation at present pay £645 per annum for gas, but it is estimated that the electric lighting scheme will only cost half that amount.

Swinton.—Tenders are invited for twelve months' supply of cables, joint boxes, joint box compound, and bitumen. Particulars from Clerk to the Council, and tenders by September 9th.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

PROVINCES.

Barrow-in-Furness.—Extensions to head post office. H.M. Office of Works, London.

Birmingham.—Pathological and Bacteriological Laboratory and X-ray department at the Infirmary, Dudley Road. Architect, W. H. Ward, Paradise Street, Birmingham.

Bolton.—Church at Heaton. Architects, Wright & Son, Lancaster.

Bradford.—Branch library at Great Horton. City Architect.

Bridgend.—New school and additions to existing ones. Clerk, Glamorgan County Council Offices, Westgate Street, Cardiff.

Cardiff.—Proposed large building for Co-operative Wholesale Society.

Darlington.—Infectious Diseases hospital.

Dunfermline.—Institute for women in Bath Street.

Edinburgh.—Ice skating rink at Fountainbridge. Architects, Walker & Ramsay, 108, Douglas Street, Blythswood Square, Glasgow.

Greenock.—Five four-storied tenements at corner of Mearns Street and Armidale Place. Architect, Mr. W. Strachan.

Keighley.—New school at Highfield. Architect, A. P. Harrison, Highfields Lane.

Merthyr Tydfil.—Sanatorium for the Merthyr Guardians. Architect, Mr. T. Roderick, Clifton Street, Aberdare.

Newcastle-on-Tyne.—Six-story building in Northumberland Street. Architect, Mr. H. Gibson, Dean Street.

MISCELLANEOUS

Cuba.—In connection with the projected scheme of electric railways and power supply in Santa Clara Province, the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C., have an address to which catalogues of materials may be sent.

TENDERS RECEIVED AND ACCEPTED

Birkenhead.—The Electrical Power Storage Co. are supplying a battery of 260 cells of 1,500 ampère-hours capacity at £1,771. The contract also provides for the maintenance of the battery for 10 years.

Bispham.—The following contracts have been placed in connection with the electric lighting undertaking: Engines and dynamos, National Gas Engine Co.; switchboard, balancers, and boosters, Kelvin & James White, Ltd.; storage battery, Premier Accumulator Co.; mains, British Insulated & Helsby Cables, Ltd.

Devonport.—The Electrical Power Storage Co., Ltd., have received an order for renewing 261 cells of the lighting battery, and also part of the traction battery, at £1,024. The contract also provides for the maintenance of the batteries for 10 years.

Erdington.—A tender for the construction of the Slade Road tramways at £24,909 has been placed with Mr. H. Holloway, Wolverhampton. The electrical equipment of the lines will be carried out by the Birmingham Corporation.

Keighley.—The offer of the Tudor Accumulator Co. to cancel the present contract with regard to the maintenance of the battery, under which the Corporation pay £118 per annum, and to double the capacity of the battery, supplying suitable switchgear and booster, on a new ten years' maintenance agreement at £302 per annum, has been accepted.

Shrewsbury.—An order has been placed with Messrs. Danks & Co., of Oldbury, for a boiler at the electricity works at £422 10s.

Stoke-on-Trent.—The contract for the buildings for the new power plant has been placed with Mr. Wardle, of Longport, at £5,120.



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APPOINTMENTS AND PERSONAL NOTES

Messrs. Dick, Kerr & Co., Ltd., require a Works Superintendent for the English Electric Works, Preston. (See an advertisement on another page.)

The salary of Mr. H. J. Andrews, Engineer and Manager of the Portsmouth Corporation Telephone Department, has been increased by £20 per annum. There is to be a further increase of £20 at the end of the year, making a total of £300.

The following candidates for the position of Chief Assistant and Electrical Engineer in the Bournemouth Corporation Tramway Department were interviewed by the Committee last week—H. Vickers, Deputy Manager and Tramway Engineer, Wolverhampton Corporation Tramways; F. W. Chattle, Ch. Engineer and Assistant Manager, Potteries Electric Traction Co.; G. F. Craven, Chief Resident Engineer, Reading Corporation Tramways; F. J. Kendrew, Deputy Tramways Manager, Southport Corporation Tramways, and E. C. Love, Chief Assistant Electricity Works, Halifax Corporation Tramways. The appointment was finally given to Mr. H. Vickers. The commencing salary is £300, rising to £400.

The Fife Electrical Power Co. have several vacancies for junior engineers. (See advertisement on another page.)

A young electrical engineer with a knowledge of German and electrical driving of collieries and iron and steel works, is required. (See advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £58 to £58 5s. (last week £58 to £58 10s.).

New Cable Works in Hungary.—The Ganz Company, in combination with the Buda-Pesth branch of Siemens Schuckert Co., are about to build a large cable factory, and the Electric Lighting Committee of Buda-Pesth have decided to give them the order for cable in connection with their new electricity works.

Cricket.—On Saturday a cricket match was played between the Tantalum Cricket Club (formed by members of Siemens' Dalston Works) and the Imperial Lamp Works (Brimsdown) Cricket Club. The match was played at Bailey's Lane Cricket Ground, Stamford Hill. The Imperial Lamp Works went in first and scored 30 runs, and the Tantalum Cricket Club followed with a score of 128 runs for five wickets.

Plant for Sale.—An electro-plating dynamo is for sale. (See an advertisemnt on another page.)

Liquidations.—The Havana Telephone Securities Co., Ltd., is to be wound up voluntarily. Mr. G. Banks, New Broad Street House, London, E.C., is liquidator.

Dissolution of Partnership.—A. Kerridge and H. Sloman, electrical engineers, 38 Alexander Street, Southend, trading as the Starlight Electric Co., have dissolved partnership.

Bankruptcies.—The last day for receiving proofs in the bankruptcy of W. H. Ridpath, electrical engineer, late 341 Nottingham Road, Ilkeston, is September 9th. The trustee is the Official Receiver, 5 Victoria Buildings, London Road, Derby.

NEW PUBLICATIONS

"Wiring Houses for the Electric Light." By N. H. Schneider. 86 pp. 7½ by 5 ins. 42 figures. (London: E. & F. N. Spon, Ltd.) 1s. 6d. net; by post, 1s. 8d.

"Low Voltage Electric Lighting with the Storage Battery." By N. H. Schneider. 85 pp. 7½ by 5 ins. 23 figures. (London: E. & F. N. Spon, Ltd.) 1s. 6d. net; by post, 1s. 8d.

"The Applications of Electric Heating." Cantor Lecture. By Prof. J. A. Fleming, F.R.S. 54 pp. 10 by 6½ ins. 48 figures. (London: Society of Arts.) Price 1s. net; by post 1s. 1d.

"Illumination: its Distribution and Measurement." By A. P. Trotter. 292 pp. 8¾ by 5¾ ins. 210 figures. (London: Macmillan & Co.) Price 8s. 6d. net; abroad, 9s. 2d.

NEW COMPANIES

WEAVERHAM ELECTRICITY SUPPLY CO.—Registered by Waterlow, Bros., and Layton, Birchin Lane, London. Capital £5,000.

WHITFIELD FAN CO., Dale Street, Shipley. Capital £2,000. Electrical and mechanical engineers and manufacturers of electric fans, &c.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Brown, Boveri & Co.—The annual report of this Swiss firm for the year ended March 31st last shows a net profit of 2,300,030 francs as against 2,142,122 for last year. This increased profit is, however, on a capital that has been increased to 28,000,000 francs from 20,000,000, and in consequence the dividend declared is only 7 per cent. as against 8 per cent. last year. Reference is made in the report to the taking over of the Alioth works during the year, and also to the formation of the new Austrian Brown, Boveri Co. The Mannheim Brown, Boveri Co. declares a dividend of 4 per cent., and the Compagnie Electro-Mécanique of Paris 10 per cent., both of which are the same as last year. The last-mentioned company has increased its share capital from two to five millions.

Northampton Electric Light & Power Co.—Interim dividend of 2½ per cent. on the ordinary shares.

Northern Light & Power Co.—The first report of this company covering the period from June 1st, 1909, to December 31st, 1910, states that the first portion of the power station at Dawson was completed in August, transmission being carried out over a distance of 40 miles. One of the largest contracts entered into by the company is with the White Channel Mining Co., which guarantees to take 14,000,000 units per annum. Reference to an issue of debentures was published in our last issue.

Liverpool District Lighting Company.—Interim dividend at the rate of 4 per cent. per annum for the June half-year.

Die Bank für Electrische Unternehmungen in Zurich.—A 10 per cent. dividend has been declared.

Companies Struck Off Register.—The names of the following have been struck off the register of Joint Stock Companies:—Albion Battery Co., Aberdare Electric Lighting Co., Buenos Ayres Electric Light Co., Private Wire and Telephone Installation Co.



THE "NEW BASTIAN" METER



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NEW, PRACTICAL, INEXPENSIVE.

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MOSSES & MITCHELL, 122 & 124, GOLDEN LANE, LONDON, E.C.

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(One Free Entry is given to every Advertiser. Entries under additional headings, 6d. per insertion.)

ACCESSORIES (Electric Light and General Supplies).
Cable Accessories Co., Ltd., Britannia St. Works, Tividale, Staffs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Electrical Power Storage Co., Ltd., 4, Great Winchester St., E.C.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Tudor Accumulator Co. Ltd., 119, Victoria St., S.W.

AIR COMPRESSORS.
Belliss & Morcom, Ltd., Birmingham.

AUCTIONEERS AND VALUERS.
Wheatley Kirk Price & Co., 46, Watling St., E.C.

ALUMINIUM.
British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

ARC LAMPS AND ACCESSORIES.
Beck Flame Lamp, Ltd., Suffolk House, Laurence Pountney Hill, E.C.
British Thomson-Houston Co., Ltd., Rugby.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.
Jandus Arc Lamp and Electric Co , Ltd., Hartham Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Union Electric Co., Ltd., Park Street, Southwark, S.E.

ARMATURE REPAIRS.
Marryat & Place, 28, Hatton Garden, E.C.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Rickard (Wm.), Ltd., Ashbourne Road Mills, Derby.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Willans & Robinson, Ltd., Rugby.

CREOSOTED POLES.
Wade (Richard), Sons & Co., Ltd., Garrison Side, Hull.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

EXHIBITION STANDS.
Erdman (M.) & Son, 26a, Theberton Street, N.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.
M.A.N. Co., Caxton House, Westminster, S.W.

HEATING AND COOKING APPARATUS.
Bastian Electric Heating Syndicate, Ltd., Palmerston House, Old Broad St., E.C.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87–89, Cleveland Street, W.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.

INSULATING MATERIAL.
Weidmann (H.), Rapperswil, Switzerland.

INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
The Fredk. Crane Chemical Co., 22 & 23, Newhall Hill, Birmingham.

LAMPS (Incandescent).
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Brush Electrical Engineering Co., Ltd., 1, Kingsway, W.C.
Cryselco, Ltd., Kempston Works, Bedford.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
Electrical Co., Ltd., 122/4, Charing Cross Rd., London, W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Krupka & Jacoby, 11, Queen Victoria St., E.C.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

METERS.
Aron Meter Co., Ltd., 80A, Salusbury Road, Kilburn, N.W.
Bastian Meter Co., Ltd., Kentish Town, N.W.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Co., Ltd., 122/4, Charing Cross Rd., London, W.C.
Ferranti, Ltd., Hollinwood, Lancs.

MINE EQUIPMENTS AND APPARATUS.
British-Thomson Houston Co . Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
Adnil Electric Co., Artillery Lane, London, E.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Electromoters, Ltd., Louisa St., Openshaw, Manchester.
General Electric Co., Ltd., 67, Queen Victoria St. E.C.
Ingleby & Co., Elland Road, Leeds.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Ltd., River Don Works, Sheffield.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
Willans & Robinson, Ltd., Rugby.

STEAM CONSUMPTION RECORDERS.
Lea Recorder Co., 28, Deansgate, Manchester.

STEAM ENGINES AND TURBINES.
Belliss & Morcom, Ltd., Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
Vickers, Ltd., River Don Works, Sheffield.
Willans & Robinson, Ltd., Rugby

SWITCHGEAR.
Adams Manufacturing Co., Ltd., 106, New Bond St., W.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Brown, Boveri & Co., Ltd., Caxton House, Westminster.
Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, S.E.
Ellison (George), Warstone Lane, Birmingham.
Ferranti Ltd., Hollinwood, Lancs.
Reyrolle & Co., Ltd. Hebburn-on-Tyne.
Union Electric Co., Ltd., Park St., Southwark, S.E.

TECHNICAL BOOKS AND JOURNALS.
Blackie & Son, Ltd., 50, Old Bailey, E.C.
Cassell & Co., Ltd., La Belle Sauvage, E.C.
Constable (Archibald) & Co., Ltd., 10 Orange St., Haymarket, W.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W.
Electric Journal, 422, Mansion House Chambers, E.C.
Electrical Engineering Abstracts, 57–58, Chancery Lane, London, W.C.
Griffin (Charles) & Co., Ltd., 12, Exeter Street, Strand, W.C.
Indian Industries and Power, 204, Temple Chambers, E.C.
International Institute of Technical Bibliography, 57 & 58, Chancery Lane, E.C.
Lewis's Scientific Circulating Library, 136, Gower Street, W.C.
Longmans, Green & Co., 39, Paternoster Row, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.
Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Graham (Alfred) & Co., St. Andrew's Works, Crofton Park, London, S.E.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.
Western Electric Co., Ltd., North Woolwich, E.

TESTING LABORATORIES.
Electrical Standardizing & Testing Institution (Faraday House), 62–70, Southampton Row, W.C.

VACUUM CLEANERS.
Duncan Watson & Co., 62, Berners St., W.

VULCANISED FIBRE.
Mosses & Mitchell, 122–124, Golden Lane, E.C.

WATCHES.
Leecla Watch Co., 215, Old Street, Ashton-under-Lyne.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY.

Our monthly supplement on "Electrical Engineering in Mines," is included in this issue. It opens with a critical article on the New Coal Mines Bill, commenting upon the amendment suggesting that the use of electricity should be discontinued where a minute proportion of inflammable gas is present in the air, and urging that in the new Home Office Rules, the regulation prohibiting the use of electricity where there is the risk of explosion, should be more definite. Some other articles summarise some of the most important mining patents during August, and describe a new controller and a new form of earth plate, suitable for mining work. A report is given of some police court prosecutions relating to infringements of the mining rules.

A demonstration was recently given of a new process of creosoting timber at the works of Messrs. Richard Wade, Sons, & Co. (Page 496.)

Under electric traction notes are included some remarks on the recent tramway accidents in London and Glasgow, and an abstract of a paper at the British Association on Rail Corrugation. The Bremen trolley omnibus system, which has been taken up in this country by the Brush Electric Engineering Co., is also described, and notes are given on other electric railway and tramway matters. (Page 497.)

A wireless system of signalling has been patented by R. A. Fessenden, in which the recorder is actuated by the frictional pull caused by a gold leaf resting on the surface of a revolving wheel, between which there is a film of oil. A detector for electromagnetic waves, which has a platinum wire pressing on a small portion of carbonate of lead, is protected by J. C. Smith and T. H. Lyon. Another specification published by the Patent Office last week, relates to a process of manufacturing metallic filaments, in which the metal is mixed with a solution of ammonia. The appeal made against the Comptroller's decision in connection with the use of phospham in metallic filament lamps by Glühlampenwerk Anker-Ges has been withdrawn. (Page 498.)

Several papers of electrical engineering interest were read at the meeting of the British Association, at Portsmouth. Prof. Andrew McWilliam presented a useful report on the "Present Position of Electric Steel Melting," which included a list of the various patterns of electric furnace, and their distinctive features. (Page 499.) Mr. H. A. Mavor, in an illustrated paper, described his system for the electric propulsion of large ships, employing electricity as a gear between the steam turbine or oil engine and the propeller. An order for a 5,000 kw. equipment for the United States Navy has been placed. In reply to remarks in the discussion, Mr. Mavor laid great stress on the simplicity of control and the strong and mechanical construction of the motors. (Pages 500–502.) A paper on Electric Steering, by Mr. B. P. Haigh was only briefly discussed; Mr. T. F. Wall contributed a long paper on the single-phase reduction motor; Mr. W. P. Digby spoke on the investigations he is making as to human susceptibility to vibration; and papers were also read on the electrical conductivity of aluminium alloys, the effect of electricity on plants, and a friction permeameter. (Pages 503 and 504.)

One or two papers on wireless telegraphy were read at the British Association, and signals were received from Continental stations. Several local authorities are taking measures to endeavour to obtain the equivalent of the rates paid by the National Telephone Co., after the transfer of the telephones to the Post Office has been effected. (Page 505.)

Reductions are to be made in the tariffs at Brighton. Profits on the year's working of the electricity undertaking are recorded at Aberdeen (£1,948), Peterborough (£184), Plymouth (£1,170), and Sheffield (£3,417), but a deficit of £357 is reported at Handsworth. A company with a large capital is being formed on the Continent to acquire and control the tramway

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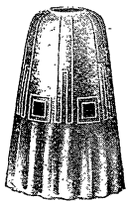
and lighting undertakings of Constantinople. (Page 505.)

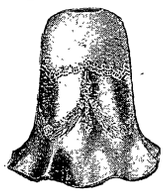
A LOCAL Government Board Inquiry was held last week regarding a loan for electricity extensions at Darwin (£7,600). The loan applied for at Wimbledon in connection with the supply to the Malden and Coombe area has been sanctioned. Tenders are invited for gas and Diesel engines at New Zealand. (Page 506.)

CATALOGUES AND PAMPHLETS, &c., RECEIVED

BRIMSDOWN LAMPS.—The Imperial Lamp Works (Brimsdown), Ltd., whose name, by the way, is shortly to be changed to the "Brimsdown Lamp Works," have sent us two new lists. One of these is a small folder with a coloured reproduction of the well-known Brimsdown poster on the front, and containing a price list of the various sizes and styles of lamp made, with some views of premises where they are used. The other is a larger and fuller list, containing also some views of the various departments of the works, in addition to the ordinary size for high and low voltages ranging from 25 to 260 volts. High candle-power lamps are made up to 1,000 c.p., and special candle and train-lighting lamps are also listed. A complete telegraph code for ordering enhances the utility of the list.

SHADES.—We have received from Messrs. Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston), a new list of glass shades for tantalum and other lamps. The list is supplementary to their price list No. 2, and affords a varied selection from which to choose. Two of the designs are illustrated here.





There is a fine assortment of satin-finish and opalescent shades in various tints, as well as some very effective etched designs. Another feature is a series of artistic bead shades. The list will be sent to any contractor or person interested.

GENERATORS.—The Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford, have issued their Bulletins 2a and 4a, dealing with D.C. and A.C. machines respectively. The contents of these are in the nature of general specifications of machines, illustrated with good reproductions of photographs showing details of construction.

ELECTRICITY SUPPLY ADVERTISING.—A further issue of supply advertising literature is being made by the Electric Supply Publicity Committee, including a booklet on electric heating with a cover by Mr. Cecil Aldin, representing two dogs enjoying the warmth of a radiator. The booklet consists of eight pages of a size fitting ordinary envelopes, and the letterpress is further relieved by dainty vignettes. The cover design is also reproduced as a postcard. A new booklet, briefly pointing out the advantages of electric driving of various classes of machinery is also being produced, and the new issue further comprises a four-page circular on the comparative safety of electric light and gas.

THE RÜPING PROCESS OF TIMBER PRESERVING

A NEW method of creosoting timber has been introduced at the works at Staddlethorpe of the well-known firm of timber preservers and merchants, Messrs. Richard Wade, Sons & Co., Ltd. A demonstration of the process was made recently, when various kinds and shapes of timber were selected for the experiment—redwood, poles, timbers, sleepers, fencing and paving blocks, and whitewood battens and boards. These were weighed and measured, and then sealed up in the cylinder, where they were subjected to an air pressure of about $3\frac{1}{3}$ atmospheres, or 50 lbs. per square inch, and then the cylinder was filled with creosote, whilst the air pressure was maintained. A pressure of 80 lbs. per sq. in. was then put on, after which the pressure was released and the cylinder opened, when the timber was taken out and re-weighed, showing the amount of oil remaining in it. Various pieces of the wood were cross cut, and showed the penetration of the oil, nearly to the centre, which we are told is impossible in the old method, except at a great cost. The wood was dry and clean to handle, and not dirty and clogged with oil, such as is often the case with creosoted wood. There are at present plants in the world, either specially erected for, or altered to suit the Rüping process, capable of doing over 38,000,000 sleepers, 9 ft. 10 by 5, by this process. The Santa Fé Railway Co., in America, are one of the largest users, and the German and Italian Governments have adopted the process.



SHADE OF NAPOLEON: I said that they were a nation of shopkeepers 100 years ago. There will be no doubt about it 175 years hence if they do not profit by Sir William Ramsay's warning now, for even their electrical industry cannot help them without coal.

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ELECTRIC TRACTION NOTES

Among the Papers read before the Engineering Section of the Bristol Association at Portsmouth, was one by Mr. W. Worby Beaumont on Corrugation of Tramway Rails. The author looked for the remedy to rail corrugation in radical alterations in the design of rolling stock, and considered the evil inevitable with the great weights now carried at high speeds on small wheels. According to his explanation of the phenomenon, the repeated running of the heavily laden tramcar wheel over the rail gradually compresses the surface of the crown of the rail beyond its elastic limit. Of this stress transversely the material relieves itself partially by the detrusion at the edges of the rail, where it forms a lip on the outside or on the groove side, or on both. This lip remains on the outside of the rail, but is worn off on the inside by the wheel flange. In the longitudinal direction the stresses arising from the compression of the surface material are not thus relieved. The heavily laden tramcar wheel presses into the surface of the rail, and as it rolls along presses before it a wave of compression, the translation of which involves the destructive rupture of the surface or the rise of the wheel over the minute crest of the wave. The result is the formation of an extremely hard surface in patches of various shapes and lengths, and separated by distances depending on several conditions, including the mechanical properties of the rail, its combined hardness and toughness. Where the bright hard patches alternate with an approach to regularity with the dull and rougher surface patches the result is known as corrugation. Mr. Alexander Siemens, in the discussion, asked Mr. Beaumont whether he really believed in his own conclusions, and thought that the heavier equipment entailed by the larger and slower running wheels would make the remedy worse than the defect. He suggested a rail made harder at the edges than in the centre, so that the wheels could, so to speak, sink in. Sir William White characterised this suggestion as a dream, and referred to similar troubles with the roller paths of old-fashioned turrets on battleships. Prof. Howe seemed to question whether corrugation was really any disadvantage at all, and Prof. Petanvel asked whether the surface of the tyre could not be made more yielding. Mr. Beaumont, in his reply, did not seem hopeful that his remedies were really practical, and ridiculed Mr. Siemens' proposed rail. The main objections to corrugated rails were the noise and vibration which they caused.

As most of our readers will have become aware from the daily Press, a regrettable tramway accident occurred on the L.C.C. tramway system at Lewisham last Saturday, when a four-wheeled top canopy car left the rails on a curve, after descending a short, steep incline at the junction of Shardeloes Road and Lewisham High Road, and overturned. One passenger was killed, and over 30 were injured. An inquest was held on Tuesday, at which the jury, in returning a verdict of accidental death, found that there was not sufficient evidence to show by what means the car left the rails. An attempt was made to prove that a quantity of dried and caked sand was present in the groove of the rail, but evidence was conflicting upon this point. At any rate it seems to have been established that the magnetic brake, although found to be in perfect order after the accident, was slower in coming on than the driver and the learner under his charge expected, and, indeed, they failed to make the compulsory stop before the descent. This was due possibly to its having been applied too soon after a power notch had been used, and that the car gathered more speed than is realised. The explanation advanced by one morning paper, that the magnetic brake being a track brake, tended to lift the car, is, of course, absurd, as these brakes are not pressed down on the track mechanically, but depend on magnetic attraction between the brake block and the rail, tending rather to increase than to diminish the pressure of the wheels on the rail. If the wheel brakes, as is quite possible, had locked the wheels, the magnetic brake would have simply been inoperative if applied before the wheel brakes were released. The number of previous fatal accidents on the L.C.C. system is given as four, which considering the immense size of the system is comparatively few.

A slight tramway accident also occurred in Glasgow on Saturday, when a driver fell from a car in a faint, and despite the efforts of a man who endeavoured to get on to the platform and apply the brakes, the car collided with another before either he or the conductor could stop it. This contingency is provided for in the case of electric railways, where only one man occupies the driver's cab, by the use of the "dead man's handle," which automatically cuts off the current and applies brakes on the driver releasing his grip. Accidents of this kind have hitherto been rare on tramways. We have been informed that only one case of a driver fainting has occurred on the L.C.C. system, and then the conductor was able to stop the car from the rear platform.

We have received a circular from the Brush Electrical Engineering Co., Ltd. (Loughborough), describing the Bremen trolley omnibus system, the British patent rights for which have been acquired by the company. The main distinguishing feature of the system, which is to be used on a few lines on the Continent, is that the two overhead wires are placed one above the other, instead of side by side. The current collector is suspended from the upper wire whereon it runs on two grooved trolley wheels, while a special form of spring bow makes rubbing contact with the lower wire while allowing full lateral play. A flexible cable connects this trolley to a mast on the car, and an ingenious spring arm is provided to take up the shock of starting, which might derail the collector. The upper negative wire is earthed at intervals, and fulfils the functions of a guard wire as well as a return wire and a support for the trolley.

The report of the Underground Electric Railways Co. of London, Ltd., for the half-year ended June 30th, records revenue from investments, properties, &c., of £108,792, and a surplus from the power house of £24,602. Out of these sums, after meeting interest on bonds, &c., including 1½ per cent. on the 6 per cent. income bonds, there remained a balance of £246, applied in reduction of accumulated revenue deficiencies. The eighth Parsons turbine has now been installed at Lots Road, and the output of the station was over 69½ million units for the half-year.

After meeting capital charges, there was a net balance on the working of the Cardiff tramways for the past year of £12,034, of which £5,087 has been added to reserve fund, and £6,947 to depreciation fund. The number of passengers carried was 25,662,830, compared with 25,448,234 in the previous year, and as the car miles have been reduced by 39,106 miles, there has been considerable economy in working. The depreciation fund now amounts to £44,515. In his report Mr. Arthur Ellis, the Tramway Manager, calls attention to the fact that the workmen's cars involve a loss of £1,566 per annum.

The proposal of the Sheffield City Council to run a system of trolley omnibuses to Dronfield has received the unanimous support of the Norton Rural District Council.

According to a telegram from Berlin, a company is being formed for the consolidation of electrical undertakings in Turkey, which will mainly devote itself to traction. The German Orient Bank and the Deutsche Bank are prominent in the matter, whilst the Ganz Co. is interested as the holders of an electric lighting concession in Turkey. It is stated that an International Finance Co. has been formed, with headquarters in Belgium, £2,000,000 being mentioned as the nominal capital.

The *Board of Trade Journal* points out that the Vienna Council have decided to construct additional tramways.

Mr. James Dalrymple, General Manager of the Glasgow Corporation Tramways, has prepared a scheme of extensions. The most important deals with the construction of a new bridge to carry tramways across the Clyde in order to relieve the congestion of traffic on the Glasgow Bridge.

Blackburn Tramways Committee have decided to pay each driver and conductor in their service 10s. extra pay for the extra work occasioned by the recent railway strike.

At a meeting of the Perth Electric Tramways, Ltd. (Australia) last week, Mr. A. H. P. Stoneham referred to the negotiations regarding the acquisition of their lines, which now include over 30 miles of track, by the municipality. It was held in some quarters that the State and not the city should purchase the undertaking, but no decision had been yet arrived at. The company are averse from any sale, but public opinion in Perth demands it. A price of £500,000 is asked. The sale of the Adelaide tramways to Government is also contemplated, and a Bill giving powers to this effect is now before the South Australian Parliament. The Hobart City Council have tramway purchase also under consideration, and a special committee have placed the limiting price which the Council will be prepared to give at £150,000.

The extension to the Huddersfield tramways from Edgerton to Birchencliffe was inspected and approved by Major Druitt of the Board of Trade, and traffic was commenced on Friday last. No decision has yet been come to with regard to the Elland extension.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published August 31, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

11,154/10. **Wireless Signalling.** R. A. FESSENDEN.—An electrical recorder is described in which a light film of gold leaf rests upon a wheel with a conducting surface. The wheel is made to revolve at a uniform speed, and dips into a bath of lubricating oil. It is so arranged that, when an impulse is received, the leaf and wheel are charged through the medium of the lubricating film, producing an increased frictional drag between the two. This causes a recording pointer, which is attached to the gold leaf by a filament, to move and make a written signal. Four figures.

22,164/10. **Detectors for Electromagnetic Waves.** J. C. SMITH and T. H. LYON. A small portion of an ore, known as carbonate of lead, is inserted in series with the conductor carrying the oscillating current. The ore and the conductor are fixed on two separate standards placed close together, and a piece of platinum wire is attached to the conductor, which can be adjusted to obtain the required pressure of the wire on the ore.

22,803/10. **Electrodes for Arc Lamps.** J. M. LEWIS. To ensure the carbon core and flaming material in an electrode burning at the same rate, so that one shall not stand up more than the other, a divided electrode is provided. This can be constructed by placing a layer of the flaming material round the tubular carbon core in the form of rings cut in a lathe, or it can be placed inside the core in the shape of cylinders with spaces in between. Other methods of arranging them are included. The flaming material is made to a previous specification (No. 15,977/10), and consists of mixing finely-divided calcium fluoride and silicon carbide with gold size, and afterwards pressing and drying. Six figures.

23,639/10. **Metallic Filaments.** Dr. J. SCHILLING. Finely divided metal, such as tungsten, is mixed with a small quantity of ammonia solution, and then kneaded and worked up at the ordinary temperature; or the metal can be exposed to the action of ammonia gas in closed vessels at the ordinary temperature. The product is a plastic mass, which can be readily squirted into filaments, when the ammonia evaporates on passing a current through, leaving a filament of pure metal.

23,891/10. **Conductor Terminal.** C. H. MEIGH. This is stamped out of a sheet of metal in the form of an eight with the waist half the width of the loops for folding over. Through the centre of the loops a hole is punched, and dished strips are provided at each end. One of these takes the insulated part of the conductor, and the other, which is a little wider, folds over on to the narrower strip, which it is made to grip by pliers. The wires of the bared end of the conductor are in this way pressed tightly between the loops, making good contact. Eight figures.

8,004/11. **Drawn Tungsten Filaments.** K. SCHWAB. The filament is drawn from a tungsten alloy containing non-metallic substances in quantities insufficient to affect the resistance of the wire. Good results are obtained with an alloy of tungsten and a little phosphorus, and nickel can also be added if desired.

12,735/11. **Arc Lamps.** SIEMENS BROTHERS' DYNAMO WORKS, LTD. This invention provides for better distribution of the combustible materials, which are supplied to lamps of this kind. One method supplies three channels or pipes, set at an angle of 120° with each other around the electrode, whilst another method is to surround the electrode tips with a collar provided with channels, through which the fuel descends in equi-distant streams. Six figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: BLONDEL [Electrodes] 12,024/11.

Dynamos, Motors, and Transformers: BRITISH THOMSON-HOUSTON CO. (*General Electric Co.*) 30,233/10.

Incandescent Lamps: ALLGEMEINES CHEMISCHES LABORATORIUM ISKAR H. ARENDT, and SCHLESINGER [Supports for filaments] 29,505/10; RICHARDSON and CROWLEY, 1,907/11.

Switchgear, Fuses, and Fittings: DAVIES, KENT and DAVIES, KENT and STEWART, LTD. [Switches] 19,071/10.

Telephony and Telegraphy: SIEMENS BROS. & Co. (*Siemens and Halske Akt.-Ges.*) [Intercommunication sets] 9,375/11.

Traction: BRUSH ELECTRICAL ENGINEERING Co. and LEECH [Tramway motor supports] 27,725/10; OESTERREICHISCHE DAIMLER MOTOREN AKT.-GES. [Trolley wire construction] 4,397/11.

Miscellaneous: HERRDE [Regulating the closing of bell circuits] 19,199/10; GILES [Condensers] 28,179/10; ENGEL [Contact devices] 320/11; BARNES [Lug joints for accumulator box lids] 6,983/11; BENKÖ [Cells] 10,156/11; CHEMISCHE FABRIK GRIESHEIM-ELEKTRON [Depolarisers for primary batteries] 11,906/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Dynamos, Motors, &c.: Soc. "PHI.," 25,026/10; PIEPER [Speed regulation] 17,675/11.

Heating, &c.: HOUSKEEPER, 17,479/11.

Incandescent Lamps: KNIGHT [Supports for filaments] 17,482/11.

Switchgear, &c.: FAGERLUND [Automatic circuit-breakers] 17,284/11; SCHAIRER [Terminal devices] 17,481/11.

Telephony, &c.: STEINBERGER [Telephone mouthpieces] 14,590/11.

Miscellaneous: Soc. "PHI." [Electro-magnets, &c.] 23,831/10.

The following amended Specifications can now be obtained.

AKT.-GES. BROWN, BOVERI, ET CIE. [Spinning machines] 19,626/06; PENROSE [Switches] 1,037/11; HENRI HELBRONNER and RECKLINGHAUSEN [Destroying bacteria] 1,805/10.

Opposition to Grant of Patents

27,938/06. **Signalling by Wireless.** LEE DE FOREST. The appeal which was lodged against the Comptroller's decision has been withdrawn. The patent relates to a system of signalling whereby a ship with receiving apparatus may locate its position with respect to a station with transmitting apparatus. It comprises a rotatable signalling wheel divided into sectors and provided with electrical contacts, by which means the wave signals are changed with their direction of transmission, and the location of the transmitting station can be identified. A rotatable parabolic reflector is also used for concentrating the direction of the waves.

19,847/08. **Phospham in Metal Filament Lamps.** GLÜHLAMPENWERK ANKER-GES. The appeal, which was made against the decision of the Comptroller to refuse this patent, has been withdrawn. An abstract of the Comptroller's decision was given in ELECTRICAL ENGINEERING, June 16th, page 390.

29,960/09. **Fan.** J. KEITH and C. TUSON. The opposition which was entered to the grant of this patent has been withdrawn. It relates to a roof ventilator for ships' cabins, railway carriages, &c., which was described in ELECTRICAL ENGINEERING of November 24th, 1910, page 753.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: GUEST, KEEN, & NETTLEFOLDS, and C. WAKEMAN, 11,088/03.

Distributing Systems, &c.: J. S. PECK [Three-wire system] 25,753/01.

Dynamos, &c.: C. A. PARSONS and G. G. STONEY, 9,203/00; V. A. FYNN [Single-phase commutator motor] 11,288/07; LA COUR [Controlling] 11,466/07; C. W. KAY [Homopolar] 11,476/07; S. VON AMMON [Commutators] 11,673/07.

Electric Ignition: A. BILLING, 11,402/07.

Electrometallurgy, &c.: G. F. BRINDLEY [Furnaces] 11,675/06.

Incandescent Lamps: E. BÖHM, 9,959/01; H. H. LAKE (*Rheinische-Weste-Fälische Maschinenbau-Anstalt und Eisengieserei* [Miners' safety] 11,059/02.

Switchgear and Fittings: J. A. GOSLING [Holders] 11,528/07; A. J. BOULT (*T. von Zweigbergk*) [Controllers] 10,228/99; H. S. HATFIELD [Switches] 11,541/07.

Telephony, &c.: AMALGAMATED RADIO-TELEGRAPH Co. (*G. Seibt, Berlin*) [Wireless telephony] 11,695/07.

Traction: J. W. MACKENZIE (*Soc. Cousin & Co., France*) [Signals] 11,272/04; P. PLATTE [Bow collectors] 10,100/05; R. BRAUN [Brakes] 10,709/07; A. A. SCHNEIDER [Trolley wheels] 11,285/07; H. TUDOR, 11,501/07; W. KNEEN and H. C. KING [Tramway conduits] 11,523/07.

Miscellaneous: H. CAMPICHE [Electric clock apparatus] 10,393/99; C. NAYDIS [Governor valve control] 11,358/07; SIEMENS BROS. & Co. and G. S. GRIMSTON [Signalling] 11,381/07; W. N. and F. W. NICHOLLS [Tremblers] 11,386/07; J. FLUEGELMAN [Counting apparatus] 11,616/07.

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ELECTRICAL ENGINEERING
IN
MINES

THE COAL MINES BILL

IT has been recognised for some time that a definite restriction as to the use of electricity in those parts of mines in which it would be dangerous would inevitably be made by the Government and enforced by the Home Office. Mine owners maintain that there is no desire on their part to utilise electric power in places where it would introduce a risk of explosion, and for that reason no exception was taken to the first of the proposed new special mining rules, by which the use of electricity is prohibited "in any part of a mine where, on account of the risk of explosion of gas or coal dust, such use would be dangerous to life." Electrical engineers, on the other hand, do not view the wording of this rule with satisfaction, for although they also would obviously not desire to utilise electricity in any circumstances where danger would attach, yet they would prefer that the cases where there would be a risk of explosion of gas or coal dust due to use of electricity should be more accurately defined in the rule. We believe that some at any rate of the mines managers are also now adopting this view. The mines managers are, naturally, in many instances not conversant with the details of the applications of electricity, and as they themselves would find it very difficult to decide in what circumstances the use of electricity would be dangerous, they might elect not to take the risk at all, and to eschew the use of electric power altogether.

In Clause 60 of the new Coal Mines Bill, as originally drafted, the special rule we have quoted above was practically repeated, and the clause in question read as follows:—

(1) Electricity shall not be used in any part of a mine where, on account of the risk of explosion of gas or coal dust, the use of electricity would be dangerous to life, and if the owner of a mine, on being required by an inspector of the division not to use, or to desist from using electricity in the mine or any part thereof on such ground as aforesaid, refuses to do so, the question as to the application of this section to the mine or part thereof shall be settled in manner provided by this Act for settling disputes.

(2) The use of electricity in any mine shall be subject to general regulations under this Act.

The first sub-section of this clause is therefore obviously redundant, and it would be quite sufficient to let the second sub-section stand alone, as the prohibition of electricity, when there is a risk of explosion, is already contained in the new special rules to be issued under sub-section 2. In a consideration of the Bill by the Standing Committee of the House of Commons, to which it was referred, a good deal of discussion was devoted to this clause. It was first suggested that an amendment should be made that electricity must not be used in any part of a mine where safety lamps have to be employed, but this amendment was not adopted. As mentioned in our issue of August 3rd, however, on the motion of Sir Arthur Markham, an addition was made to the clause, to the effect that the use of electricity should be at once discontinued in any part of a mine in which the inflammable gas in the air current exceeds ½ per cent. The Solicitor-General for Scotland, who had charge of the Bill at the time on behalf of the Government, opposed this, but it was carried notwithstanding. As the Bill is left, therefore, the indefinite clause prohibiting electricity where there may be the danger of explosion still remains, and this addition of Sir Arthur Markham stands, not as a definition of when the danger of explosion may be anticipated, but as an additional restriction. When we add that it is highly improbable that the presence of ½ per cent. of inflammable gas could be detected in the air current by any of the ordinary means of testing in use at the mines, it will be seen that the position is one that must be altered. There appears little reason to doubt that the Government will move the omission of Sir Arthur Markham's addition to the Bill when the Bill comes up for third reading in the House of Commons during the autumn session; but those who desire to promote the increased use of electricity in mines with the consequent increased efficiency in working should endeavour to have the first part of the clause also omitted, so that any control as to the use of electricity should be contained only in the special rules for the purpose, and not partly in the Act itself. In addition, as the new rules proposed are not yet definitely adopted, and representations are to be heard by the Home Office as to the desirability of amending them, the question should then be debated as to whether rule No. 1 (prohibiting the use of electricity "where on account of the risk of explosion of gas or coal dust, such use would be dangerous to life") should not be made more definite and intelligible.

ELECTRICAL MINING PATENTS OF AUGUST

AMONG the patent specifications of interest to electrical mining engineers published during the past month was one by E. A. Hailwood, of Morley, near Leeds (No. 18,415 of 1910), for an electrically lighted safety lamp. The lamp vessel is provided with a wick tube, which carries a sliding sleeve. This sleeve has a boss with a threaded aperture, which engages with a similar thread on the exterior of a metal tube passing through the vessel. The tube has an enlarged headpiece knurled on the exterior. Inside an insulator is placed provided with an electric igniting pin and snuffer arm. The bottom of the pin terminates in a button, and is kept down by a spring fixed between the button and insulator head. Adjustment is obtained by turning the headpiece and moving the sleeve up and down the wick tube.

Specification No. 21,080 of September 10th, 1910, by W. E. Gray, of London, describes a portable safety lamp. A battery with projecting contact lugs is placed in a case with a hinged cover, which, when closed, can be locked by means of a hinged slotted clasp secured by a rivet or other fastening device to a lug on the case. A non-conducting base plate is fixed on the cover, into which two metal studs are screwed, passing through the base plate and cover. In the ends of these studs metal plungers are screwed, so that when the cover is closed electrical contact is made with the battery terminals. A glow lamp is mounted on the cover between an upper and lower conical reflector, the bases of which rest upon a circular metal disc and the non-conducting base respectively. One wire of the glow lamp is connected to the lower reflector, while the other is taken to one of the studs on the base plate. The electrical circuit is opened and closed by means of a milled-headed metal screw, which makes and breaks contact between the lower reflector and the second metal stud. A glass cylinder, enclosing the glow lamp and reflectors, is placed between the circular metal top disc and the cover. The disc and cylinder are secured to the cover by a number of bolts and nuts.

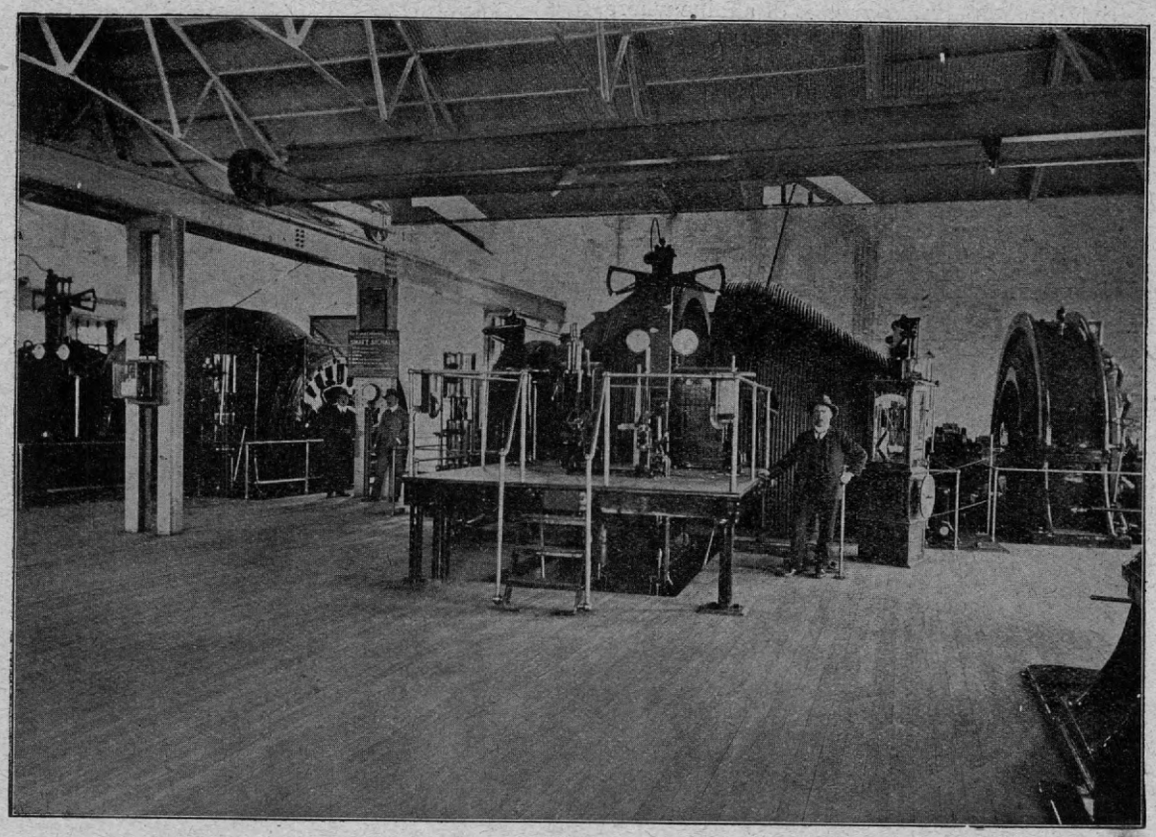
Specification No. 27,804 of 1910, by C. W. Speakman, of America, describes an insulator and means for supporting it in mines. The end of the pin of the insulator, which is driven into the roof or wall, is split and tapered, and a series of short, bevelled prongs extend from it to hold it more securely. The insulator is keyed on to the pin. The part of the pin under the insulator has a vertical groove to form a conduit for removing any water that may accumulate on the top shoulder of the insulator. The cable is placed in an angularly disposed groove on one side of the insulator, and the binding wire, which holds it to the insulator, is mounted in a transverse groove on the opposite side.

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A NEW CONTROLLER FOR INDUCTION MOTORS

THE type of reversing controller for induction motors which has been hitherto mostly favoured for colliery and similar work is the one in which a revolving drum is employed on which is carried various contacts. In designing the new type of contactor controller described below, Messrs. Dick, Kerr & Co., Ltd. (Abchurch Lane, Cannon Street, E.C.), the manufacturers, have endeavoured to obviate the use of contacts rubbing on a slowly moving drum, in order to ensure that, however severe and exacting the conditions may be, the maintenance shall be much lower than that of the more ordinary drum pattern. An arrangement is adopted

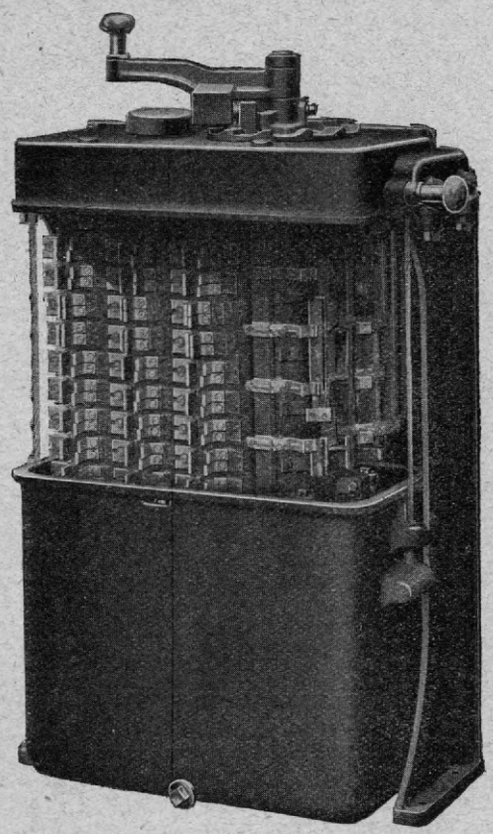


FIG. 1.—CONTROLLER WITH OIL TANK LOWERED.

similar to the contactor system, which gives quick break and make, and maintains the surfaces smooth and clean, and at the same time has a minimum of wear on the contacts.

Describing the apparatus more in detail, the general arrangement is shown in Fig. 1, and it will be seen from Fig. 2 that there is a fixed frame on which is carried the spindles

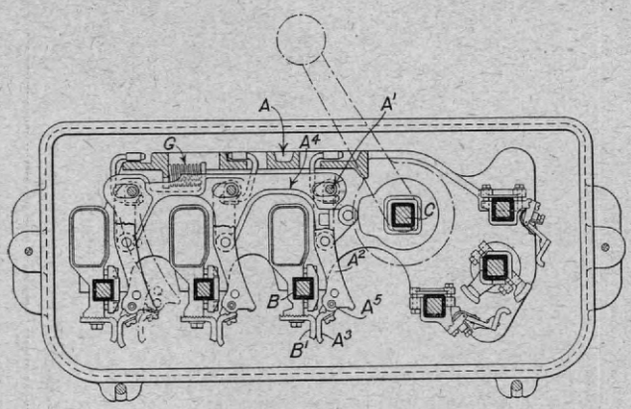


FIG. 2.—SECTIONAL PLAN SHOWING ARRANGEMENT OF CONTACTS.

*A*1, which extend almost the entire height of the controller. Pivoted on each of these spindles are movable arms *A*2, to which are fixed contacts *A*3, each spindle carrying the number of arms with contacts corresponding with the steps of the rotor resistance, of which there are usually nine, with one step full resistance. These arms *A*2 have a rotating movement on the spindle, and also a small lateral movement, the combination of these movements ensuring that the contact pieces shall approach one another at such an angle as to ensure a good wiping action contact. Corresponding with and registering horizontally to these contacts *A*3, are the same number of fixed contact pieces *B*1 mounted on vertical standards *B*, but insulated from same by mica. Each of the movable contact pieces is held extended to the left by means of a spring, the movement being limited by blocks *A*5. This addition ensures that in each case when contact is made between the two contact pieces *A*3 and *B*1, and that any wear or unevenness of alignment relative to one another will not cause sparking, as, in the closed position, perfect contact is made against the full compression of this spring. Each main operating pillar is actuated by means of the controller handle, and carries a number of cams, each appropriated by one of the movable cradles *A*4, on which are pivoted the movable contact arms *A*2. In addition to this the operating pillar has at the top just below the handle another cam, by which on the first operation of the handle the stator circuits are closed. At this point the motor is connected to the line and with all resistance in the motor circuit. The succeeding notches actuate the movable contacts, and an automatic notching device is also attached to the handle which prevents it from moving forward more than one notch at a time, and ensures a pause at each clip. The handle can, however, be brought rapidly to the "off" position, the whole of the speeding up action being reversed, the stator connection being broken last.

For starting up the motor in the opposite direction the handle at the side is used to raise or lower the reversing drum, so that the stator connections are reversed. The reversing handle is locked in position by the first movement of the controller handle, and the controller handle is locked by the reversing handle in any intermediate position of the latter.

Easy access to the contacts is ensured by the way the casing moves vertically up and down in guides, with the whole of its weight, including the oil, taken by a counterweight.

These controllers are usually supplied with ten positions in either direction, and can be supplied for three- or two-phase wound rotors.

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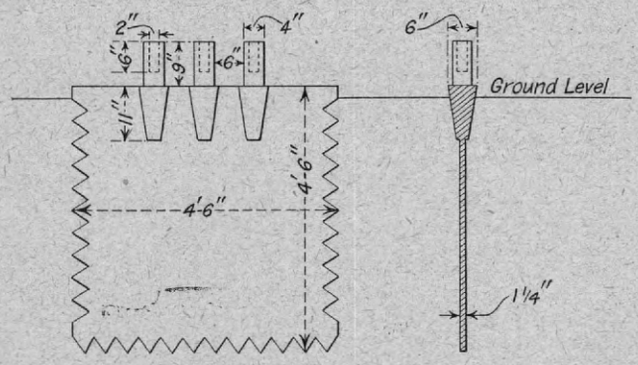
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A USEFUL EARTH PLATE

THE earth plate sketched below has been designed by Mr. John Bentham, electrical engineer at the New Sharlston Collieries, near Normanton, where it has been put into use. Its object is to comply with the Home Office requirements, and to ensure at all times a permanent and durable earth connection. The whole of the earth plate and cable terminals is one solid casting weighing 11 cwts., and is made of cast iron 4 ft. 6 ins. square to point of teeth, and 1¼ ins. in thickness. It will be seen that the cable connections are above ground, so that there is no danger of the cable becoming detached from the earth plate through corrosion, and as inspection is easy, constant testing is unnecessary.



The cast-iron terminals to take cables are 9 ins. in height from top of plate, and 4 ins. diameter, having a hole bored in the centre of each terminal 2 ins. in diameter and 6 ins. deep.

The earth plate at the Sharlston Collieries is fitted with three terminals, one for the 220 kw. generator, one for the 550 kw. generator, and one for the earth cable for the mine; it is fixed in a vertical position in the ground in the usual manner, just outside the power house. The full length of cast-iron terminals remain above ground. It is so arranged that the water from the exhaust pipe of the engine flows constantly on to the earth plate, the whole being protected by a small brick cabin with door. The earth plate is also bonded to the water main by means of copper tape ¾ in. wide and ⅛ in. thick, two pieces of this being used. Their ends are put into the cast-iron terminals of the earth plate.

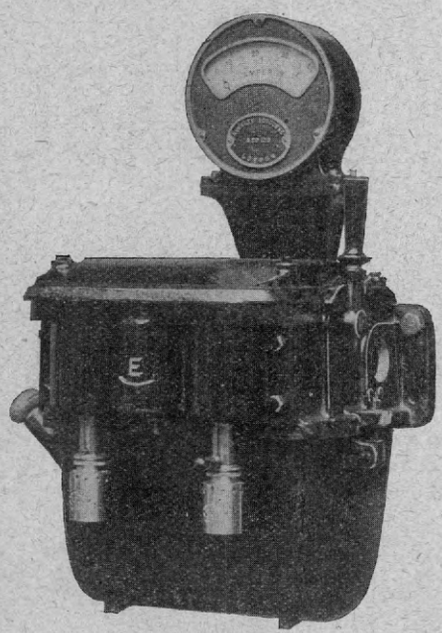
In fixing the cables to the earth plate, the insulation is taken off for about eight or nine inches, and after the terminals have been made hot by means of blow lamps, &c., the copper cable is pushed down to the bottom of the terminal and then run in solid with white metal. When the terminals have cooled off the bare part of the cables may be finished off with insulation and black varnish.

POLICE COURT PROSECUTIONS

MINE managers are apparently becoming more alive to their responsibilities in the case of breaches of regulations, and are occasionally following the course of prosecuting careless employés who are guilty of neglect of the rules for their own safety and that of their fellow-workmen.

In the Falkirk Sheriff Court on August 7th, a machineman belonging to the Craigend Colliery was summoned for failing to have the earth wire of an electric coal-cutting machine connected to the gate end box. There had evidently been a leakage, as he had received a shock which necessitated his being off work for three weeks. The prosecution was doubtless instituted to give greater publicity to the case, and to serve as a warning to others, as the man's punishment would appear to have been sufficient without the additional infliction of the fine of 5s. to which he was subjected.

Another case—a more serious one—was heard at the Manchester County Police Court last week. It appears that a haulage lad employed at the Newtown No. 2 pit of the Clifton & Kersley Colliery Co., had interfered with the electric cable which ran along one side of the main haulage road. A hammer had been found on the top of a girder, and it was alleged that the defendant had acted in such a way as to make both the girder and the hammer alive with electricity. The pressure was 220 volts. A fine of 10s. was imposed.



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MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The Coal Famine.

SIR WILLIAM RAMSAY, the President, delivered his Address at the opening of the meeting of the British Association for the Advancement of Science on Wednesday last week at Portsmouth. This address, the concluding part of which was devoted to the question of the early exhaustion of our coal supplies, was reported in our last issue, and has excited a great deal of comment, not only in engineering circles, but also among the general public and in the daily Press. Sir William Ramsay has pointed out clearly the disastrous effect upon the industries of the country which would be the result of the exhaustion of our coal supplies, and has shown that actual estimates of the amount of coal available and of the annual increase in the quantity mined, point to the complete exhaustion of our coalfields in 175 years. Long before the end of this period is reached, however, the country would feel the effect of a rise in the value of coal, and, as no other practicable sources of energy are available to take its place, the outlook is certainly serious. Sir William Ramsay certainly does not understate the case when he predicts "the near approach of famine and misery" if the Government does not take almost immediate steps to prevent the enormous and unnecessary wastage which is going on by the continuance of the employment of uneconomical methods for its combustion.

In the Engineering Section (Section G) on Thursday. Prof. Biles, the President of the Section, delivered his Address, which, however, did not deal with any electrical engineering subject. A discussion then followed on rail corrugation; this is referred to in our Electric Traction Notes on a later page.

The Use of Electricity in Steel Production.

In the Chemical Section (Section B), a report by Prof. Andrew McWilliam on "The Present Position of Electric Steel Melting" was presented. The author himself was absent, and the report was not discussed.

Prof. Andrew McWilliam explained that the melting of steel by means of electricity had become a commercial process by means of which steel was manufactured for the market. The general impression which he has gathered from much conversation with users is that the arc furnace product from slightly impure materials, purified to Swedish standard, just about takes its place by Swedish open-hearth and Bessemer steels, and that the induction furnace product skilfully made from pure materials equals anything but the very highest qualities of crucible steels. The special feature of the Héroult and Röchling-Rodenhauser types is that with an oxidising purification phosphorus can be eliminated to almost any extent that will pay, and after removing the slag, and forming another, by a reducing purification suphur can similarly be removed. The Kjellin induction furnace acts as a melter of materials much after the manner of the crucible, and has one advantage over the crucible in that there is no absorption of sulphur during melting. He endorses the conviction quoted in an article on the subject in our issue of August 17th, that the electric furnace will not make good steel automatically, but the same metallurgical skill required by the older processes must be expended on the proper killing and finishing of the steel, by whatever type of electric furnace it is being melted, and the fact that in electric as in other furnaces bad steel may be made from good materials increases the difficulties of finding the exact place of any steel in the world's work.

The successful application of electric power to the production of charcoal pig-iron allows of a much reduced consumption of charcoal, and the rapidly increasing price of charcoal in Sweden, owing, among other causes, to so much of the wood being used for making wood pulp for paper-making, is quite a serious situation which the application of electric power derived from waterfalls may help to relieve.

A brief description of the various types of electric furnaces was then given:—

The *Stassano* furnace is an independent arc furnace. Three carbon electrodes are used, between which arcs play, and the heat from the arc is merely used for heating the charge, partly by direct radiation and partly by reflection from the dome of the furnace.

The *Héroult* steel-melting furnace is a direct arc type, in which the charge forms one pole of the arc. Two vertical carbon electrodes come through the roof of the furnace and two arcs play, one between each electrode and the molten metal or slag beneath it.

In the *Girod* furnace one or more electrodes of like polarity are maintained above the bath, and soft steel pieces embedded in the hearth of the furnace are in direct contact with the molten metal for the negative electrode. These lower pole-pieces are water-cooled. Large quantities of ferro-silicon, ferro-chrome, &c., as well as of ordinary carbon and special steels, are made in this furnace.

The *Keller* furnace is very much like the Héroult, but the two electrodes come into separate cavities which are joined by the molten material of the bath.

In the *Grönwall* furnace the current enters by two electrodes through the roof, and when once the bath is heated, so that the lining becomes a conductor, the current from both electrodes passes through the lining to a graphite block underneath, and hence to a common wire.

The *Nathusius*, like the Grönwall, is a combined arc and resistance furnace. It contains three vertical carbon electrodes, arranged at the apices of an equilateral triangle, and three steel electrodes similarly arranged in the bottom of the furnace but covered by refractory material. Three-phase current is used.

In the *Kjellin* induction furnace the metal charge is placed in an annular hearth, almost like a steel-melting crucible in section, but in the form of a ring. The primary coil of twenty-four turns is placed in the centre round a core of laminated iron. The bath or ring of metal acts as a secondary circuit of a single turn, and the heat is thus produced in the charge itself without contact with electrodes.

In the *Frick* furnace the primary coil is above the crucible, and in the *Colby* round the outside of the crucible.

The *Röchling-Rodenhauser* furnace is based on the Kjellin principle, but has an important addition. In its simplest form for single-phase current there are two grooves or heating channels corresponding to the annular crucible of the Kjellin, but these join to a central open-hearth, the whole hearth forming a kind of figure 8. In the central open-hearth all the distinctly metallurgical operations take place, so that this form can be used for refining work, for which the Kjellin is not very suitable. Not only so, but a distinct secondary winding is provided in which a secondary current is induced, and these windings are jointed to steel terminal plates which are embedded in the refractory material of the furnace at the ends of the central hearth. At high temperatures the refractory material becomes a conductor of electricity, and thus the currents induced pass through the bath in the central hearth, heating it still further.

The loss in melting is an important point, and the author has been informed that this amounts to about 1½ per cent. in the Kjellin, about 4 to 5 in the Röchling-Rodenhauser, and 7 to 8 per cent. in arc furnaces.

About June, 1910, there were about 118 furnaces of all types, of which 70 were in use, 10 not working, and 38 being built. The majority of these were between 5 and 80 tons per charge capacity, but there is one at Domnarfvet, Sweden, for the production of 2,500 tons of pig-iron per annum, and one in Norway, and another at Trollhättan, Sweden, both in course of construction, and each designed to produce about 7,500 tons of pig-iron annually.

Of the induction furnaces, the Kjellin furnaces erected totalled fourteen with 35 tons capacity, the Röchling-Rodenhauser fifteen, with 30 tons in work, 1 ton not in work, and 17 tons capacity being built, all others about 18 tons in work. That gave a total capacity of about 250 tons for the arc furnaces and 100 tons for the induction, or a grand total of 350 tons per charge for all electric steel-melting furnaces.

Since June, 1910, however, there has been a continued development; for instance, in June, 1910, there were twenty-nine Héroult furnaces with a capacity of 80 tons in work and 50 tons in course of erection, 130 tons in all, whilst about June, 1911, there were forty-three furnaces, with a total capacity of about 242 tons.

The output of electric steel in Germany, the United States, and Austria-Hungary in 1910 amounted to almost 112,000 tons, which is an increase of 63,000 tons over the figures for 1909, and the increase will probably be more than maintained in 1911, as more than thirty new furnaces of various types should be

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started during the year. Before the beginning of the present year the Héroult furnace at Edgar Allen's in Sheffield was the only arc one in England in steady operation. In January three Héroult furnaces were commenced in England, at Vickers', and Thos. Firth & Sons', in Sheffield, and at Lake & Elliott's in Braintree, Essex. A Grönwall furnace, for demonstration and manufacturing purposes, was also started at about the same time in Sheffield, and the output of England for 1911 should amount to about 13,000 tons. A 15-ton Héroult furnace is to be erected at Skinningrove shortly, and is expected to turn out 200 tons per day. About the same period Kjellin induction furnaces have been working satisfactorily at Vickers' and Jessop's in Sheffield, and an experimental furnace at the University of Sheffield.

The electric furnace can be used either for melting scrap directly or in combination with some other form of furnace, in which case it simply acts as a refiner. The majority of the recent furnaces have been employed in this way, in conjunction either with Bessemer or open-hearth furnaces. The latter are usually of the basic tilting type, part of the charge being removed to the electric furnaces after the pig is melted and the bulk of the phosphorus removed, leaving some phosphorus and the oxygen and sulphur to be eliminated by the electric furnace. In this case the time required for the electric furnace is from one hour to two hours, according to the degree of refining required and the original condition of the steel when removed from the basic furnace. The power used varies from 100 to 300 kw-hours per ton. When cold scrap is melted the time required is about six hours, and the power consumption said to be from 650 to 750 kw-hours, but really, all in, more probably 800 to 1,000 per ton. Of the forty-hour Héroult furnaces in operation or construction twenty-one are to melt scrap, twenty to take molten steel from the basic open-hearth, one from a Talbot furnace, and two from converters.

Application of Electricity for the Propulsion of Ships.

On Friday in the Engineering Section, Mr. H. A. Mavor read an interesting Paper on "Electric Drives for Screw Propellers," in which he put very clearly the reasons for using turbines or oil engines to drive generators which supplied current to electric motors for driving the screws instead of driving direct. He also described briefly some of the vessels which are being equipped on this system.

High efficiency is associated with low rate of revolution of the propeller, while in the steam turbine high rates of revolution are essential to the most economical use of the steam. Internal-combustion engines have speeds more nearly approximating those of reciprocating steam engines, but here also there is a tendency to speeds higher than are convenient or economical from the propeller standpoint.

In addition, the draught, beam, and form of the vessel limit the area of the propeller. The traffic for which the vessel is designed influences the determination whether one, two, or more propellers are to be used, and the speed, size, and form of the vessel determine limits to the designer's choice.

All these considerations taken together frequently fix the diameter, pitch, and thrust of the propeller, and, within very narrow limits, also the rate of revolution. This rate of revolution is not always the most favourable for the engine or turbine, and the designer is in such cases compelled to resort to new expedients if he is to attain the standard of efficiency which has been set by results attained on land.

A vessel running one-day voyages, and burning 50 tons of coal, could not possibly submit to an increase in weight of machinery in excess of the coal-saving, because such increase would increase the displacement, and therefore the power necessary to drive the vessel. On the other hand, if the vessel make a 10-day voyage, and the saving in fuel carried amount to 10 tons per day, a considerable increase in weight of machinery might be associated with decreased displacement and a substantial all-round economy. The author, however, does not consider that vessels of the type of the *Lusitania* and *Mauretania* present favourable cases for electric transmission arrangements.

Various methods of making the required adaptation of generator to propeller are at present under trial. For this, mechanical gearing by toothed wheels or hydraulic transmission may be considered serious competitors with electric transmission, but, for large powers, the cost, weight, and efficiency of electric transmission compare favourably with either of the two competing methods. Power generators give their best efficiency when full speed of rotation is maintained, even when running below full power. It is therefore advantageous to keep the engine revolutions within the range of governor control while the required speed change is accomplished by electric combinations.

There are other important qualifications of electric transmission in which it stands altogether unrivalled, particularly the facility of reversing and of changing speed. Further, it provides means for applying the power of one or more engines to one or more propellers, so that the power generating units may be so disposed as to give the highest efficiency, and when they are not required they can be stopped.

The property of combining the power of more than one engine for application to one or more propellers is the special feature of the author's inventions as distinguished from the ordinary methods of electrical engineering. Engines of different types sizes, and rates of revolution can have their powers combined without interconnection of their electric circuits, and without risk of mistake or error. An oil engine at 100 r.p.m. may be running the vessel at low speed, and a steam turbine running at twenty times the speed may be jointly applied to the propellers without any complication of the electric equipment. Each unit does its own work independently.

In the case of the mechanical transmission by the tooth-gear which has been carried out by the Parsons Marine Steam Turbine Co. and by the Westinghouse Co. in America, the results at sea appear to be quite satisfactory, but Mr. Mavor says, we are still left with the necessity of providing a reversing turbine, and it remains to be proved that the gear will stand the rough-and-tumble service of a vessel where there is much "backing and filling" to do. The weight, price, and economy of the mechanical transmission gear appears to show no advantage over the electric gear. This arises from the fact that the gear ratio can be made higher.

The other competitor is the Föttinger hydraulic transmission. While less rigid than the mechanical gear, it is not so flexible as the electric transmission. For an equal range of adaptation it appears certain to the author that the electric transmission will be cheaper and more efficient, and the convenience in manœuvring is entirely in favour of the electric gear.

A few examples of application of the author's system are here presented, together with a description of a small vessel built to demonstrate and illustrate the principles of operation and to provide experience in the use of the plant. In all cases alternating three-phase currents are used, and interlocking devices connect mechanically the main reversing switches with the exciting switches, so that no change can take place in the connections while they are passing currents.

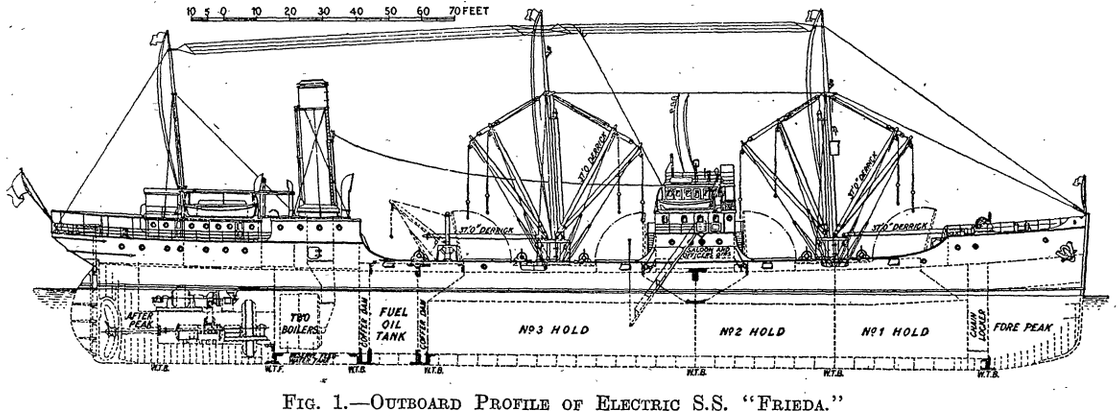


FIG. 1.—OUTBOARD PROFILE OF ELECTRIC S.S. "FRIEDA."

DESCRIPTION OF THE TURBO-ELECTRIC STEAMSHIP "FRIEDA" (FOR AMERICAN OWNERS). (See also Figs. 1 and 2.)

This vessel has been specially designed for the transport of bulk freights between the Gulf of Mexico and New York City. The vessel is to be 300 ft. long and will carry a deal weight of, approximately, 5,000 tons at a mean loaded speed of 12 knots at sea. The propelling machinery is aft, and consists of a turbo-electric outfit for three-phase 50 cycles when running at 3,000

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r.p.m. The turbine is supplied with steam at a pressure of 200 lb. per square inch at the stop valve. This electric generating plant is arranged on foundations on a platform deck in the engine room and the condensing plant in the engine-room hold. The condenser is fitted with a vacuum augmentor, and is suitable for dealing with the full load quantity of steam from the turbine. The vacuum obtained will be 28½ in., with cooling water about 85° F. The condensing plant consists of a vacuum

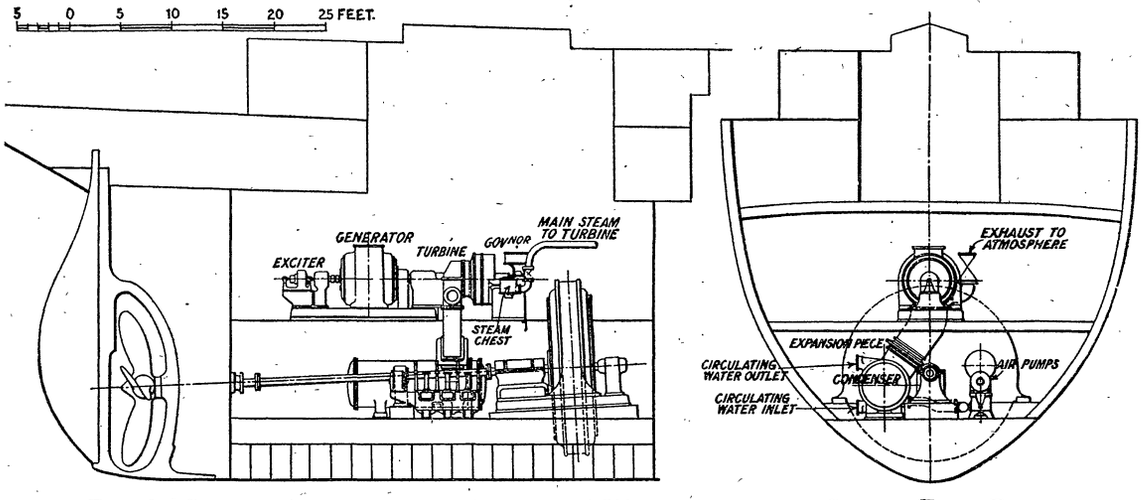


FIG. 2.—GENERAL ARRANGEMENT OF PROPOSED 1,500-KW. ALTERNATING-CURRENT TURBO-ELECTRIC MACHINERY FOR BULK FREIGHT, S.S. "FRIEDA."

condenser, three-throw air pumps, and centrifugal pumps with electric motor drives.

The current is led to a three-phase motor, which is keyed direct to the main propeller shaft, and is capable of developing 1,900 b.h.p. at a speed of about 84 r.p.m. The steam is generated in two Scotch boilers, with Howden's forced draught and liquid fuel burners.

This installation costs and weighs less than the normal equipment. The coal-saving is over 10 tons per day.

OIL ELECTRIC TANK BARGE FOR CANADIAN SERVICE.

Fig. 4 shows the application of the system to the propulsion of a 245 ft. Canadian canal type tank barge. The ship about 10 per cent. above the normal, but the carrying capacity is very largely increased.

MARINE TURBO-ELECTRIC INSTALLATION PROPOSED FOR U.S. NAVY COLLIERS.

The installation illustrated in Fig. 3 shows a marine turbo-electric installation submitted to the U.S. Navy Department for adoption in one of the four large colliers recently given out to contract.

It consists of a steam turbo-alternator of 5,000 kw. capacity with condensing plant; the current is led to two motors, one being keyed to each propeller shaft. The machinery is right aft

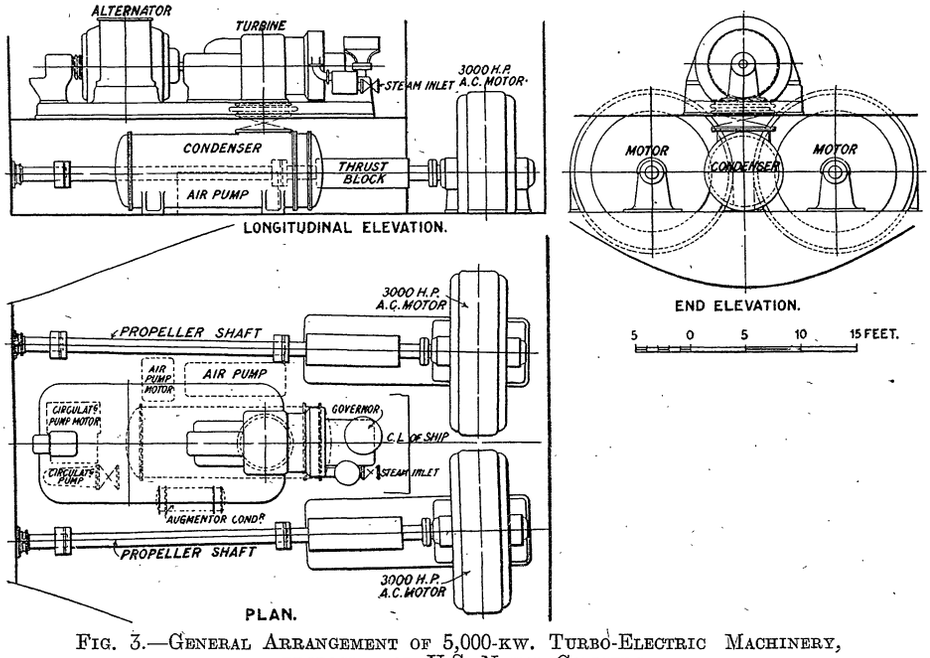


FIG. 3.—GENERAL ARRANGEMENT OF 5,000-KW. TURBO-ELECTRIC MACHINERY, PROPOSED FOR U.S. NAVAL COLLIERS.

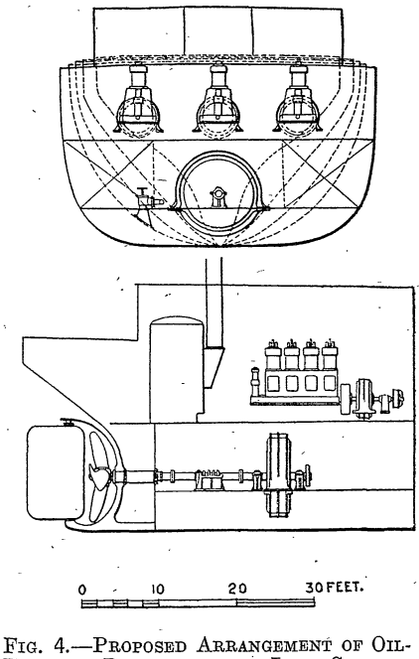


FIG. 4.—PROPOSED ARRANGEMENT OF OIL-ELECTRIC PROPULSION FOR LAKE STEAMER, 250 FT. BY 42 FT. BY 19 FT.

equipment consists of three separate units of Diesel non-reversible oil engines, each capable of developing 200 shaft h.p., and directly connected to an alternating-current generator. The currents from one or all of the units are respectively led to the separate windings of a three-phase motor keyed to the main propelling shaft and operating a single slow-turning screw.

The great advantage and economy of this system consists in being able to run at full power or at one-third power using one or three engines at full-load economy at will, thus providing for an economical operation impossible with any other propulsive system. The fact that non-reversible oil engines are used, running under governor control, greatly simplifies the maintenance and operation. The control is operated by a low-tension interlocking switch, operated by an ordinary engine-room telegraph stand located in the pilot house, so that the manœuvring of the vessel is at all times in the hands of the navigating officer. This equipment increases the cost of the in the vessel; the steam is generated by Scotch boilers. The vessels in which it is proposed to instal this machinery are 525 ft. long, and will carry a dead weight of 12,500 tons of coal, at a speed of 14 knots at sea. Here again the cost, weight, and economy are better than can be shown with the normal reciprocating-engine equipment.

An order for one of these vessels has been placed, and Admiral Cohn, of the United States Navy, intends to place an order for a second one.

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Figs. 5 and 6 show the "Electric Arc" which was built by Messrs. Mavor & Coulson for the purposes of demonstration and trials. It is certified by the Board of Trade to carry fifty passengers. Its length is 50 ft. between perpendiculars, beam 12 ft., moulded depth 7 ft. 4 ins., maximum draft 4 ft. 6 ins. The power equipment consists of a 45 b.h.p. cylinder gas engine (with producers and scrubbers) coupled to a three-phase

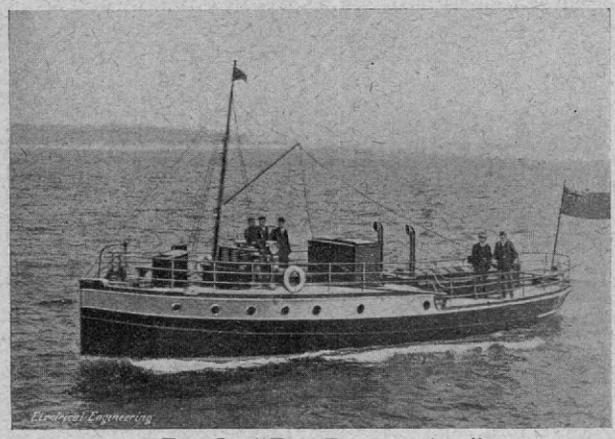


FIG. 5.—"THE ELECTRIC ARC."

generator. The propeller is directly coupled to a commutator-less motor of the "multiple-wound" type with two independent windings, and the generator is designed to give two power circuits to the motor to represent the condition which would obtain when large powers are involved, and two or more generators are in use, both used on full speed, and only one at low speed. The control of the motor is accomplished by two simple switches. One of these controls the excitation of the alternator; and the other, which is interlocked with this and can only be operated when the current is off, controls the direction of the supply to the motor in one or both of the windings,

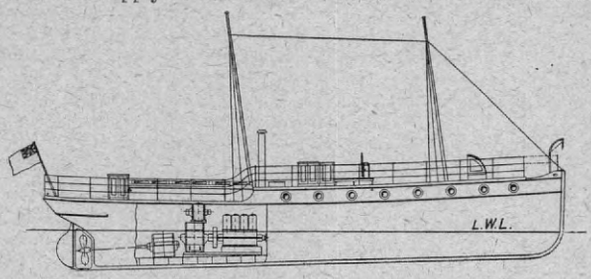


FIG. 6.—GENERAL ARRANGEMENT, ELEVATION, AND LONGITUDINAL SECTION OF "THE ELECTRIC ARC."

so as to give slow speed or full speed ahead or astern. These switches are operated directly by chain connections from the ship's telegraph on deck, so that the navigator actually performs the switching operations and the engineer below can confine his attention to the generating plant.

Prof. W. E. DALBY, who opened the discussion, asked for figures of mechanical efficiency of Mr. Mavor's system at full, half, and quarter load. He also asked for some dimensions of the motors attached to the propeller shaft, as he anticipated considerable flywheel action which would give rise to some interesting problems with regard to the strength and oscillation of the shaft.

Prof. J. E. PETAVEL pointed out that Mr. Mavor's system practically involved three sets of propelling machinery introducing greater complication and greater liability to breakdown. There were the turbine or engine, the generator, and the motor, each liable to individual defects, and the complication of the switchgear was also a disadvantage.

Sir WILLIAM WHITE, K.C.B., said the question of electric driving of ships was bound up with that of increasing propeller efficiency whilst maintaining a high rate of revolution. Any electric system, however, would have to justify itself in the eyes of shipowners. Although the British Admiralty had left it to America to undertake the first official experiments, yet we could feel quite certain that the British Navy would not fail to avail itself of any means of advance, no matter where it might come from, once it was satisfied with the new system.

Prof. G. W. O. HOWE asked for a few particulars of the windings of the motor. Would Mr. Mavor also explain how it was possible to shut down one of the generators without touching any of the switches, without any bad effects? He should have thought that by shutting down a generator whilst the other two were running, current would pump back from the motor and tend to drive the engine round. He disagreed with Prof. Petavel's view that the three links in Mr. Mavor's system of transmission were a disadvantage, as squirrel-cage motors and A.C. generators could be made so reliable that they would not introduce any weakening in the chain.

Dr. J. M. MORROW asked what type of vessel the author would suggest his system was most suitable for. There was the low-speed cargo boat, the high-speed liner, and the warship. In the former, the electric drive had to compete with mechanical drive; in the high-speed liner electricity had yet to make out a case, whilst in the case of warships the question of economy at low speeds was the determining factor. The United States Navy had discarded the turbine for the reciprocating engine, and this type of vessel might be the more suitable field for electric drive.

Mr. C. T. DYER asked, in reference to a vessel in which three oil engines are used for driving the dynamo, if the efficiency was as good as with one engine.

Mr. C. E. HANDY also asked for information on this point. He failed to see that three small engines would have a higher overall efficiency than one large engine.

Sir WILLIAM WHITE said he must correct Dr. Morrow as to the action of the U.S. Navy in preferring reciprocating engines. They had merely installed this type in one vessel built by a particular firm, owing to the very satisfactory results obtained in a previous vessel built in the same yard.

The PRESIDENT (Prof. Biles) suggested that someone should speak as to the effect upon the motors if they were "drowned out" in any way. Was any dangerous short-circuiting likely to occur?

Mr. B. P. HAIGH said he knew of a case in which motors of the type mentioned by the author had been flooded with salt water and continued in operation perfectly well. The voltage was not so high as that used by Mr. Mavor, but the effect of flooding was not such as to cause any great anxiety provided the motor was not allowed to remain in that condition too long.

Mr. MAVOR, in his reply, said he was able to use voltages varying from 600 to 2,000, the latter being with the object of keeping down the size of the cables in the newer designs. If there was any essential reason for keeping the voltage down there was no difficulty in doing so. The estimated mechanical efficiency of the boats mentioned as about to be built was 90 per cent. It was possible to increase it to 96 per cent., but in adopting a motor which would give this its properties would not be quite so favourable for the purpose in view, as, in order to push up the efficiency, the clearance between the moving and stationary parts must be reduced to very small limits. The question was whether they could afford to undergo the loss of 6 per cent. The answer was that in the case of the *Frieda* the coal consumption would be reduced from 40 to 30 tons per day. The diameter of the motor was about 15 ft.; he had found this big enough to deal with most cases. As to strains, as suggested by Prof. Dalby, in the *Electric Arc* the motor weighed about 10 cwt. in the rotating part, and there was no indication of any strain or disturbance to the propeller shaft or bearings. In the sea, the motor ran much more steadily than the engine. The electric system involved not three sets of machinery, but one, with two rotating parts. The rotor of the turbine and the generator were rigidly coupled together and formed one rotating part. The motor was rigidly fixed to the propeller shaft, and it was simpler in construction than a cart-wheel. All the other parts were stationary, and corresponded with the stationary parts of the reciprocating plant. The moving parts in both systems were precisely the same in number. An electrical engineer could not speak of the system as a complicated one. All change in the connections was made when there was no current flowing and there was no danger. He had had an opportunity of making a precise comparison with a mechanically geared ship, and there was no doubt that mechanical driving was a very serious competitor indeed in respect of mere transmission, but he was pleased to be able to say that the weight, price, and efficiency of the electric system was about the same, and in the *Frieda* the steam consumption with the electric drive would be 25 per cent. less. There was no more danger of breakdown with the electric driving of ships than there was with other forms of applying electric power upon which we depended a good deal in our daily lives. In the design of the motor, the whole question was to make the windings mutually non-inductive. The use of three engines instead of one had the advantage that one could be shut down when high speeds were not required. The boat of bulk freight already mentioned had to go at slow speed in the locks and canals, but was to be run at full speed in the lakes. Another point was that three low-power Diesel engines were lighter than one high-power engine. With regard to short circuiting, he had astonished the representatives of the Admiralty by being able to throw the motor right over from full speed ahead to full speed astern without anything happening except that the boat went astern as desired. This was where the squirrel-cage motor was a distinct advantage. As to other possibilities of short circuit, he had put a similar motor in a tank of water for a whole day and run it without trouble, although there was danger of damage to the insulation if the test were maintained for too long a period. Again, even if the cable on the boat were to be connected to the body of the ship, the generator would give out 2¼ times its normal power at low voltage, and the turbine would continue to run, but there would be no danger to anyone in the boat.

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Electrical Steering.

Mr. B. P. Haigh followed with a Paper on "Electrical Steering."

He pointed out that electrical steering offers considerable advantages for steamers as well as for vessels propelled by internal-combustion engines, for the improved economy corresponds to a saving of weight in boilers and fuel. Difficulty had been experienced in obtaining a reliable system of control, capable of dealing with the power necessary to put the helm hard over in emergency in the shortest possible time, and possessing sufficient sensitiveness to enable an accurate course to be kept by moving the rudder promptly in small angles. Sensitiveness was shown by absence of "time lag" between the movement of the hand-wheel and the corresponding movement of the rudder, and in this respect electrical gears promised an improvement on steam gears, whose economy was reduced when large control valves were fitted. Sensitiveness also required an absence of undue "idle travel" of the hand-wheel, but a certain small amount was nevertheless desirable. The steering motor might be started and stopped for every motion of the rudder, but it was preferably kept running continuously, mechanical control being introduced either in the form of hydraulic transmission or in the form of magnetic clutches as developed by the author. In the latter type of gear two magnetic clutches were employed, these being fitted at opposite ends of the motor; and, as no gearing was kept continuously in motion, the wear and tear, as well as the current required, was reduced to a minimum. The clutches prevented the shock of the sea being transmitted to the electrical system, and as they had considerable flywheel effect, the current taken by the motor did not fluctuate widely under normal conditions, and the steering gear might therefore be supplied from the ship's lighting generator. To economise power it was advantageous to arrange the gear so that greater leverage was obtained when the rudder was hard over than when amidships, and by doubling the leverage in this manner a saving of 30 per cent. might be made in the motor power. Drawings were shown of a steering gear suitable for an 11½-in. rudder-post, and of a smaller gear of the same type, built by Messers. Brown Brothers & Co., Ltd., of Rosebank, Edinburgh, suitable for a 7-in. post. When tested against an artificial hydraulic load the latter gear had developed a torque of 50 foot-tons, at the rudder-post and had shown an efficiency of over 50 per cent. at half load. It had been found capable of moving the tiller through 70° in 25 seconds and had responded to motions of the hand-wheel equivalent to 1° of helm.

In a brief discussion, SIR WILLIAM WHITE said he was very much in favour of electric steering, the possibilities of which he considered very great. A difficulty with regard to them was the human element; on one yacht with such a gear, which he had designed, there was nearly a collision due to the nervousness of the operator, because he kept moving the gear without giving the hunting gear time to do its work. With all electrical systems it was essential to put a helm indicator, quite independently of the gear, so that the man in the steering position could see where the helm was. He concluded with a reference to the Hele-Shaw system of electrical steering (ELECTRICAL ENGINEERING, April 20th, 1911, p. 206).

Prof. W. E. DALBY, referring to the Author's system, in which magnetic clutches are made use of, asked as to the coefficient of friction between the fibre and the steel, and what would be the safe limiting pressure to work at in order to make sure of durability of the fibre, *i.e.*, the pressure per square inch between the fibre and the armature working under normal conditions.

Mr. HAIGH, in reply, said that at first the fibre gave a little trouble, being very hygroscopic. It was now boiled in linseed oil, which filled up all the pores and no water got in. He usually relied on a coefficient of one-sixth. In answer to a question put by Sir William White on behalf of Mr. Worby Beaumont, he said that no danger need be apprehended from the cables buried in the shaft, which supplies current to the magnetic clutches.

The Single-phase Repulsion Motor.

A long and valuable Paper by Mr. Thomas F. Wall was next presented.

In the first part of the paper expressions were deduced for the following quantities (the flux distribution in the air gap being taken as triangular or trapezoidal as the case may be):—(1) The E.M.F. induced in the stator winding due to an alternating current in that winding. (2) The E.M.F. induced in the rotor winding due to an alternating current in the stator winding. (3) The E.M.F. induced in the rotor winding when rotating in the field due to an alternating current in the stator winding. (4) The E.M.F. induced in the stator winding due to an alternating current in the rotor winding. (5) The E.M.F. induced in the rotor winding due to an alternating current in that winding.

Curves were given which had been deduced from the expressions for Nos. 2, 3, and 4, and which enable the values of these E.M.F.'s to be rapidly determined for any value of the displacement of the rotor brushes from the stator axis.

In the second part of the paper the above results were employed in developing the theory of the repulsion motor. The theory cannot be explained in a few words, but it results in the establishment of a series of simultaneous equations, the solutions of which give expressions for the speed, stator current, power factor, and power of the motor. It was shown that, if the vector of the applied pressure be drawn in the direction of the ordinate axis, the extremity of the current vector moves over the circumference of a circle which passes through the origin, and that diameter which passes through the origin is inclined to the abscissa axis at a certain angle, the magnitude of which depends upon the resistance and the leakage reactance of the rotor winding. The torque and power of the motor are respectively represented by the distance of the extremity of the current vector from certain lines. The speed is given by the intercept of the current vector on a line drawn at 90° to that diameter of the circle which passes through the origin.

In the third part of the paper the results of some tests on a 6-b.h.p. motor were given, and the agreement of the values of the stator current, the power factor, and the speed as deduced from the theory, and the values determined from the test was shown in the form of curves. The curves have been plotted with the speed as abscissa.

In the fourth part of the paper a method of calculating the open circuit characteristic of a single-phase motor was given. The applied pressure was assumed to be sinusoidal, and the effect of saturation on the shape of the current wave was taken into account.

Human Susceptibility to Vibration.

Mr. W. Pollard Digby in conjunction with Captain H. Riall Sankey presented a Paper upon this subject. Mr. Digby, in the course of his professional work, had occasion to design a portable instrument for taking permanent records of the amplitudes of vibration of steam turbines and reciprocating engines, and of measuring the effect of such vibrations on neighbouring buildings. Captain Sankey, on being shown this instrument, referred to a statement by Admiral Melville that the effect of vibration depends upon the frequency and on the actual amount of linear motion, and that the frequency multiplied by the amount of motion was a constant. Further, Admiral Melville had quoted Mallock's statement in regard to the Central London Railway cases, that vibrations rarely exceeding a thousandth of an inch, when the frequency is over 10 per second, are a genuine source of annoyance.

After discussing Admiral Melville's dictum (which one presumes applies to normal persons) the authors decided to pursue the present study. The phrase "human susceptibility to vibration" was coined to cover the range of sensitiveness of various people to vibrations of short duration of different amplitude and frequency, together with their opinions as to when those vibrations approached or exceeded the point of being a nuisance. At the time of writing this Paper only a certain number of cases had been studied. The unit of measurement adopted by the authors as a mechanical unit of intensity of vibration is a vibration having a maximum linear amplitude of one-tenth of a millimetre at a frequency of 10 cycles per second. So far the general consensus of opinion points to the degree of vibrations classed as "perceptible—just a nuisance" being reached for a mean intensity of 1 unit. The lower range for persons of delicate perceptiveness is in the neighbourhood of 0·7 unit, and the higher range for persons of coarse perceptiveness is about 2 units. The comparison of the mean value of an intensity of 1 unit as the point at which vibration just becomes a nuisance compares very strikingly with the value quoted by Admiral Melville. Converting Mr. Mallock's value of one mil multiplied by cycles per second into the authors' alternative of millimetres multiplied by cycles per second, we have 2·54 units of intensity of mechanical vibration as a genuine source of annoyance. For the enunciation of a general law the authors would like to deal with a total of 100 to 150 cases, and they invite members of the British Association and their friends to visit Mr. Digby's laboratory on either Monday or Thursday afternoons after October 1st, and to form the subjects of experiment. It is desirable from many points of view, and not least the legal one, that there should be some definition of what exact intensity constitutes a nuisance.

The Electrical Conductivity of Light Aluminium Alloys.

In 1908 Prof. Ernest Wilson reported on the exposure tests of a certain series of light aluminium alloys. The present Paper included tests on conductivity made in July, 1911. The copper series have shown that alloying commercial aluminium alone with copper to the extent of 2·6 per cent. is not to be recommended. The copper manganese specimens have not seriously deteriorated in ten years. An alloy known as a "duralumin" has been tested, and a report is made thereon. Its specific resistance is $5{\cdot}35\times10^{-6}$ ohms at 15° C., as against $2{\cdot}76\times10^{-6}$ for pure commercial aluminium.

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Effect of Electricity on Plants.

Two Papers on research in connection with this subject were read in Section K (Agriculture).

In many experiments upon the electrification of plants an acceleration in growth has been reported, accompanied with an earlier attainment of maturity and consequent more rapid harvesting of such electrified crops.

This appears to indicate an acceleration of the normal vital processes of the plant, and it was thought that an increase in the rate of respiration might act as an index to such accelerated vital processes and enable some idea to be obtained as to the electrical condition most favourable to such acceleration. With this in view a long series of experiments were carried out by Dr. J. H. Priestley and Mr. R. C. Knight, the results of which are briefly summarised below. To determine the relative amounts of respiration going on in germinating seeds under normal conditions and under the influence of electricity, continuous currents varying from 0·75 to 9 milliamperes were passed through the seeds (usually peas), and a decrease in respiration on electrification amounting to 20 per cent. or 30 per cent. was observed. When the current was continually reversed at a rapid rate, 50 microamperes producing an *increase* of about 30 per cent., 150 microamperes had no effect, and 500 to 600 microamperes resulted in a 20 per cent. *decrease* in respiration. The positive pole of an electrical machine was then connected with a platinum loop above the seeds, which were themselves "earthed," and a beaker of turpentine was inserted to absorb the ozone. Increase of respiration resulted on electrification; the amount of increase varied with different sets of seeds, the largest obtained being 110 per cent. with peas.

The second Paper, by Dr. J. H. Priestley and Miss E. M. Lee, dealt with the investigation of the effect of weak currents of electricity upon micro-organisms, using the rate of production of their metabolic products as an index of their rate of growth. The organisms selected as the result of many preliminary trials were *B. Bulgaricus*, the "sour milk" bacillus of Prof. Metchnikoff. The effect on the production of metabolic products as indicated by the change in resistance of the culture treated was considerable, and seemed to be directly due to the action of the current on the bacteria. Counts of the bacteria made by the usual methods also indicated more rapid growth in the electrified culture. The maximum effect seemed to be produced by a current of about 60 microamperes. Currents of greater strength inhibit the activity of the bacteria as measured by the change in conductivity of the liquid. There was no appreciable difference between the effects produced by direct and alternating currents, so that it seems that no detrimental effect has been produced in the former case by the accumulation of the products of electrolysis in the region of one electrode.

Magnetic Testing of Iron.

W. H. F. MURDOCH contributed a Paper on "A Friction Permeameter," which was received without discussion. The instrument consists of a specimen of cylindrical section, magnetised by a solenoid excited by an electric current, and entirely surrounded by a hollow cylindrical yoke of iron. This yoke is divided symmetrically at the middle and the lines of induction act on this gap together with other attractive forces. If now the top portion of the yoke is rotated about the specimen as a vertical axis, and slides steadily on the lower portion of the yoke, then the torque may be measured, or the angular displacement between the zero and pointer be read while sliding is occurring. To eliminate the friction pull previous to magnetisation the pointer is adjusted to read zero under mechanical friction only. Consequently when the specimen is magnetised the magnetic pull is taken up on the surfaced faces and the angular displacement is due to the magnetic induction only. Therefore the magnetic induction in the test specimen can be obtained by multiplying the square root of the reading by a constant. Owing to the completeness of the magnetic circuit, tests at high inductions can be made and the results agree closely with ballistic tests besides possessing the advantage of great rapidity.

The only papers of electrical engineering interest read on Monday were two on wireless telegraphy, which are referred to in our Notes on Telephony and Telegraphy, on another page.

Owing to pressure of space, our report of Tuesday's and yesterday's proceedings is held over until our next issue.

Prof. E. A. Schäfer, of Edinburgh University, has been elected President of the Association for next year, when the meeting will be held in Dundee from September 4th to 11th. In 1913 the Association will meet in Birmingham.

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TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The only references to wireless telegraphy at the British Association meeting at Portsmouth were the Paper by Prof. C. W. O. Howe on Monday, and a demonstration by Capt. Sankey of portable field apparatus. Prof. Howe pointed out how great had been the recent growth in the number of wireless messages transmitted, and said that on account of this the principal difficulty to be overcome in the design of modern apparatus was the prevention of interference. This has been sought in two ways: firstly, by sending out well-sustained trains of waves of one definite frequency, thus permitting sharper tuning; secondly, by giving the signals a high musical pitch, easily distinguished from the crackling noises caused by atmospheric disturbances, and also from other stations having notes of a different pitch. The sending apparatus in common use at the present day differs, however, but little in principle from that used with the earliest coupled aerials. The spark-gap is either stationary and provided with a powerful air-blast or the electrodes are rotated at a high speed, thus causing movements of the air, and at the same time bringing cold metal surfaces to act as electrodes. The production of undamped or slightly damped trains of waves by means of Poulsen or Lepel arcs has not made the revolution in radio-telegraphy which was predicted, while the quenched spark between plane metal surfaces a fraction of a millimetre apart falls far short of the long open gap in reliability. The unquenched long gap necessitates very loose coupling, and therefore very low efficiency if beats in the emitted waves are to be avoided. Although the receiving arrangements have been made very convenient for rapid tuning, no radical change has been made in the detectors employed. One has still to choose between reliability and sensitiveness. If extreme sensitiveness is not desired, the magnetic detector is ideal in its simplicity. For the reception of weak signals we have the Fleming valve, the electrolytic and various crystal detectors, if necessary, in conjunction with the Brown telephone relay. Attempts have been made to obtain selective working by tuning the reed of the relay, but the general utility of the station so equipped would be greatly reduced, to say nothing of the adjustment and manipulation required.

An installation had been erected in the room, on which the time signals from the Eiffel Tower were received, as well as weather reports from Norddeich.

Prof. Howe was followed by Captain Sankey, who showed a number of slides of Marconi portable field wireless cavalry and infantry sets. In the cavalry sets the frame of the saddle forms a stand for carrying a petrol motor and dynamo. A 60ft. aerial pole is carried, and the whole station can be unpacked and erected in nine minutes, and dismantled and packed again in six minutes. A valve receiver is used. The cavalry sets, which are carried on four pack horses, use 0·4 kw., and have a range of twenty miles over mountainous country, or fifty miles over normal country. The 1½ kw. infantry set has a range of 200 miles. The weight of the latter is 180 lbs.

The Dundee Corporation are considering what steps are to be taken in view of the serious financial loss which will accrue when the telephone system is taken over by the Post Office, owing to the discontinuance of payment of rates by the National Telephone Co., amounting to nearly £900, and the payment of wayleaves. The Corporation are considering whether they can proceed against the National Telephone Co. for not having properly safeguarded the rights of the Corporation.

The rateable value of telephone properties in the Blackburn district exceeds £3,591, and at a meeting of the Guardians for this Union on Saturday, a resolution was passed asking the Government to continue to pay local rates after the transfer of the telephone undertaking has been effected, or to pay an equivalent contribution each year, based on the amount set forth on the Valuation Roll.

Telegraphy between Rome and Constantinople was down for a short while on 29th ult., and on the 1st inst. the lines between Medan and Sabang were not working. Telegrams for Sabang and Koetaradta are sent by telephone from Pangkalanbrandan or by post from Padang or Medan. The c.s. *Minia* of the Anglo-American Telegraph Co. was recently engaged in a repair of the St. Pierre-Duxbury section, which was down about 100 miles from Halifax, N.S. Apparently nothing has been done towards the repair of the Assab-Perim cable, which has ceased working since July 8th, 1909. The Zanzibar-Mombasa cable has also been inoperative since July 11th, last, and the Kotonou-Grand Bassam cable since 23rd ult. Landlines in Ecuador to Manta, Bahia, Chone, Salango, Jipijapa, and Montecristi were down on the 2nd inst., and telegrams are being forwarded by best means. The San Thiago-Bathurst and Bathurst-Sierra Leone cables were down on 4th inst, telegrams for Bathurst being sent by best means pending repair.

LOCAL NOTES

Aberdeen: *Electricity Accounts.*—The annual report of Mr. J. A. Bell (City Electrical Engineer) records increased sales, notwithstanding continued depression of trade in the city. The total income worked out at £47,553, and the expenses at £20,634. The resulting profit, which is £1,061 more than last year, leaves, after meeting capital charges and depreciation, a sum of £1,984 to carry to reserve. The increase in the heating and cooking load was as much as 91·3 per cent., and in the power load 26·25 per cent.

A reduction in price of supply for lighting from 3¾d. to 3½d. per unit is to be made. Where slot meters are used, the charge will be 4d. per unit.

Brighton: *Changes in Tariff.*—Among the changes in the tariff of the Electricity Department announced are the abolishment of meter rents to flat rate and prepayment consumers, and ultimately to establish a common rate of 3d. per unit. The power rate is to be reduced from 1½d. to 1d. per unit.

Cavan (Ireland).—At a special meeting of the Urban Council last week, the following notice of motion was handed in by Mr. Pollock:—"That the Urban Council proceed forthwith to install an electric plant for the purpose of the public and private lighting of the town, and that a sufficient sum be borrowed to carry out the scheme."

Gorleston: *Failure of Supply.*—On Friday last a portion of the street and private lighting was interrupted for a considerable time owing to some trouble on the mains.

Handsworth: *Electricity Accounts.*—The report for the year ended March 31st gives the income as £8,320, against £7,812 for the previous year. The total expenditure was £74,152 but after meeting capital charges there was a deficit of £555 on the year's working, or a net deficit of £357 with the balance brought forward from the previous year. The increased costs are attributed to alterations in the tramway service.

Llanelly: *Electric Shock.*—An employee of the Llanelly Electric Light Co., while switching off some arc lamps on Saturday, received a serious shock, which had the effect of making him dumb, although otherwise he is uninjured.

London: *Marylebone.*—At a somewhat stormy meeting of the Borough Council, when several members aired their views as to the general management of the Electricity Department, and more particularly the Sales Department, proposals of the Electricity Committee relating to sub-letting of wiring in the case of hired installations, sale of disused thermal storage vessels in the station, and reduction of the rate for contractor showrooms from 2d. to 1d. per unit were agreed to.

Peterborough: *Electricity Accounts.*—The number of units sold have increased from 36,222 for last year to 39,938, the coal consumption per unit has also decreased, with the result that surplus of £184 has been made, as compared with last year's figure of £160. The costs per unit work out at 1·74d.

Plymouth: *Electricity Accounts.*—The annual report of the Electrical Engineer records a reduction in costs, which work out at 1·22d. per unit, excluding capital charges. The total expenses were £13,202, slightly less than last year, and the gross profit was £12,815, of which £2,987 remained after meeting capital charges. Of this £1,797 was devoted to new



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meters, services, and mains, leaving £1,170 to be applied to relief of rates.

Sheffield: *Electricity Accounts.*—Mr. S. E. Fedden, in his annual report of the Electric Supply Department, gives the following summary of the position:—Increase in total revenue, £10,890; increase in total costs, £4,370; increase in debt charges, £1,067; increase in power energy sold, 3,804,486 units (56 per cent.); increase in new consumers, 399; surplus, £3,417. For the first time since March, 1908, the units for lighting have exceeded the previous year's sales, although even yet the lighting revenue is still slightly less than the preceding year, due, of course, to the use of metallic filament lamps.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bulgaria.—Tenders are invited by September 30th for an electric power station at the port of Varna. According to the *Board of Trade Journal* local representation is necessary.

Darwen.—A Local Government Board inquiry was held last week into an application for a loan of £7,600 for electricity extensions.

New Zealand.—Tenders are invited by the municipality of Dunedin for gas or Diesel engine-driven sets for 500 and 800 kw. Particulars from 73 Basinghall Street.

Wimbledon.—Sanction has been given by the Local Government Board to the loan applied for in connection with the extension of supply to the Malden and Coombe area.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Darlington.—Cottage Hospital. Architect, R. Argile, 35 Oxford Street, Ripley, Derby.

Glasgow.—Club house in Dumbreck Road; Church Hall and Offices, Dalmarnock Road.

Haslingden.—Tenders are invited by September 9th for electric lighting installations in Corporation public buildings. Particulars from Borough Electrical Engineer.

Mansfield.—Extensions to Hospital.

Merthyr Tydfil.—The Corporation invite tenders for wiring and fittings for the Mardy Hospital. Particulars from Borough Engineer. Tenders by September 12th.

Ramsgate.—Extensions to County School. Architect, W. H. Robinson, Caxton House, Westminster.

Richmond.—Alterations to the Star and Garter Hotel.

Rochdale.—New General Post Office.

Sale.—Public baths. Architect, W. H. Mitchell, 94 Market Street, Manchester.

Salford.—New infant school.

Staines.—New Hospital.

Sunderland.—A new training college is projected.

MISCELLANEOUS

Spain.—Tenders are required at Madrid for two wireless telegraph installations, one of a naval pattern, and the other suitable for a landing party. A deposit of about £80 is required, and local representation is necessary.

Sweden.—Electric windlasses are required for the harbour at Nörrköping. Particulars at 73 Basinghall Street.

The Institution of Mining Engineers.—The annual meeting of the Institution of Mining Engineers will be held on Wednesday, Thursday, and Friday of next week at Cardiff. The papers to be read and discussed do not bear directly on electrical working in mines, but among the many visits arranged for in the neighbourhood there is much of electrical interest. Among them may be mentioned that to the Cardiff Corporation Electricity Works on the Wednesday, and visits on the Thursday to the Bargoed, New Britannia, and Penallta Collieries, and the alternative visit on the same day to the Great Western and Ferndale Collieries. At Bargoed gas engines are used in the generating station, and electric power is extensively used for high lift pumping. At the New Britannia pits there are two large Ilgner winding plants and motor-driven air-compressors in use for sinking operations. Steam-driven electric generating plant will also be inspected at Penallta. The chief attraction at the Great Western Colliery is the winding plant on the Westinghouse converter equaliser system, and at Tylorstown the Lahmeyer winding plant on the Ilgner system of one of the Ferndale group of collieries and the power house supplying the whole group will be on view. Many other attractive excursions are planned. The arrangements for the meeting are being made by the South Wales Institute of Engineers.

TENDERS RECEIVED AND ACCEPTED

New Zealand.—The British General Electric Co., Ltd., Harbour Street, Wellington, have secured the contract for the electrical plant, switchboards and motor pumps for the Gisborne Borough Council. The company have also supplied the Wellington City Council with a quantity of 1,000 c.p. Osrams the largest lamps introduced into the Dominion.

Peterborough.—The tender of Messrs. Crompton & Co. for an electrically driven condensing pump (£90) has been accepted.

Stockton.—A contract has been placed with Messrs. Richardsons, Westgarth & Co. for a mixed pressure turbine coupled to a Siemens continuous-current, 500-kw. generator (£2,932). The extension scheme also includes enlargement of the existing cooling tower by the Klein Engineering Co., a superheater installation by Messrs. T. Sugden, Ltd., and a switchboard by Messrs. Drake & Gorham.

APPOINTMENTS AND PERSONAL NOTES

A battery mechanic used to Tudor plates is required for South Africa. (See an advertisement on another page.)

Mr. Frederick Swarbrick has been appointed engineer and manager of the Galway Electric Co., in succession to Mr. Percy A. Spalding, who has been appointed engineer of the Dundalk scheme.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £57 15s. to £58 (last week £58 to £58 5s.).

Bankruptcies and Liquidations.—Creditors of the Solium Electrical Co. (in liquidation) are required to send in their claims to E. Harlow, 23 King Street, Nottingham, before September 30th.

A receiving order has been made in the bankruptcy of T. G. Poole, electrical engineers' salesman, of Hale, Cheshire. The first meeting will be September 13th at 3 p.m., at the Official Receiver's Offices, Byrom Street, Manchester, and the public examination is fixed for 10 a.m., at the Court House, Quay Street, Manchester.

A first and final dividend of 11d. in the pound is announced in the bankruptcy of J. D. Carlmark, of West Bromwich, electrical engineer.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

South Metropolitan Electric Light & Power Co.—Warrants for dividends on the company's 7 per cent. cumulative first, and 6 per cent. cumulative second, preference shares, for the half-year ended June 30th, 1911, have been posted.

Oxford Electric Co.—A dividend at the rate of 6 per cent. for the half-year has been declared.

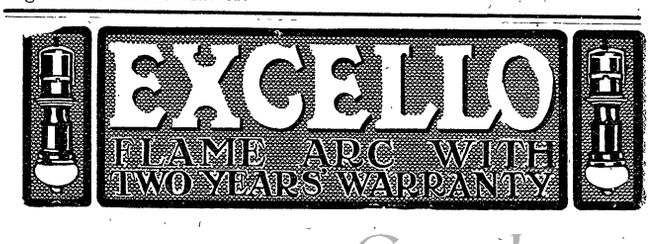
Sao Paulo Tramway, Light, & Power.—A quarterly dividend at the rate of 10 per cent is announced.

British Electric Transformer Co.—An interim dividend at the rate of 6 per cent. has been paid.

Electric Lighting at Westminster Abbey.—The electric lighting installation which was put in in the nave of Westminster Abbey for the Coronation has been retained for permanent use now that the Abbey has been re-opened.

The Electrical Exhibition at Olympia.—The Management of the Electrical Exhibition will be happy to send any contractors pictorial posters of the Exhibition on hearing from them, and on consideration of such contractors exhibiting these bills in their windows they will be entitled to two complimentary tickets to the Exhibition.

"C.S.S."—The *Evening News* on Monday published a paragraph giving particulars of a movement for a "Citizen State Supply" service for the purpose of assisting in the maintenance of communications and food supplies during a general strike. It was stated that the movement is being "organised by members of the Institutions of Civil, Mechanical, and Electrical Engineers," but inquiries which we have made at these Institutions have elicited the information that none of them have any cognisance of the matter.



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ELECTRICAL ENGINEERING

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ARBITRATIONS.

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WHEATLEY KIRK, PRICE & CO.,

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SUMMARY

We publish an important announcement regarding the reorganisation and enlargement of the field of action of the National Electrical Manufacturers' Association. (Page 508.)

Our monthly article on new electrical supplies and accessories opens with an illustrated description of the magnetite arc lamp which is being introduced to this country by the British Thomson-Houston Co. Particulars are also given of the sizes of Mazda wire lamps now available, and other novelties described include some new designs of lampholders, and a regulator for A.C. cinematograph lamps. (Page 509.)

The Shoreditch Borough Council are recommended to abolish gas for street lighting in the whole of the district north of Old Street, and to lay mains at an estimated cost of about £8,000. (Page 510.)

Our report of the electrical engineering features of the meeting of the British Association last week is concluded in this issue. On the Tuesday three Papers were discussed together, dealing respectively with superheated steam, gas, and oil engines. In the first Paper Mr. W. J. Marshall claimed efficiencies up to 1·21 lbs. of coal per b.h.p. hour for superheating locomobiles, while in the second Mr. W. A. Tookey voiced the claims of the gas engine to the highest thermal efficiency. The third Paper, by Mr. C. Day, gave interesting details and results of tests of Diesel engines. The conditions under which the economy of the last-mentioned can be taken full advantage of were referred to in the discussion, and suggestions were thrown out as to the possibilities of a combined superheated steam and internal combustion engine. Mr. E. Kilburn Scott contributed a description of some of the processes in use for the electrical production of nitrates from the atmosphere, and the possibility of fixing a new standard of smoke emission from factory chimneys was discussed by Dr. J. S. Owens. An original note was struck by Mr. W. Y. Lewis' description of his proposed system of continuous transport, in which the vehicles are driven by a continuously running screw thread of varying pitch. Among the proceedings of the Mathematics and Physics Section was a Paper by Prof. N. E. Dorsey on the work of the American Bureau of Standards on absolute current measurement, and the presentation of the Annual Report of the Committee on Electrical Standards. (Pages 511 to 514.)

Under "Telegraphy and Telephony (including Wireless)," we report that the Marconi Wireless Telegraph Co. has obtained a contract for the erection of a wireless station in Ceylon, and give some technical details of the proposed installation. The Marconi Company has also a proposal before the Portuguese Government. The British Government are now considering the details of the scheme for linking-up the Empire by means of wireless telegraph stations. We refer to the experiments in wireless telephony by Mr. H. G. Matthews, to which much prominence has been given in the daily press, and also experiments by the U.S. Navy between shore stations and aeroplanes. (Page 514.)

In our "Electric Traction Notes," we refer to the Board of Trade inquiry into the circumstances of the overturning of an L.C.C. tramcar in Lewisham Road on September 2nd. The evidence showed that the car was running upon the wood paving, and that the overturning was due to the wheel striking the tramrail. We correct the rumour that a man was killed upon the electrified section of the L.B. & S.C. Railway, and among other matters mentioned are the proposed extensions of the trolley system at Bradford, the accounts of several traction companies, and a statement that the passenger cars on the Prussian railways are to be lighted by electricity instead of gas. (Page 515.)

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AN incandescent lamp with two or more filaments, one of which can be cut out until required through failure of the other one, has been devised by G. F. Richardson and R. J. Crowley. A novel equipment providing a gap in an overhead trolley wire, bridged by a spring gate, allows the collector of a railless trolley omnibus to pass through at right angles by deflecting the gate. The omnibus wires are mounted just above on a bow-shaped frame. Another specification published by the Patent Office last week describes a method for supporting metallic filaments, in which two rings are mounted loosely on the central rod and connected by crinkled ties. The British Thomson-Houston Company has protected a method of ventilating rotors by means of channels extending from one portion of the periphery to another, and arranged with the ends at different angles to the radial lines. (Page 516.)

THE British Consul at Kobe (Japan) calls attention to the increasingly severe competition there for electrical machinery.—Applications have been received by the Tata (Bombay) Hydro Electric Power Co. for power supply amounting to 34,000 h.p.—Schemes for reduced charges for power supply have been formulated in Shoreditch and Brighton.—The Stourport Council have at last decided to allow overhead wires to be erected for electric supply purposes.—Electric pumping is to be substituted for the existing steam plant at the Farnham sewage station. (Page 517.)

THE Local Government Board have sanctioned a loan of £4,587 at Leigh (Lancs). A coal-handling plant is required at the Keighley Electricity Works; a 4,000 kw. exhaust turbo-alternator at Manchester; cables, switchgear, rotary converters and transformers by the L.C.C.; cables at Bray; six double-decked tramcars at Birkenhead; electric jib cranes at Bristol; electric lighting schemes are under consideration at Cavan and Herne Bay, and tramway extensions at Manchester, Doncaster, and South Shields. (Page 517.)

THE NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION

THE Council of the above Association announce that the proposals for the reorganisation of the work of the Association, which have been in contemplation for some considerable time, and with the details of which members are already familiar, have now been successfully carried through, and will shortly be put into effect.

They include the alteration of the title of the Association (which will in future be known as "The British Electrical and Allied Manufacturers' Association, Incorporated"), the appointment of a new secretary, giving his whole time to the work of the Association (*vice* Mr. F. O. B. Hawes, resigned), and of a larger working staff; the leasing of commodious offices in a central position; and certain necessary amendments of the constitution of the Association to meet the new conditions, including the revision of qualifications for Members, Associate Members, and Associates; and the alteration in the bases of subscription and voting powers. The new secretary of the Association is Mr. D. N. Dunlop, who is already well known to the industry as the energetic Sales Manager of the British Westinghouse Company's Supply Department, Manager of the Publishing Department, and Superintendent of the Printing Bureau, at Trafford Park, Manchester.

Mr. Dunlop, who was unanimously elected at the meeting of the Council held on the 7th inst., has been empowered as from that date to begin the reorganisation of the Association for its new activities, the present Secretary's time being entirely engaged in connection with the forthcoming Electrical Exhibition. Mr. Dunlop, whose appointment dates as from January 1st, 1912, will undoubtedly have the hearty good will and co-operation of every member of the industry.

The present Council of the British Electrical and Allied Manufacturers' Association, and in particular Mr. F. H. Nalder (chairman) and Mr. B. Longbottom (vice-chairman), are certainly to be congratulated on their success in bringing members to realise the position of advantage which they occupy, and the immense importance of the work which by their united efforts can be done to enhance the British electrical and allied industries. In wishing the Association all success, we earnestly commend it to the attention of every manufacturer who has not yet joined.



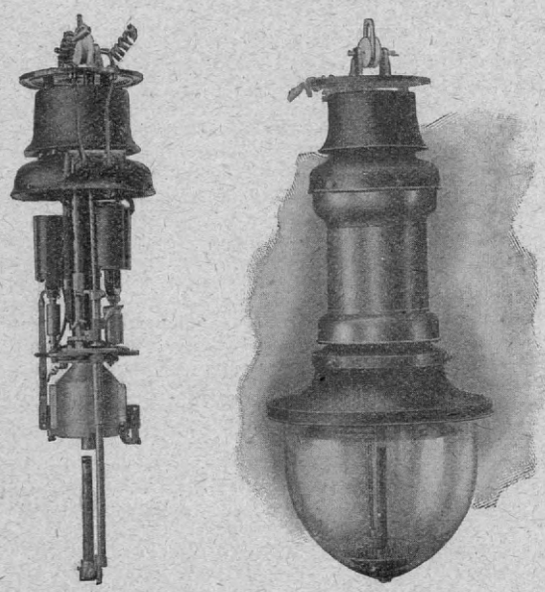
BOY (*sotto voce*): "**Don't go too near him, Sis,** *he might be ALIVE!*"

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NEW ELECTRICAL SUPPLIES AND ACCESSORIES

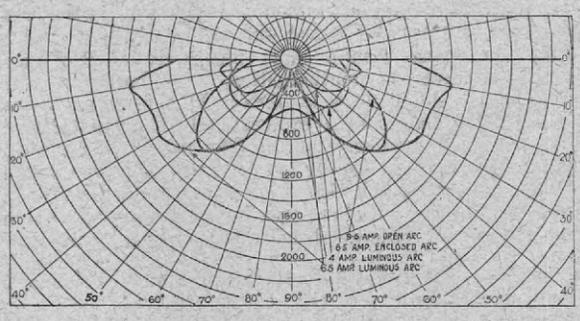
Arc Lamps and Accessories.

The British Thomson-Houston Co. (Rugby) are now putting on the market in this country a perfected form of the magnetite arc lamp, which has already proved so popular in America for lighting large areas. In this lamp the arc is formed between an upper electrode consisting of a short copper bar, and a lower electrode of a composition of which the principal ingredient is magnetite, an oxide of iron. The design of the lamp is such that the upper electrode is fixed, and all feeding and regulating is done by the lower electrode, so that the arc remains in the same focal position. This is clear in the exterior and interior views of the lamp reproduced herewith. In feeding, the lower or negative electrode is drawn upward by a pair of shunt magnets until it strikes the positive electrode; the magnets are then short-circuited by an automatic series cut-out, and allow the lower electrode



Exterior and Interior Views of Magnetite Arc Lamp (British Thomson-Houston Co.).

to fall back into normal position, thereby forming the arc. Thus when the lamp is operating, the steadying resistance and small series cut-out only are in circuit with the arc. The lamps give an excellent distribution of light as shown in the accompanying curves, which is maintained throughout the life of the electrodes. Inside the globe and directly above the arc is a reflector 11 in. diameter, made of sheet steel and of the inverted concentric type. With the magnetite arc most of the light is emitted by the arc stream proper in a horizontal direction. By placing a reflector above



Curves showing Distribution of Light from Magnetite or "Luminous" Arcs compared with other Arc Lamps.

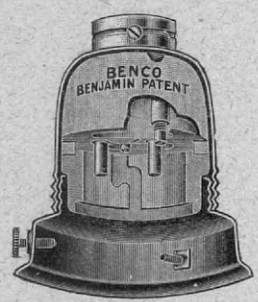
the arc, part of the light is concentrated directly beneath the lamp so that the maximum light and a very even distribution is obtained on the working plane. Special reflectors can be furnished to throw the maximum light in either a horizontal or a vertical direction. The magnetite arc lamp is one of the most efficient lighting units, and, because of its long electrode life, the maintenance cost per candle-power is as low, if not lower, than that of any other unit. At 4 amperes, the efficiency is ·758 watts per mean hemispherical candle-power, and at 6·5 amperes it is ·493. The cost of the upper electrode can well be considered negligible, as it has a life of between 6,000 and 8,000 hours at 4 amperes, and 1,000 to 2,000 hours at 6·5 amperes with a comparatively small renewal cost. In trimming, only the lower electrode requires renewing, and as this has a life of from 175 to 200 hours at 4 amperes, and 100 to 130 hours at 6·5 amperes, the expense of trimming is relatively low. The lamp is suitable for continuous circuits only, and is made in two sizes for 4 and 6·5 amperes respectively. They can be run singly on 100/120 volts, two in series on 200/150 volts, or five in series on 500 volts.

Incandescent Lamps.

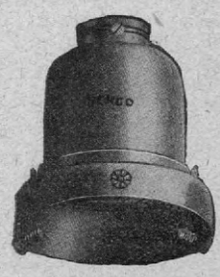
An interesting pamphlet has been issued by the British Thomson-Houston Co., Rugby, giving full particulars of the new drawn tungsten wire Mazda lamp, the manufacture of which was described in some detail in Electrical Engineering, August 24th, page 469. The lamps of standard style are now listed in sizes ranging from 14 to 360 c.p. for 100 to 135 volts, and from 32 to 600 c.p. for 200 to 260 volts; a few sizes are also made for 150 to 155 volts, as well as low voltage lamps for pressures in the neighbourhood of 25, 50, and 80 volts. Most of the sizes can be supplied forthwith, and the complete scale will be available by October 1st. Mazda drawn wire filaments are also applied to twisted, plain conical, and plain olive-shaped candle lamps in many useful sizes.

Fittings and Accessories.

The Benjamin Electric, Ltd. (117 Victoria Street, London, S.W.) has brought out the "Benco" lampholder for use on high voltage circuits with lamps of high candle-power in one-light fittings. They are also adapted for conduit work, tram or railway service, and for outlining buildings, as they are weatherproof. The interiors are made in two pieces of vitreous china, covered by a metal casing of aluminium or brass. These are made with bayonet cap



Sectional View of "Benco" Lampholder.



"Benco" Lampholder equipped with gallery.

(Benjamin Electric, Ltd.)

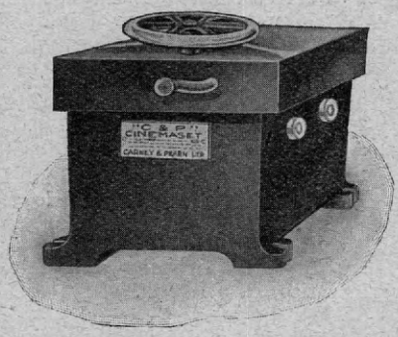
and Edison or Goliath screw holders. A sectional view of this holder is shown. They can also be equipped with shade galleries of aluminium or brass, as shown in the illustration. A modified design for mounting on strips, borders, ceiling blocks, or casings is known as the Benjamin holder. The outside diameter of the base is $2\frac{1}{4}$ in. and of the barrel $1\frac{3}{8}$ in. A rubber ring is provided to prevent moisture entering the lampholder.

Miscellaneous.

A special regulator choking coil for alternating-current cinematograph lamps has been put on the market by Messrs. Carney and Pearn, Ltd. (Nutsford Vale Works, Longsight, Manchester) in the form illustrated here. This set consists of a regulating choking coil with a suitable step-down transformer permanently connected up and enclosed in a substantial ventilated cast-iron box. The use of the transformer at the lamp renders possible a reduction in the size of the cable for the wiring. Compared with the use of series resistances, the saving in running costs is in the same proportion as the saving in the wiring. There are only four terminals (all inside); two for the mains and two for the leads to the lamp. These connections are never disturbed, all the regulating being done on the choker simply by turning

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the handwheel, which can be locked in any position by the lever provided for the purpose; there are no nuts to be undone before adjustments can be made. For supply voltages up to 300 volts, the transformer is of the Auto type, above



A.C. CINEMATOGRAPH REGULATOR.
(*Carney & Pearn.*)

300 volts, only insulated secondary transformers are used. In a new list from the firm describing this piece of apparatus, particulars are also given of an extensive range of auto and balancing transformers, as well as independent secondary transformers for all purposes.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

TWIN CABLES.—The India Rubber, Gutta Percha, and Telegraph Works Co., Ltd. (Silvertown, London), have sent us list 40A of their twin, concentric, and high-tension vulcanised cables, and flexible cords. Full details are given, with prices, for grades of 300, 600, 2500, 5000 megohms, and a price-list is also included of their flexible conductors.

ALUMINIUM.—A leaflet from the British Aluminium Co., Ltd. (109 Queen Victoria Street, London, E.C.), illustrates the torsion sleeve joints for aluminium overhead transmission lines.

GLASS SHADES.—A new list from the British Thomson-Houston Co., Ltd. (Rugby), gives particulars of the latest designs of Mazda-Holophane shades and reflectors suitable for domestic use.

IRONCLAD SWITCHGEAR.—Oil switches of a pattern suitable for building up with other accessories into complete ironclad units, form the subject of a further interesting pamphlet among those just issued by the British Thomson-Houston Co. Their type O switch is specially designed for this class of work up to 3,000 volts, and can be fitted with time element and other releases for overload, or no voltage, provided with ammeter and voltmeter, and the whole can be made up as a wall or pedestal switch, with the means of access interlocked with the switch itself. For complete motor panels, starting rheostats can be added in addition to isolating switches and cable boxes, and complete ironclad switchboards can be built up from an assemblage of appropriate units made up in this way. Full particulars are given of a variety of the combinations available.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

RADIATORS.—Another new leaflet describes the British Thomson-Houston Co.'s special designs of non-luminous radiators, which include some attractive vertical and horizontal patterns, suitable for small offices, studies, &c., as well as larger radiators for public buildings, halls, &c., and forms intended for ships' staterooms, cabins, tramcars, and shop window heating.

SWITCHES AND RESISTANCES.—We have received a copy of a list of knife switches, rheostats, &c., which are supplied by Messrs. W. Mickelwright & Co. (Sicilian House, Southampton Row, W.C.). The knife switches, which are made up as single and double pole, and also as change-over switches up to 100 amperes, have a specially quick break, and an ample partition is provided between the poles in the double pole forms. The rheostats, with or without regulating switches, are of the open wire type, mounted on very substantial frames, with the coils well spaced apart.

BUSINESS LITERATURE.—We have received from the Ironmongers' Federated Association a copy of a publication which should be of use to those in the hardware and allied trades, containing forms for filling in with statistics of such a business, and explanatory notes. The work has been translated from a German original prepared by Mr. C. Schmahl, of Mayence, President of the Hardware Merchants' Union of that town, by Mr. R. H. Smith, general secretary of the Ironmongers' Federated Association (Apsley House, Fitzroy Road, Sheffield), from whom it can be obtained for 1s. 6d.

METAL FILAMENT LAMPS.—We have been favoured with a copy of an effective new showcard from the Brush Electrical Engineering Co., Ltd. (Loughborough). The chief feature of the design is a representation of a large "metallum" lamp suspended from an aeroplane and lighting up the country beneath.

TURBO-COMPRESSORS.—Plant of this description is described and illustrated in a well-illustrated pamphlet which has been issued by the A.E.G. Electric Co., Ltd. (133-135 Oxford Street, London, W.). In these compressors, the gas to be compressed is conveyed in radial paths through the rotors, which are provided with a series of impellers varying in number from 1 to 26, fastened in groups of 8 to 12 on one shaft, and are run in a suitably formed casing, with guides directing the air from each impeller to the centre of the nest. The turbo-compressor is coming into increasing use in collieries, forges, foundries, and other works, where large quantities of compressed air are required.

FLASH LAMPS, TORCHES, &c.—A pamphlet from W. & R. Jacobs (39c King William Street, London, E.C.) describes a series of pocket flash lamps and leather-covered hand torches, &c., at various prices. Electric bells, switches, pushes, and dry cells are also included, as well as small electric novelties of a miscellaneous nature.

GLASSWARE AND SHADES.—A list of lamp-shades of every description is before us from G. Braulik (8 Lambeth Hill, Queen Victoria Street, London, E.C.). These can be had in glass and enamelled iron, and we understand that a good stock of all these is ready for immediate supply.

SWITCHES, FUSES, MOTOR STARTERS.—A price list from Johnson & Phillips (Victoria Works, Charlton, Kent) deals with oil switches for pressures from 500 to 30,000 volts, besides many other types for the switchboard. Potential and current transformers, ammeters and voltmeters, fuses, distribution boards, and circuit breakers are also included. Amongst the many types of motor starters is one, which has been patented, to control both the rotor and stator circuits with automatic overload and no-voltage releases, so that a separate main switch is not required. Other types are the two- or three-phase auto-starter for squirrel-cage motors, the liquid starter, and the star-delta type for three-phase squirrel-caged induction motors.

ELECTRIC STREET LIGHTING IN SHOREDITCH

THE Electric Lighting Committee of the Shoreditch Borough Council have made an important recommendation that electricity shall be substituted for gas in all the streets in the borough north of Old Street. The number of burners now illuminated by gas in this district is 1,055. In making the recommendation it is pointed out that in the majority of streets there are a large number of factories which warrant the supposition that a demand will arise for electricity for electric lighting and power purposes. About fourteen miles of cables will be required in the 160 streets affected by the proposed change, and mains of sufficient size to meet any reasonable private demand, in addition to the street lighting load, will be laid at an approximate cost of £8,385. The cost of converting the existing posts for electric light is estimated at £665.

The Central.—The Old Students' Association of the Central Technical College have issued the September issue of their journal. It opens with a short biography of Professor O. Henrici, professor of mathematics, who has just retired, having joined the college in 1884. This is followed by an account of the banquet to Professor H. E. Armstrong, held at the Hotel Cecil on May 13th. The use of reinforced concrete is described in an article on slipways for launching lifeboats, and there are also some notes upon modern bridge construction. The number closes with some old students' notes and a few reviews of books recently published.

Failure of Supply in the Blackwall Tunnel.—Owing to a serious short circuit on the L.C.C. feeders which supply the lighting of the Blackwall Tunnel, on Monday last the tunnel was in darkness from 7.0 p.m. until 11.0 p.m. Great inconvenience was caused to traffic, and the police eventually had to close the tunnel. Some difficulty was also caused to the fire brigade, who were called to a fire in Greenwich, and had to drive through the tunnel when the lights were out. We understand that the engineers of Poplar Electricity Department were on the spot, and gave valuable assistance, although the supply to the tunnel is given by the L.C.C. through a special sub-station independently from the Poplar Borough Council system.

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MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE proceedings up to Monday last week (with the exception of a Paper on the absolute measurement of electric currents which we mention later) were reported in our last two issues.

Superheated Steam, Gas and Oil Engines.

On Tuesday, in Section G, three papers upon economical and reliable power generation by overtype superheated steam engines, suction gas engines and producers, and Diesel engines respectively, were discussed together.

Mr. W. J. Marshall, the reader of the first Paper, said that the overtype superheated steam engine on the Wolf principle had now a fuel economy on a par with that of the internal-combustion engine. It consists of a special tubular boiler with the engine mounted on the top of it, the boiler forming the foundation or bed-plate for the engine. A superheater is placed in the smokebox, and forms an integral part of the plant, as also do the air-pump, condenser, &c., when such are fitted. The result of this arrangement is that steam-pipe losses are reduced to a minimum, and the full value of the superheated steam can be employed. The cylinders can also be jacketed with high-pressure steam from the boiler without any loss due to drains or steam traps, as the cylinder casing forms a portion of the steam space of the boiler. Particulars of exhaustive trials on one of these engines were given, showing that 1 b.h.p. can be obtained with a consumption of 1·21 lb. of steam coal per hour. A detailed description of the type of Wolf engine developed by Messrs. Richard Garrett & Sons, Ltd., was given, with drawings and photographs showing actual installations of some of these engines in various types of factories. Particulars of results obtained in regular work were added, and comparisons drawn between these and those obtained with other types of prime mover. The relative importance of the different items which go to make up the cost of power in a factory was discussed, with especial reference to that of reliability.

Mr. W. A. Tookey, in his Paper on Suction-Gas Engines and Producers, spoke of the difficulty of obtaining figures recording actual performances with regard to fuel consumption, cost of maintenance, cost of repair. The author has, however, collected from his own tests and those available from various sources, representative performances of suction-gas plants of various sizes when under test, not only when the power can be determined by means of some form of brake dynamometer, but when generating electric current—so taking into account the efficiency of the combined gas-electric set—and also when raising water under different "heads," indicating the comparison between fuel consumed and foot-pounds of work performed in such circumstances. Moreover, as "test" figures are usually obtained under what must be admitted to be abnormal conditions—no account being taken of standby losses, wastage of coal in charging, in removal of ashes, &c., the engine and producer being worked at a constant and regular output for but a limited number of hours—further figures were presented which enable the average performances of suction-gas plants of moderate power to be noted. These figures have been compiled from the statements of factory owners in Great Britain and in European countries. They take into account the variations of consumption due to the different grades of fuel used; they reflect the influence of variations of output, of load fluctuation, of length of standby periods, as well as the effect of the variation in the "human element." Figures representing the consumption of lubricating oil were also given. The author expressed the view that although the Diesel engine was more efficient as regards utilisation of heat units available in the fuel for conversion to power, yet it required several conditions to be fulfilled before the higher economy became apparent in the pocket of the user. Similar suggestions were made with regard to the relative performances of steam engines of the high-pressure, superheated, compound, condensing, semi-stationary type, and the conclusion was arrived at that the balance of advantages was in the favour of the gas power-plant, at all events for moderate powers.

Mr. Charles Day followed with a Paper on the Diesel Oil Engine. The Paper opened with arguments against the selection of an engine being made on makers' guarantees of fuel consumption, as such guarantees cannot possibly cover all working conditions, making it quite possible for the engine which gives the best results on tests to give inferior results over a long period in normal service, when items such as wages, repairs, and maintenance are included. It was urged that the judgment must be based on records of actual working results, which include all items of expenditure, and it was pointed out that, owing to the power costs of electricity supply-stations being kept on a uniform basis, and to the great majority of them being published or obtainable, these form the best available data on which to judge the working results obtained with different types of plant. He emphasised the importance of load factor and the economies at light loads, and, in the case of the steam engine, he pointed out that in the case of steam plant it is not sufficient to consider only the steam consumption of the engine and the evaporative efficiency of the boiler, but due allowance must be made for the power to drive accessories such as feed-pumps, coal-handling plant, condensing plant, and other such accessories. At light loads the power taken by these accessories may easily represent a large proportion of the total power. The advantage of being able to start up a Diesel set at a moment's notice, without the necessity of keeping up steam in boilers, and previously warming up the engine, were insisted on.

The author agreed that the conditions of working in some factories differ considerably from those of an electricity supply-station, but claimed that loss of efficiency is largely brought about by causes which are common to all places, and that consequently deductions from electricity-station figures are applicable to the great majority of power cases.

Stations having a plant capacity exceeding 1,000 kw., *i.e.*, 1,500 h.p., were excluded from the main comparisons. In the following table the author gave comparison of results of the different types of plant in stations where the plant capacity does not exceed 1,000 kw.

The wages and repairs items include some of the costs on the distributing system.

Average Cost per B.T.U. Sold.

Engine.	Fuel.	Lubricating oil, waste, stores, and water.	Wages.	Repairs and maintenance.	Total works cost.	Load factor.
Steam ...	0·45	0·06	0·25	0·26	1·02	14·7
Gas	0·43	0·09	0·28	0·24	1·04	15·3
Diesel... ...	0·23	0·04	0·19	0·07	0·53	14·3

The following table was also given of the average results obtained from steam stations of various sizes.

Average Works Costs per B.T.U. Sold, on Steam Stations of Different Sizes.

Capacity of station not exceeding kw.	Fuel.	Lubricating oil, waste, water, and stores.	Wages.	Repairs and maintenance.	Total.	Load factor.
250	0·63	0·09	0·35	0·36	1·43	13·2
500	0·56	0 06	0·27	0·29	1·18	13·3
750	0·43	0·05	0·23	0·24	0·95	15·4
1,000	0·40	0·05	0·23	0·21	0·89	16·8
1,500	0·42	0·04	0·17	0·18	0·81	16·9
2,000	0·37	0·04	0·16	0·21	0·78	17·7
3,000	0·33	0·04	0·15	0·17	0·69	17·4
4,000	0·40	0·03	0·14	0·20	0·77	18·8
5,000	0·34	0·03	0·11	0·16	0·64	18·7
7,000	0·36	0·04	0·13	0·20	0·73	17·9
10,000	0·26	0 03	0·09	0·13	0·51	22·6
20,000	0·30	0·03	0·11	0·16	0·60	19·6
50,000	0·23	0·02	0·10	0·11	0·46	20·56

Constructional features were then dealt with and reasons given in favour of the multi-crank vertical engine, particularly for dynamo driving. For high-speed engines forced lubrication and very complete enclosing were strongly advised. He pointed out that, in the case of Diesel engines for speeds which are not slow, the multi-crank type becomes desirable, otherwise serious vibration is likely to be caused. For the same reason it is important that the distance between the centre lines of the cylinders of an engine be reduced as much as possible. In such engines he recommended the vertical construction rather than the horizontal, as it gives much better accessibility, and any unbalanced inertia forces do not tend to slide the engine about, but merely increase or decrease the weight on the foundations. The vertical design, he said, is also better from the point of view of piston wear. Multi-crank engines are also advantageous as regards speed regularity during each revolution, which is a point of importance when driving alternators in parallel. With the first few oil-engines to which forced lubrication was applied a portion of the lubricating oil got drawn up into the cylinders. Detailed improvements in construction have, however, completely overcome this, and now the oil consumption is quite as low with the forced lubrication as with the ordinary systems. For moderate speeds of revolution, ring lubricating main bearings are thoroughly satisfactory combined with centrifugal lubrication to crank-pins. With such an arrangement less complete enclosing meets all requirements of cleanliness.

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The development of the Diesel cycle from the Carnot cycle was then briefly traced, and the following fuel consumptions given as every-day consumptions for Diesel engines of moderate size :—

At full	load	0·44 lb. per b.h.p. per hour.	
At threequarter	,, ...	0·45	,, ,,
At half	,, ...	0·47	,, ,,
At quarter	,, ...	0 62	,, ,,

The further advantages resulting with Diesel engines are then briefly stated as: No sparking apparatus, lamp, or burner; no carburetter or vaporiser; no back-firing or pre-ignition; no warming up required before starting; very smooth running owing to no explosion or sudden rise of pressure; cheap crude oils used; very little water used; and no ashes or offensive effluents.

In regard to the question of continuous running, a case was quoted where during four years the average running time works out at 23¾ hours out of each 24, or about 1½ hour stoppage per week.

Captain SANKEY opened the discussion by asking for a clear definition of "rated output," a term used by all the authors. In the case of the gas engine, the Engineering Standards Committee had defined the rated horse-power as 85 per cent. of what the engine could possibly do, but this definition had not been published.

Prof. DALBY said that for small steam plants the only salvation was superheating.

Mr. W. J. LEWIS said that whilst it would probably be found that the Diesel engine would carry the day for the generation of electric power in works, yet great difficulty would be found in getting it into those places where a large supply of steam was required for heating purposes. Was there any prospect of benefit in the same way from the exhaust heat from gas or Diesel engines? A few years ago an open challenge was issued to gas-engine makers by Messrs. Wolf, the locomobile builders, for tests as to the best figures for fuel consumption, but the gas people had altogether ignored it.

Mr. KILBURN SCOTT strongly championed the Diesel engine for small electricity works, and referred to the Chichester power station, where, he said, the only complaint of the man in charge was that he had not enough work to do. He looked forward to the makers being able to build them in large sizes, when the large steam-driven station would cease to exist. At present, due to patents and the small number of makers, Diesel engines cost far too much.

Mr. H. E. WIMPERIS thought we should gradually develop towards a type of engine which would neither be a gas nor a steam engine, but a combination of both; in other words, the use of superheated steam, which was a gas, in an internal combustion engine. He was often called upon to advise in cases where native labour had to be relied on, and in such circumstances he had never yet recommended the Diesel engine, as it seemed too complicated to leave in the hands of unskilled men.

Captain SANKEY, referring to Mr. Wimperis' suggestion about using steam and gas in an internal combustion engine, said he had such a proposition under consideration at present.

Mr. H. S. RUSSELL said the whole question of the low costs which could be obtained with the Diesel engine, especially in electric light stations, depended on the load factor, and the load factors which Mr. Day had mentioned in his paper, about 15 per cent., were about the average obtained in electric power stations of that size. The lower fuel consumption of the Diesel engine was brought about by the very much higher thermal efficiency of the engine and the absence of standby losses. The large amount of exhaust heat available for a steam engine only showed how inefficient it was; the efficiency was only 10 or 11 per cent., whereas gas engines gave 18 to 20 per cent. and the Diesel engine up to 40 per cent., which naturally reduced the heat available afterwards as exhaust. With regard to the difference between makers' and actual figures, he had figures which showed that, whereas Diesel figures in practice only came out to 13 per cent. in excess of the makers, with the locomobile the actual figures came out to 140 per cent. in excess. Mr. Marshall had suggested that Diesel engines were unreliable, but he had figures of a Diesel engine in an electric light works which had been running 23¾ hours a day for four years. On a battleship, too, a Diesel engine had run 800 hours continuously. Wages of running Diesel engines were not more than half compared with either gas or steam.

Prof. E. W. MARCHANT (Liverpool University) pointed out that capital charges had been omitted by the authors, and suggested that they were very important. He had been through some figures of electricity works in reference to the relation between capital and fuel charges, and found that, on the average, the capital charges were about double the fuel charges, and in some cases more, depending on the load factor.

The PRESIDENT suggested that the authors, in reply, should give some attention to the commercial side of the question, *i.e.*, the comparative cost per unit of generating electricity.

Mr. MARSHALL, speaking on the question of rating, said that with a 140–180 h.p. engine, the guaranteed fuel consumption would be the same over the whole range; it would be equally economical at either load. But they would work quite economically above and below those limits. He had no figures with regard to producing electric power, as there were no electricity works in this country using his type of engine entirely, although he could have got figures from Germany. He criticised Mr. Day's table as absolutely valueless, as the type of steam or gas engine was not mentioned; it might embrace a lot of steam engines 25 years old. The same applied to the wages figures. Mr. Tookey's figures also wanted a good deal of explanation before a useful direct comparison could be made.

Mr. TOOKEY, in a brief reply, pointed out that, unlike the other two authors, he was not an engine maker. All his figures had been compiled in the ordinary way from users. Gas-engine builders, unlike the makers of other engines, were to a large extent unanimous in their method of rating h.p.; it referred almost universally to the maximum power that could be hoped for from an engine of the particular size, running sometimes 15, 30, or 60 minutes. He, however, worked on the basis of taking the piston displacement multiplied by the number of revolutions divided by four. This gave the rated b.h.p. Generally speaking, however, the makers' ratings agreed with this within 10 per cent.

Mr. DAY also replied. Mr. Kilburn Scott, he said, was quite wrong on the question of patents. The master patents expired some years ago, and as to the number of firms making Diesel engines, he really could not count them. No less than 30 new firms started in Germany last year. He went to Hungary last year in order to open up business, but found five firms making Diesel engines in one town alone. He had a prejudice in favour of native labour; the Chinese coolie was about the best, and was far better than a skilled engineer, and did not think he could improve the machine. Dealing with Mr. Marshall's point, as to his comparative figures, he said that he had taken stations in which the steam engines were not old. He had not picked special stations, but had taken the averages of all stations of the size mentioned. As a matter of fact there was no very old steam plant in electricity works to-day.

Electrical Production of Nitrogen Compounds.

A Paper by Mr. E. Kilburn Scott described the methods of manufacturing artificial nitrates and other electrically produced compounds of nitrogen.

The Birkeland-Eyde arc furnace, in which the arc is spread out by a strong magnetic field, and the Schonherr tubular furnace, with a long spiral arc held central by a strong current of air, were fully described in ELECTRICAL ENGINEERING, June 3rd, 1909, Vol. V., p. 515, as were also the processes used for forming nitric acid and nitrate of lime from the nitrogen peroxide produced in these furnaces. The third type of furnace, the Pauling furnace, was described in ELECTRICAL ENGINEERING, November 11th, 1909, Vol. V., p. 964. The nitrate of lime produced in this way contains about 13 per cent. of nitrogen. The other principal artificial manure is calcium cyanimide, with 18 per cent. of nitrogen, which is produced by combining nitrogen, separated from air by the Linde fractional distillation process, with electrically produced calcium carbide. The author stated that nitrate of lime is usually employed as a top dressing, whereas calcium cyanimide is dug into the soil, but that, in his experience, the best result is obtained by mixing the two manures.

The nitric acid produced by the above processes is concentrated at some of the works for the manufacture of explosives, and can readily be formed into ammonium nitrate, a constituent of many modern explosives, by mixing with ammonia liquor from gas-works. This substance can also readily be manufactured from electrically-produced calcium cyanimide. In this connection, the author pointed out that this country is largely dependent on oversea supplies for the manufacture of explosives, and that it would be advisable to establish factories for the electrical manufacture of such nitrogen products in this country and other parts of the empire, so as to ensure an efficient supply in time of war, even if the products could not compete in price with existing supplies. Another product of these factories is sodium nitrite, which is used in the manufacture of azo dyes. The former method of reduction of Chile nitrate with lead has practically ceased, and the whole demand is supplied from factories using the electrical method. Various compounds of ammonia are made by treating calcium cyanimide with superheated steam, a sulphate of ammonia of very high quality being produced in this manner.

Turning to the cost of production and the possibility of the electrical manufacture of nitrogen products in this country, the author said that the power used at Notodden to manufacture nitrates is said to cost only 0.045d. per kw. hr., and that at Niagara the price charged to electro-chemical consumers is 0·133d. per kw. hr. There is every reason to believe, he said, that waste heat power stations in this country could sell power at this latter figure with 100 per cent. load factor. He had heard of cases where 0·25d. per kw. hr. was charged to consumers with a 33 per cent. load factor, and, working from this figure, the price should be 0·168d. per kw. hr. on a 100 per cent. load factor. This referred to a plant with steam raised from coal, and power could be supplied at a lower figure from a waste heat plant. Thus, whereas a capital cost of from £10

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to £12 per kw. installed was a fair figure for an ordinary steam plant, the cost of the generating plant used in a waste heat station was about £6·5 per kw. installed. Very few water-power plants were constructed at as low a cost as £10 per kw. installed.

The discussion was opend by Sir WILLIAM RAMSAY, who believed that the future of the country lay in establishing chemical works in the neighbourhood of the collieries. He looked upon this as largely a Governmental question. There was very little doubt that a policy of this sort would largely lengthen the coal supply, and cheapen commodities.

Dr. E. ERKHARDT said that the time was not yet ripe for the full development of the electrical manufacture of nitrates in this country. They had already entered into negotiations with regard to establishing works on the Birkeland-Eyde system, but the final conclusion come to was that it would be better to wait at least for several months. The Notodden works was earning well, and at Ruckhardt, in Norway, a big plant was being erected which would have a final capacity of 250,000 h.p. At present four-fifths of the plant was on the Schonherr process, and one-fifth on the Birkeland-Eyde process, but, as the result of their experiments, it was quite possible that these proportions would be altered later on. With regard to Mr. Scott's remarks concerning explosives, he thought that if the British Navy could not protect the Chili saltpetre fleet in time of war, it would not appear that they could do much for the food supply of the country, which was a much more serious problem. However, he did not think the British Admiralty took this view, and for that reason did not think they would be able to induce the Government to take up one or other of these processes. Naturally, he would be only too pleased if they would.

SIR WILLIAM WHITE, after speaking appreciatively of the work done in the direction of cheap power distribution on the Tyneside, expressed the opinion that although it might not be absolutely essential to produce the materials for the manufacture of explosives, yet it was a great advantage to have the means of doing so in our own hands, and every encouragement in this direction should be given, quite apart from the sufficiency or efficiency of the Navy.

Mr. H. E. WIMPERIS said that three years ago he had had to investigate the amount of power running to waste in this country from blast furnaces, gas and coke ovens, and the result showed about 1,000,000 h.p. continually going to waste. At that time he suggested the possibility of utilising this power in the way suggested by the author, but on the Tyneside it was being used for ordinary electric power purposes.

Mr. E. KILBURN SCOTT, in reply, said he felt very strongly that we were lagging behind in metallurgical processes, and sincerely hoped the Government would step in, if private enterprise was not given the necessary facilities. He recalled the fact that the manufacture of carbide of calcium was started a few years ago, and a factory erected next to the Yorkshire Electric Power Co.'s power station. A very low price was offered on the condition that the power company had a right to cut off supply during peak time, which, as a matter of fact, was never done. The manufacture of calcium carbide, however, was in the hands of a trust with headquarters on the Continent, and after a while they came to the conclusion that there were too many factories, and subsequently shut down the Yorkshire works.

Smoke Abatement.

Dr. J. S. Owens next read a Paper on the possibility of fixing a new standard of smoke emission from factory chimneys.

He suggested a standard of maximum density for maximum time of emission. By density, he explained, he meant the amount of soot per unit volume of flue gas, and he described an instrument which he has devised by which the density of smoke is matched with that of calibrated smoked glasses, each glass representing a certain density of smoke in a column of unit thickness. The final figure for comparison is obtained by dividing the density represented by the glass by the diameter of the chimneys.

There was very little discussion upon this paper, but some amusement was caused by the vehement remarks of a gentleman (who subsequently turned out to be a boiler-setting expert) expressing the opinion that all manufacturers allowing smoke to be emitted from their chimneys should be put in prison and kept there until the nuisance was abated. He also remarked upon the impossibility, at any rate in provincial towns, of getting smoke nuisance convictions, as he said all the magistrates were manufacturers, and were themselves the biggest sinners in allowing smoke emission from their chimneys.

Continuous Transport.

The final Paper in Section G on Wednesday was by Mr. W. Y. Lewis, who described the Adkins-Lewis system of continuous transport.

The principle upon which this system is worked is that of the continuous lift. In shallow subways a spirally threaded shaft driven by electric motors would be installed, this shaft extending throughout the whole route and rotating at constant speed. A large number of small cars would be driven by this shaft, engagement with which is by means of a roller. The pitch of the spiral on the shaft is graduated. Thus to give slow speed at the stations, the pitch would be close, and to enable high speeds to be obtained between stations, the pitch would be six or eight times greater, acceleration and deceleration being practically unnoticeable, due to the graduation in the pitch. Another feature of the system is the return to the circuit of about 80 per cent. of the kinetic energy of the cars during deceleration. The spiral is designed to give a speed of three miles per hour whilst passing through the stations, a speed which it is contended would enable passengers to board the cars or alight without the necessity for them to stop. The drivers, brakes, and signalling apparatus would all be dispensed with. Electric motors for driving the shaft will be inserted at intervals of a quarter of a mile, and although the inventors admit that the system will adapt itself more readily to straight and more level routes, yet they have arrangements for dealing with curves. A full-size line has been erected at Messrs. Ransome & Rapier's works at Ipswich, and Mr. H. M. Hobart, now consulting engineer to the General Electric Co., of America, has made a report upon the system, in which he expresses the opinion that it is based upon thoroughly sound and practical principles, and that, both as regards capital and operating costs, results could be obtained much more cheaply than with present electric trains. Mr. Hobart lays great stress upon the safety to the travelling public of this system, and points out that each car is positively under the control of its driving thread, and as the successive cars were always the same number of convolutions apart, they need never touch each other, unless required to. Captain H. Riall Sankey has inspected the experimental equipment at Ipswich, and expressed his surprise at the small amount of power required and at the large amount of energy, of the order of 80 per cent., returned to the circuit by the retardation of the cars. He experienced no difficulty in getting on and off the cars, and could stand up easily whilst the car was accelerating and decelerating at the average rate of 4·5 ft. per second per second.

In the course of a short discussion, Professor Dalby, who had examined the system closely, spoke highly of the engineering skill which has been put into it during the seven years it has been developing. In answer to a few questions, Mr. Lewis said that the efficiency of the spiral thread was about 90 per cent., and that the shaft would need to have a diameter of 2 ft. for a railway dealing with a traffic like that of the District Railway.

Absolute Measurements and Practical Standards.

Before Section A (Mathematical and Physical Science) on Monday last week, Professor N. E. Dorsey read a short Paper on the work done at the Bureau of Standards on the absolute measurement of electric currents.

A balance of the type used by Lord Rayleigh was employed. Coils of square cross section are wound bifilarly on enamel insulated wire upon brass forms. A novel feature of the fixed coils is the provision in the forms and the back of the windings of a channel through which water can be pumped, so as to maintain the coils at the constant temperature.

Three tiers of fixed coils (two 50 cm. in diameter and of 36 layers each of 18 double turns, and one of 40 cm. diameter and 28 layers of 14 double turns each) and two moving coils (one 25 cm. in diameter and of 12 layers of six double turns, the other 20 cm. in diameter and of 14 layers of 7 double turns) were used in the final work.

The distance between the two fixed coils was always such that the sum of the forces which they exerted upon the moving coil was a maximum. Under this condition, a maximum force for a given current depends solely upon the ratios of the diameter of the moving coil to those of the fixed coils. Consequently the actual distance between the fixed coils need not be measured—a great advantage.

The ratios of the diameters of the coils were obtained by a modification of the electrical method used by Lord Rayleigh.

Observations give the average value for the E.M.F. of the mean Weston normal cell (as defined at the Washington Conference) at 20·00 degrees C, in terms of the international Ohm and the Bureau Standards balance, as 1·018224 volt. The maximum deviation from the mean was 9×10^{-6}. This value, 1·01822, differs from that obtained at the National Physical Laboratory by 4 in 100,000.

The instrument was designed by Professor E. Rosa, and the entire work has been done under his strict supervision.

The Committee on Electrical Standards presented their annual Report on Wednesday.

Further satisfactory progress has been made with the Lorenz apparatus. Preliminary experiments have shown that it is uninfluenced by changes in the earth's magnetic field, and that the

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thermal E.M.F.s at the brushes on the two discs very nearly balance.

The construction of new mercury standards of resistance in accordance with the specification of the London Conference is being proceeded with, and some of the standards will be completed this year. Similar work is in progress in France, in Germany, in Austria, and in the United States. In the latter country four standards have had all of their constants determined, and the resistance unit so obtained is in very close agreement with that obtained from the old National Physical Laboratory standards.

In the Committee's Report for 1908 it was shown that many manganin resistance coils—some of which were purchased by the Committee in 1895—were very changeable in resistance, and in consequence frequent comparison with mercury standards was necessary. In 1908 it was shown at the Bureau of Standards, and confirmed at the National Physical Laboratory and at the Reichsanstalt, that these changes were largely due to the effect of moisture on the shellac covering the wire. To eliminate this source of trouble, many of the coils were hermetically sealed in 1909, and it is satisfactory to record that they are now much more constant. The importance of this hermetical sealing is so great when manganin resistances are to be sent to such places as cable stations in the tropics that the attention of instrument manufacturers is drawn to the matter. Standard coils are readily sealed and boxes of coils may be sealed in metal cases.

The results of the experiments made at the National Physical Laboratory upon the effects of different septa, such as silk, filter paper, porous porcelain, &c., in a silver voltameter, indicate that a septum of any kind is usually a source of trouble, and may produce secondary reactions during the electrolysis which affect the weight of the silver deposit. Fortunately, voltameters have been designed which render a septum unnecessary.

The reproducibility and constancy of the Weston normal cell are still being carefully examined. The chief anomaly is the hysteresis effect mentioned in last year's report. With ascending temperatures the E.M.F. changes in close agreement with the temperature—E.M.F. formula, but with descending temperatures the E.M.F. changes too rapidly, corresponding to values at temperatures lower than the temperature of the cell, by from 3° to 15°. For this effect an explanation is much needed, as probably it would enable cells to be made so as to remain even more constant in E.M.F. than at present.

The Electrical Exhibition at Olympia.—The Management of the Electrical Exhibition will be happy to send any contractors pictorial posters of the Exhibition on hearing from them, and on consideration of such contractors exhibiting these bills in their windows they will be entitled to two complimentary tickets to the Exhibition.

Faraday House Journal.—The September issue of this journal is to hand. The papers contributed include the electrification of the Randfontein Central by T. P. E. Butt, and a method of finding the neutral point in continuous-current machines by J. T. Chapman. We are pleased to hear that several new affiliations have been added to the already long list, and these include the British Westinghouse Electric and Manufacturing Co., Ltd. (Trafford Park, Manchester), Brown, Boveri & Co. (Baden), Metropolitan Borough of Hornsey, Rawtenstall, and York Corporations. A time-table for the first and third year's courses has been added at the end of the journal.

"Tilling-Stevens" Petrol Electric Omnibuses.—As a result of the successful running of the new "Tilling-Stevens" petrol electric omnibuses in London service, Messrs. Tilling have decided to adopt that type for all their future omnibuses, and are constructing a fleet to replace their present horse-drawn vehicles. Messrs. Tilling have designed the chassis and body, which are being built at their works at Peckham. The electrical transmission is supplied by Messrs. W. A. Stevens, Ltd., of Maidstone. The design is generally similar to that described in ELECTRICAL ENGINEERING, Vol. VI., page 678. An agreement has been entered into between the two companies in which Messrs. Tilling have secured the sole rights of use and sale of the "Stevens" patent electrical transmission for use in omnibuses and mail vans in the Metropolitan Police Area; Messrs. Stevens to have the sole rights of manufacture and sale of the complete "Tilling-Stevens" petrol electric chassis outside the Metropolitan Police Area, and also inside the Metropolitan Area for vehicles other than omnibuses or mail vans. The same construction will be adopted in the chassis for use either inside or outside London. The "Tilling-Stevens" petrol electric vehicles are the result of exhaustive experiments carried over a period of four years under public service conditions in London. The first vehicle, which is still in service in excellent condition, and was described in ELECTRICAL ENGINEERING, Vol. III., page 83, has run over 120,000 miles.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

An account of a series of investigations made by Lieut. J. O. Mauborgue on the operation of inductive tuners in wireless-telegraph receiving sets is given briefly in the *Electrical World* of New York. The tests described included use of the inductive tuner alone, and with variable air condenser in secondary, in series with the primary, and in parallel with the primary. From characteristics shown by curves plotted between wave-lengths and coupling ratios, the author concludes as follows: Varying the coupling varies the wave-length. Regardless of coupling used, apparatus is always tuned to two wave-lengths at same time. This double periodicity was illustrated by pulling out the secondary coil to a particular position, when the equipment is tuned to both a 1,355-m and a 490-m wave. Use can be made of this double frequency in avoiding a station operating in the lower register while continuing to listen to the desired station by changing primary inductance. In tuning with an inductive tuner alone the longest wave-length is obtained with the primary and secondary inductances at a maximum and the coupling as close as possible. With a variable condenser in series with the primary inductance, loosening the coupling causes a rapid drop in the wave-lengths of the higher curve and a similar rise in the lower curve, enabling the operator to eliminate an undesired station with a short wave-length. In conclusion the author declares that the most selective device would be an inductive tuner having its primary variable by single turns, and with a variable condenser capable of being connected in either parallel or series with the primary, and a variable condenser of small value around the secondary.

The annual report of the Meteorological Office states that 3,955 wireless weather reports were received from Atlantic liners last year. Reference is made to the great value of these reports in enabling warnings to be sent to various districts in advance.

The Marconi Wireless Telegraph Co., Ltd., has recently obtained a contract from the Crown Agents for the Colonies to erect a radio-telegraph station in Ceylon. It will be capable of transmitting normally a wave length of 600 metres, and with wave lengths between 1,000 and 2,000 metres, it will also be able to communicate with ships within 450 miles. The generating equipment will consist of a 5-kw. alternator and exciter, driven by a 10-h.p. 100-volt, 60-cycle, single-phase motor, connected to the supply mains. The machines will be protected from injurious effects induced by the high frequency circuit by means of shunting resistances. A high-tension transformer will step up the voltage suitable for a battery of condensers. These will be of the glass plate type placed in galvanised iron oil-tight tanks, and suitable arrangements will be made for adjusting the coupling to produce various waves. An inductance of the adjustable type will be inserted in the condenser circuit for tuning the high-frequency primary circuit to the aerial circuit, while the low-frequency primary circuit, and the spark frequency, will be tuned by means of an inductance in the form of an iron core. The discharger will be of the disc type, and designed to produce a musical spark so as to distinguish between signals and atmospheric disturbances. There will be two aerial tuning inductances, each consisting of a multiple solenoid winding of stranded conductor. The manipulating gear will include a Morse key, which will actuate a relay key in the transformer primary.

One part of the receiving apparatus will comprise a magnetic detector and a multiple tuner, which will provide a highly syntonised circuit for waves between 100 and 2,500 metres. A switch will also be furnished for changing from a "tuned" to an "untuned" position, ready for picking up waves of other lengths. The other part of the receiver will have a detector of the valve type, suitable for wave lengths of 1,600 to 4,000 metres. There will be two masts, each 270 ft. high. One earth system will be used, consisting of iron plates arranged in a circle with radial conductors to the central apparatus. This will be supplemented by radial wires underneath the transmitting aerial.

A few months ago we announced that a wireless telegraph station would be erected at Spitzbergen. This station and one at Hammerfest, with which it will communicate, will probably be completed this autumn. Telefunken apparatus is being used, with aerials about 200 ft. high. Each station will have residential accommodation for the staff, and will be under the control of the Norwegian Government.

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The *Times* Lisbon correspondent states that the Portuguese Government have decided to adopt the Marconi system of wireless telegraphy, and that stations are to be erected at Lisbon, another on the Portuguese coast, and a third at Cape Verde. The Portuguese Government, it is stated, have been offered the same terms as those which have been accepted by the British Government.

Some stir has been caused among journalists in search of sensations by announcements that a Mr. H. G. Matthews has accomplished feats of wireless telephony hitherto considered impracticable. According to some accounts he was shut up in a strong room with his transmitter, and communicated thence to an operator in another part of the building. Tests from Chepstow to Tintern, between which a considerable amount of rock intervenes, and other places in the neighbourhood, have been carried out, and an attempt is to be made between Cardiff and Chepstow, for which the aerials will be of such a size as to necessitate man-lifting kites for their support. Technical particulars of the system are not yet available. Mr. Matthews' name will be familiar to some in connection with a music-hall turn in which a wirelessly-controlled airship took part.

On the 5th inst. the line between Sabang and Kotaradja was restored, and on the 7th inst. the lines between Bagdad and Bassorah were down.—By reason of faults, &c., telegrams for Casablanca, Mogador, and Rabat are subject to long delay, and can only be accepted at sender's risk. Telegraphic lines in the interior of Ecuador have now been repaired, and on the 9th inst. the Bagdad—Bassorah line was in good working order.—We understand there is some trouble with the Eastern cables, and that they are diverting their traffic.

The report of the Pacific Cable Board for the year to March 31st, 1911, shows a gross profit of £29,334, but the interest and sinking fund charges amount to £77,544. The difference between the two sums has to be met by the contributing Government. The gross profit was £11,378 more than was available in the previous year. The net traffic receipts increased by £24,677. The result for the year is arrived at after placing £30,000 to renewals fund, which now stands at £264,236. The statement is made that there is every prospect within the next few months of messages being accepted in plain language to be sent at half the existing rates, subject to the condition that they may be delayed for a period not exceeding twenty-four hours.

It is stated that the Government are now considering the details of the scheme for linking up the Empire by means of wireless telegraph stations, which was proposed and carried at the Imperial Conference in London. The outline of the proposal is that there shall be one station in England, one at Gibraltar or Malta, and one each at Cyprus, Aden, Bombay, Singapore, and Australia. The ultimate aim of the scheme is to enable the British Admiralty to direct the movement of every unit of the Navy at any moment.

ELECTRIC TRACTION NOTES

The Board of Trade inquiry into the circumstances of the accident upon the L.C.C. tramway system at Lewisham on Saturday, September 2nd, was held on Wednesday last week. Col. von Donop conducted the inquiry. It will be remembered that a four-wheeled top-canopy car left the rails on a curve, after descending a short steep incline, at the junction of Shardeloes Road and Lewisham High Road, and overturned, one passenger being killed and over 30 injured. The evidence was very similar to that given at the coroner's inquest. It all went to show that the magnetic brake and the car generally was in good order. Mr. W. Crawford, assistant permanent-way inspector, said he found the track in good condition after the accident. The rails on the curve had been in use since February, 1910, and he put their life at ten years. In answer to the inspector, witness said he noticed a mark on the inner side of the near rail where the flange on the wheel, then running on the wood paving, had struck the check of the rail. The inspector expressed the opinion that this was the cause of the car overturning. As to the cause of the car leaving the rails, we have to await the inspector's report. In connection with this latter point, it is reported that other car derailments have recently taken place upon the curve running from Malpas Road into Lewisham High Road, only a short distance away from the scene of the fatal accident on September 2nd. Indeed, one account refers to the derailments at this spot as "a common occurrence." At present, special attention is being paid by the L.C.C. engineering staff to the Malpas Road section in order to ascertain the cause of the derailments.

A rumour was current on Monday that a fatal accident had occurred on the electrified section of the L.B. & S.C. Ry. It appears, however, that the facts of the case are that a fireman, when watering coal in a tender at the Crystal Palace Station, accidentally touched the overhead wire with his shoulder, receiving burns and a shock which caused him to fall and sustain cuts. His condition is reported as not serious.

At the half-yearly meeting of the Aberdeen Suburban Tramways Co. a dividend at the rate of 2½ per cent. was declared.

There is considerable opposition to some of the proposed tramway extensions in Glasgow, referred to on page 497 in our last issue, and the Corporation have agreed that the discussion of the whole matter shall be postponed for another week. It is proposed to borrow £180,000 in connection with this scheme.

The London County Council have received the Board of Trade's sanction for an experiment in running two double-decked tramcars linked together on the Euston Road and Hampstead route during the busy hours night and morning.

The accounts of the Dumbarton Burgh & County Tramways Co. show a profit of £8,468 for the year to July 31st, and after meeting the 6 per cent. preference dividend and adding £1,200 to the sinking fund for redemption of debenture stock, the balance of £2,768 is carried forward. The traffic receipts were about £1,000 in excess of those in the previous year.

According to the Frankfort correspondent of the *Financial News*, the passenger cars of the Prussian railways are to be lighted by electricity instead of gas. It is also stated that the Rosenberg system will be adopted.

After meeting the preference dividend, the accounts of the United Electric Car Co., Ltd., for the year to June 30th last, show a profit of £2,482, which it is proposed to carry forward. The directors regret that there has been a great stagnation in the car-building trade, but report that the works are now well employed. The Hadley & Trafford Park works have been disposed of at a loss of £46,171, which amount it is proposed to transfer from general reserve and depreciation reserve.

The accounts of the National Electric Construction Co., Ltd., for 1910 show an available balance of £7,353. The directors propose to transfer £1,550 to debenture redemption fund, and after setting aside £644 as depreciation on free-wired installations, the balance of £5,156 is to be carried forward.

The trolley omnibus system at Bradford has proved such a financial and technical success that the Tramways Committee has decided to extend the system by some 11 miles.

The tenth annual conference of the Municipal Tramways Association will be held in Glasgow on September 27th, 28th, and 29th, at Glasgow, under the presidency of Mr. J. Dalrymple (General Manager, Glasgow Corporation Tramways). After the Presidential Address on the Wednesday, Councillor C. W. Nelson will read a Paper on the "Common Good" of the City of Glasgow and its relation to the tramway undertaking. In the afternoon a Paper by Councillor J. H. Rodgers on "Tramway Finances and Policy" will be discussed. A Paper will be discussed on the following day on "Tramcar Meters" by R. G. and J. C. Cunliffe, and a report on "Tramway Track," embodying experience at Glasgow, Manchester, and Leeds, will be considered. An attractive programme of visits and excursions has been arranged.

The *Board of Trade Journal*, quoting from the *Japan Mail*, states that the Government have sanctioned the application of the Tokio municipality for the taking over of the electric tramways of the city as from August 1st. A thorough investigation has been ordered by the municipal authorities with a view to the speedy completion of the unfinished lines and the improvement of all the rolling stock. It is proposed to abolish thirteen or fourteen miles of the existing lines, and to construct five new lines, three of which were especially ordered by the Government to be completed by July 31st, 1916. An endeavour is to be made to finish the whole of the lines by the end of 1914. It is also proposed to build about 500 new cars, divided into two classes. Cheap, uncovered cars are also to be built for the use of workmen.

It is proposed to construct an electric tramway from Mödling (Austria-Hungary), either direct to Vienna or to Wiener Neudorf, to join the Vienna-Baden line. It is also proposed to construct a trolley omnibus system there.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Sept. 7, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

27,725/10. **Tramway Motor Supports.** THE BRUSH ELECTRICAL ENGINEERING COMPANY, LTD., and S. LEECH. Brackets are secured to the side frames of the truck, and screwed nipples are threaded into both ends of the spring attached to each bracket, those at one end being provided with means for attachment to the motor beams. An extension piece with a large hole is fixed to each bracket, through which the motor beam passes, with plenty of clearance, to the nipple. In this way the springs can act either in compression or tension, and owing to the flexibility of the springs the motor beams can vary their position within the limits of the clearance in the bracket extension. Three figures.

28,179/10. **Condensers.** G. GILES (*Switzerland*). To avoid the needle effect which takes place along the margin between the ends of the coatings of a jar-shaped condenser, instead of thickening the dielectric at the edge of one of the coatings, the latter is formed as one closed surface, a part of which rests on the dielectric, so that this coating offers no sharp edges. Six figures.

29,505/10. **Metallic Filament Supports.** ALLGEMEINES CHEMISCHE LABORATORIUM, OSKAR H. ARENDT, and C. SCHLESINGER. Two rings are mounted loosely on the central rod, or one can be rigidly fixed. These are connected by ties of suitable material running in the direction of the rod, and are crinkled to give elasticity between the rings and the filament. The rings have the usual radial arms for supporting the filaments. Two figures.

30,933/10. **Rotor Ventilation.** BRITISH THOMSON-HOUSTON Co. (*General Electric, U.S.A.*). Ventilating spaces are provided with channels extending from one part of the periphery to another. The ends of these channels are arranged at different angles to the radial lines, so that the forces tending to throw the air out of the rotor are different at the two ends of the channels. By this method it is claimed that the windage losses are avoided, and the rotor diameter reduced. Two figures.

1,907/11. **Incandescent Lamp.** G. F. RICHARDSON and R. J. CROWLEY. A lamp in which two or more filaments are used, has one end of each connected to a common contact plate at the bottom of the lamp, which is insulated from two other contact plates, to which the other ends of the filaments are attached. A bridge piece, half of which is insulated and half conducting, is rotatably fixed in the lamp-stem, making contact with the two plates, so that the filament which makes contact with the insulated part of the bridge piece is cut out of circuit. It can, however, be switched in by rotating the bridge. The plungers in the lamp socket are always in contact with the common contact plate and the bridge when the lamp is in position. Four figures.

4,397/11. **Overhead Trolley Wires.** OESTERREICHISCHE DAIMLER-MOTOREN A.G. A construction to allow a railless trolley omnibus to cross the original wire of the ordinary overhead tramway is supported by a bow-shaped frame, which is inserted in the original wire, forming a gap or gate. This gap is bridged by two movable strips placed in line with the trolley wire, which are kept in position by means of springs. The railless trolley to which a pendulum is attached runs on a line mounted above in the bow of the frame, so that when it wants to pass this point, the pendulum simply brushes the strips apart, which are returned to their original position by the springs attached. Two figures.

6,983/11. **Lug Joints for Accumulator Lids.** P. J. BROWN. The lug projects through a porcelain sleeve, which extends above and below the lid to within a short distance of the electrolyte. Both the sleeve and the lid have a grooved hole to take a rubber ring, which holds the lug central, and makes a flexible joint. There is also sufficient clearance round the lug for the gases to escape. Three figures.

Opposition to Grant of Patents

28,210/09. **Advertising Device.** A. W. LEONARD. This patent has been granted in spite of opposition. It comprises a series of discs, carrying advertisements, which are revolved by a motor fixed in a non-transparent casing with apertures, through which the revolving signs are shown.

18,969/10. **Reduction of Organic Bodies.** H. HIGGINS. Opposition has been entered to the grant of this patent. It relates chiefly to the reduction of the unsaturated fatty acids, and employs a special catalysing agent, composed of the oxide or hydroxide of cobalt or nickel, or a mixture of the two. This is used in the cathode compartment of an electrolytic cell.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: PÉREZ, 11,275/11.

Distributing Systems and Insulating Materials: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Insulating compounds] 176/11; LAKE (*United States Light and Heating Co.*) [Automatic regulators for electric circuits] 5,490/11.

Dynamos, Motors, and Transformers: BERRY [Transformers] 12,355/10; SIEMENS BROS. DYNAMO WORKS [Rotary field induction generators] 223/11; CRAWSHAW, and PHŒNIX DYNAMO MANUFACTURING Co. [Motors] 1,543/11; SIEMENS BROS. DYNAMO WORKS, and SCHUPP [Controllers] 9,606/11; ELECTRIC and ORDNANCE ACCESSORIES Co., GARNER and MUELLER [Controllers] 14,867/11.

Electric Ignition: HARPST, 11,811/11.

Incandescent Lamps: MOND [Supports for filaments] 23,404/10; WESTINGHOUSE METALLFADEN GLÜHLAMPENFABRIK GES. [Decarbonising metallic filaments] 24,637/10.

Instruments and Meters: WESTON [Wattmeters] 17,091/10 and [Vibration dampers for precision instruments] 5,268/11; CARPENTIER [Measuring relation of two currents] 5,961/11.

Switchgear and Fuses: LIDDLE (*Rudolf Buderer and Co.*) [Time switch for lighting circuits] 22,760/10; CRESWICK and BENTHAM [Flame-tight fuse and switch boxes] 9,037/11.

Telephony and Telegraphy: QUERTIER [Transmitting signals, &c.] 19,701/10, and [Transmitting, indicating, recording, and printing apparatus] 19,703/10; IRWIN [Selective signalling] 29,206/10; MURPHY [Signalling] 29,798/10; DELANY [Telegraphy] 55/11; GIRARDEAU [High-frequency alternator for radiotelegraphy] 3,948/11; BENNETT [Telephone mouthpieces] 12,200/11.

Traction: W. R. SYKES INTERLOCKING SIGNAL Co., SYKES, and TARRANT [Mechanism operated by train for actuating switches] 23,933/10; SCHEITHAUER and KLICHE [Operating points and switches] 4,611/11; J. STONE & Co. and DARKER [Hot-air system for railway carriages] 17,537/10.

Miscellaneous: KALLMANN [Resistance] 19,993/10; ALLEN, WEST & Co. and MOGGRIDGE [Collectors for cranes] 20,107/10; BROWN [Fire indicator] 24,183/10; ALTHER and GILL [Annunciating apparatus] 25,368/10; SELVATICO [Chest-warmer] 1,481/11; ROTHWELL, ROBERTS, and ROBERTS [Miners' safety lamps] 4,562/11; SCHWERIN [Electric Osmose treatment] 11,626/11; SIEMENS BROS. & Co. (*Siemens & Halske Akt.-Ges.*) [Relays] 12,295/11; WALKER and R. WAYGOOD & Co. [Lift control] 15,933/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Cables and Wires: NOBLE [Insulating wire machines] 18,674/11.

Incandescent Lamps: DEUTSCHE GASGLÜHLICHT AKT.-GES. (*Auerges*) [Drawn filaments] 1,161/11.

Traction: ALLGEMEINE ELEKTRICITÄTS-GES. [Locking the high tension gear of electric vehicles] 17,304/11.

The following amended Specifications can now be obtained.

LYSAGHT, LTD. and BEDDOE [Zinc condensers] 4,667/09; HANSEN [Block-signalling] 25,129/09; BOULT (*Ruzicka*) [Ignition] 18,946/10; BIGGE and BUTT [Electro-medical photographic apparatus] 25,670/10.

Amendment

16,017/10. **Power Handle for Controller.** W. R. SHAW and G. H. GREEN. As a result of the extended investigation under section 8 of the Patents Act, a disclaiming note has been inserted in this specification. It relates to a detachable power handle designed to prevent excessive sparking at the contacts. An abstract appeared in ELECTRICAL ENGINEERING, July 6th, 1911, p. 389.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, Motors and Transformers: SIEMENS BROS. & Co. (*Siemens & Halske Akt.-Ges.*) 11,828/07; SIEMENS BROS. DYNAMO WORKS and M. KLOSS [Field magnets] 12,050/07.

Switchgear: T. VON-ZWEIGBERGK [Switches] 2,751/07; W. H. SCOTT [Circuit-breakers] 11,814/07; A. G. CHARTERS and J. G. JONES [Cut-outs] 11,952/07.

Telephony: H. W. LAKE (*J. S. Stone, U.S.A.*) [Relays] 11,823/07.

Miscellaneous: E. A. CAROLAN (*General Electric Co., U.S.A.*) [Lightning arresters] 11,649/03; CROMPTON & Co. and C. CROMPTON [Fans] 10,928/05; SIEMENS BROS. & Co. and H. WRIGHT [Valve Control] 12,216/06.

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LOCAL NOTES

Austria-Hungary: *Electric Lighting.*—The "Allgemeine Oesterreichisch-Ungarische Gasgesellschaft" has purchased the Mödling gasworks for £100,000, and has made an offer to the Communal authorities to set up in Mödling an electric generating plant for lighting and power purposes. According to the *Board of Trade Journal*, the communal authorities have appointed a committee to consider the matter.

Bath: *Electric Lighting Accounts.*—The accounts of the Electric Lighting Department for the year to March 31st show a net profit of £1,196, compared with a loss of £580 for the previous year.

Brighton.—Mr. J. Christie, Borough Electrical Engineer, recommends the abolition of meter rentals, and the reduction of the charge for power purposes from 1½d. to 1d. per unit. He also proposes to do away with the cut-out period for power supply, which now operates between 5.30 and 8 p.m. in December and January. It is anticipated that the abolition of meter rentals will mean a reduction of £1,200 a year in revenue, whilst the second reform will cost a further £400, but Mr. Christie argues that the reforms will simplify the tariffs, and bring on a larger number of consumers, which will counterbalance these losses. Before committing themselves to the recommendations, the Council are to have a report from the Borough Accountant on the financial aspect.

Constantinople: *Tramway and Lighting Undertaking.*—According to the *Financial Times* an international company, to be known as the Consortium of Constantinople, is to be formed under Belgian law, with a share capital of £1,800,000 and debentures bringing the total available sum of £3,600,000, to acquire and control tramway, tube railway, and gas and electric lighting enterprises in the city, including the construction of a tunnel connecting Pera and Galata.

Farnham: *Electric Pumping.*—The Public Works Committee propose to substitute electric pumping at the sewage station for the existing steam power. The proposal to use suction gas plant has been put on one side in order to discuss the electric proposition with the Farnham Gas & Electricity Co.

Ilkley: *Electric Lighting Extensions.*—The Council have decided to apply to the Board of Trade for an electric lighting Provisional Order for supplying electricity in the urban district of Ilkley and the districts of Myddleton and Wharfedale.

India: *Bombay Supply Scheme.*—It is stated that the Tata Hydro Electric Power Co. have received applications for power supply to the full limit of their present plant, viz., 34,000 h.p.

Inverness: *Fire at Electricity Works.*—The works of the North of Scotland Electric Light & Power Co. in Inverness were badly damaged by fire last week. The main generating machinery, however, was not injured, although the damage is estimated at £1,000.

Japan: *Electrical Competition.*—The British Consul at Kobe reports that competition for the supply of electrical machinery into Japan is becoming increasingly severe. British manufacturers secured most of the orders for the first power stations that were erected there, but Continental manufacturers have been cutting prices so drastically that they have secured a number of very important contracts. In addition, native manufacturers are becoming formidable rivals, and an instance is mentioned of an electric cable factory in Kobe which, both as regards price and delivery, holds its own easily against foreign competition. The British Consul points out that, in spite of the fact that the English language is generally adopted in Japanese business circles, there is a lack of British commercial travellers there, and the hope is expressed that British firms will make strenuous efforts to retrieve their losses throughout.

London: *Shoreditch: Charges for Power and Factory Lighting.*—The Council have adopted the Electric Lighting Committee's recommendation of a flat rate for supply for power purposes of 1¼d. per unit, for not less than 1,250 units per quarter, with a load factor of at least 10 per cent. A scale of discounts, varying from 5 per cent. to 20 per cent., according to the quantity taken beyond 1,250 units per quarter, is included in the scheme. A new flat rate, ranging from 2½d. to 3¼d. per unit for factory lighting, has also been adopted. In addition, electrical contractors are to be offered electrical energy at 2½d. per unit for the lighting of their showrooms, whilst the supply for street arc lighting is reduced from 1·9d. per unit to 1·5d. per unit. This will show a saving to the general rate of £1,292 per annum. This new scale of charging will come into force after the September meter readings.

Shoreditch: Electric Lighting Accounts.—The net profit on the electricity undertaking for the year to March 31st was £6,811, against £6,432 in the previous year. The sum of £5,000 is carried to reserve for renewals, £1,614 to change of pressure account, and the balance is carried forward.

New Zealand: *Water Power Development.*—Mr. E. Parry, the recently-appointed Electrical Engineer to the New Zealand Government, has inspected the Lake Coleridge water power area with a view to its utilisation for electric power generation. This scheme has been gone into in some detail, but reports are being obtained regarding other water powers. It is anticipated that the scheme at Christchurch will be completed within two years.

South Africa: *Oudtshoorn.*—The Municipal Council propose to borrow £33,000 to purchase the undertaking of the Oudtshoorn Electric Light and Power Co.

Generating Costs on the Rand.—It is reported that the working expenses at the Kleinfontein station work out at 0·74d. per unit, but it is anticipated that further increase of load will bring this down to 0·4d., or even less.

Stourport: *Electric Lighting.*—After some discussion the Council have agreed to allow the Kidderminster & Stourport Electric Power Co. to distribute electricity by means of overhead wires. Negotiations between the Company and the Council referring to this matter have considerably delayed the introduction of electric light into Stourport.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Atherton.—Larger transformers are to be installed.

Bray.—The Council's Electricity Department invite tenders for 2,500 yards, in 440-yard lengths, of 7/18 S.W.G. concentric paper-insulated and plain lead-covered cable for 2,000 volts pressure. Tenders by 19th inst.

Bridlington.—Mains extensions are contemplated at a cost of £1,500.

Herne Bay.—The Council are considering what steps to take with regard to putting their Electric Lighting Order into force.

Holmfirth.—A ratepayers' meeting has approved of the Council's electricity scheme.

Ireland.—An electric lighting scheme is under consideration by the Cavan Council.

Keighley.—A coal-handling plant is required at the electricity works. Particulars from Borough Electrical Engineer.

Leigh (Lancs.).—The Corporation has received sanction from the Local Government Board to borrow £4,587 for an engine, dynamo, condenser, and switchboard.

London: *L.C.C.*—The London County Council invite tenders by Oct. 24th for (1) overhead travelling crane; (2) high-tension cables; (3) low-tension cables; (4) rotary converters and static transformers; (5) high-tension and low-tension switchgear. (See advertisement on another page.)

Manchester.—The Manchester Electricity Committee require a 4,000 to 4,500 kw. low-pressure exhaust type turbo-alternator. (See an advertisement on another page.)

New Zealand.—The Dunedin municipal authorities require a 500 b.h.p. Diesel or gas engine for rope drive to motor generator running at 500 revolutions per minute, and a Diesel oil engine for driving an 800 k.w. continuous-current generator at 550 volts. Tenders to Town Clerk by Nov. 1st. Specifications, &c., at 73 Basinghall Street, E.C.

Russia.—The *Board of Trade Journal* states that the Archangel municipal authorities are negotiating for a loan of £105,000 for electric lighting and other public services.

OSRAM·LAMPS

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WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Arbroath.—Reconstruction of infirmary.

Birmingham.—Extensions to Birmingham telegraph stores. H.M. Office of Works, London.

Bridlington.—Alterations and additions to the North Eastern railway station. Architect, W. Bell, York.

Colchester.—Electric lighting of new wing at infirmary.

Colwyn Bay.—New concert hall.

Dover.—Girls' school, Barton Road. W. C. Hawke, Borough Engineer, Maison Dieu House, Biggin Street, Dover.

Dublin.—New printing works in Boyne Street, for Messrs. Browne & Nolan, Ltd. Architects, Messrs. Doolin & Butler, Dawson Chambers, Dublin.

Durham.—An electric lighting installation is required at the new stores of the Sherburn Hill Co-operative Society, Wheatley Hill. Architect, J. W. Taylor, St. John Street, Newcastle-on-Tyne.

Falmouth.—A committee has been appointed to consider the cost of wiring the workhouse for electric light.

Finchley.—New elementary school for 1,000 children on the Great North Road.

Glasgow.—Post office extension. Office of Works, G.P.O., Glasgow.

Huddersfield.—New post office.

Ilkley.—Proposed winter garden.

Leeds.—Hostel and training college. Architect, W. P. Schofield, Park Row.

Llanrwst.—Extensions to county school. Architect, W. D. Wiles, 42 High Street, Wrexham.

Manchester.—The Markets Committee invite tenders for electrical plant and wiring at their Cold Air Stores, Elm Street. Particulars from Superintendent, Markets Department, Town Hall, and tenders by September 25th.

Redditch.—Biscuit factory. Mr. B. H. Clark, Crabb's Cross, Redditch.

Sale.—Public baths. Architect, W. H. Mitchell, 9A Market Street, Manchester.

St. Helens.—Extensions to school in Elephant Lane. Architects, Messrs. Biram & Fletcher, George Street.

Wakefield.—Additions to Normanton school. Education Architect, County Hall, Wakefield.

Wigan.—Additions to sanatorium. Borough Engineer, King Street West.

MISCELLANEOUS

Birkenhead.—Six double-deck tramcars are required by the Tramways Committee. Particulars from the Electrical Engineer and Manager, and tenders by Sept. 26th.

Bristol.—Tenders are invited by the Docks Committee for one 10-ton and eight 2-ton electric jib cranes for the Royal Edward Dock. Particulars from Docks Engineer, Cumberland Road, Bristol.

Doncaster.—The Corporation have decided to extend their tramway system on the Balby route to Warmsworth.

Durban.—The Corporation require six miles of 95 lb. steel tramrails with fish plates, bolts and nuts, tie bars, and copper bonds. Particulars from Messrs. Webster, Steel & Co., 5 East India Avenue, Leadenhall Street, E.C., and tenders by Sept. 25th.

London: *Hackney.*—Tenders are to be invited for 100,000 pairs of white open type arc lamp carbons.

Manchester.—The Corporation propose carrying out important extensions of their tramway system in Didsbury, and also to extend the Alexandra Park lines along Alexandra Road South to Chorlton-cum-Hardy.

Mexico.—We understand that the tramway system of San Luis Potosi, Mexico, has been sold to Messrs. Hooghwinkel, Anthony Brown, & Partners, Consulting Engineers, of London. The system includes 14 miles of track in the city and suburbs. The line will now be electrified.

Russia.—The *Board of Trade Journal* states that the Archangel municipal authorities are negotiating for a loan of £105,000 for the construction of electric tramways and other municipal services.

South Shields.—The Tramway Manager is preparing a report upon extending the tramways from the Pier head to Mowbray Road.

Electric Smelting.—It is stated that a large electric smelter is to be erected at Kenora, Ontario, in connection with the iron deposits there.

TENDERS RECEIVED AND ACCEPTED

Gateshead.—Messrs. Chamberlain & Hookham, Ltd., have received an order for the equipment of the whole of the Council's cars, viz., 140, with meters.

Lewes.—The tender of the Lewes & District Electric Supply Co., Ltd., for lighting 127 street lamps was discussed at the last meeting of the Council, and was referred back to the Highways Committee for further consideration. The tender represents a saving of about £147 per annum over the price now paid for gas.

London: *Battersea.*—The Council have accepted an offer by Mr. Haydn Harrison to purchase a number of arc lamps which have been displaced in connection with the public lighting conversion scheme. The following tenders have been accepted at schedule rates :—British Insulated & Helsby Cables, Ltd., for 315 ironclad fuse-boxes; W. T. Henley's Telegraph Works Co., Ltd., for 45 two-way switches; Messrs. Lucy & Co., for 45 fuse-boxes and 70 pairs of porcelain bridge fuses.

Manchester.—Tenders for 20,000 tons of best washed slack at 9s. 9d. per ton, and 10,500 tons at 9s. 10d. per ton, were accepted by the Manchester Corporation last week. The interest attaching to these contracts is that at the previous meeting of the Council contracts were recommended with the firms in question, but were referred back as many members of the Council urged that the price should be lower. Since then, however, the market price has gone up, and the Committee have been forced to pay 5d. per ton more than they would have done had their original recommendation been adopted.

Nelson.—The tender of Messrs. Davidson & Co., of Belfast, has been accepted for the supply of a 40 in. induced draught fan for the electricity works stack.

Stockton.—A contract has been placed for a mixed pressure turbine coupled to a Siemens direct-current 400 to 500 kw. generator at £2,923. It is anticipated that the completion of this extension will effect a saving of about 20 per cent. in fuel consumption.

Wolverhampton.—The following tenders have been accepted by the Electricity Committee :—Two motor-driven boosters, the Phœnix Dynamo Mfg. Co., £1,538; battery switchgear, the Electric Construction Co., £1,058 9s.; 400 kw. motor converter and control apparatus, Bruce Peebles & Co., Ltd., £1,060.

APPOINTMENTS AND PERSONAL NOTES

The Hackney Electricity Committee recommend an increase in the maximum salary of Mr. T. Dawby, Works Superintendent, from £200 to £250 per annum. The salary of Mr. E. Matthews, Testing Engineer, is recommended for increase from £130 to £160 per annum by yearly increments of £7 10s., and that of Mr. E. Wilkinson, Deputy Generating Engineer, from £117 to £125 per annum.

An electrical engineer seeks an appointment as representative of a firm of good repute at the Olympia Electrical Exhibition. (See an advertisement on another page.)

In announcing that the secretaryship has now been filled by the appointment of Mr. D. N. Dunlop, the Council of the British Electrical and Allied Manufacturers' Association (Incorporated) beg to return their best thanks to all those gentlemen who were good enough to respond to their recent advertisement inviting applications for it.

There are two vacancies for junior assistants in the Civil and Mechanical Engineering Department of the City and Guilds Engineering College, London. Salary, £150 per annum. (See advertisement on another page.)

Re-union of Old Cromptonians.—A few of those associated with Messrs. Crompton & Co. in the earlier days have arranged to hold a dinner of Old Cromptonians in London on October 14th next, with the object of giving those who were at one time closely associated, and have since drifted apart, an opportunity of renewing friendships, and of spending a pleasant evening. The arrangements are in the hands of a committee consisting of Messrs. W. A. Chamen, S. Dobson, E. J. Fox, H. M. Leaf, W. L. Pakenham, C. Peel, and A. H. Pott, and already some seventy-five old members have indicated their intention of being present at the dinner. Colonel R. E. B. Crompton, C.B., has accepted the committee's invitation to preside at the dinner, and Mr. W. A. Chamen will act as vice-chairman. Anyone who has been associated with the firm, and has not already received notice of the dinner, can obtain full particulars by applying to the Honorary Secretary, Mr. E. J. Fox, Winchester House, Old Broad Street, E.C.

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MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £57 5s. to £57 15s. (last week, £57 15s. to £58).

Fire.—The Imperial Lighting Company of London inform us that the fire which occurred at their premises at Pocock Street was practically confined to the packing department. The damage was confined to a large number of electrical signs and illuminating material for the Delhi Durbar.

Feld Bros. & Co., Ltd.—This firm have removed to more commodious offices and stores on the ground floor of 25 Budge Row, Cannon Street. Their new telephone number is 1501 London Wall.

Glover's Glasgow Offices.—Messrs. W. T. Glover & Co., Ltd., of Manchester, have removed their Glasgow offices and stores to 158 Hope Street, Glasgow. The Telephone Number has been changed to 3856 Douglas, Glasgow, and the Telegraphic Address remains as before, viz., "Conductors," Glasgow.

Bankruptcies.—The last day for receiving proofs in the bankruptcy of G. V. Barker, Electrical Engineer, of Leeds and Harrogate, is Sept. 23rd. The trustee is Mr. D. S. Mackay, The Red House, Duncombe Place, York.

The trustee in the bankruptcy of J. W. Barnet, Electrical Engineer, 25 Waterloo Road, Burslem, Staffs, has been released.

Electric Ambulances in London.—The Port of London Authority will shortly have delivered four electric ambulances, similar to those at present being used by the City of London Corporation, and which were described in detail in ELECTRICAL ENGINEERING, Vol. I., p. 654. It is proposed to use these vehicles for the Victoria and Albert, Surrey Commercial, London, and the West India dock areas. The estimated cost of the maintenance of this service is put at £4,000 per annum.

Forthcoming Book.—Messrs. Rentell & Co., of 36 Maiden Lane, Strand, will shortly publish a new book by Mr. W. Perren Maycock, entitled "Small Switches, &c., and their Circuits." This will deal exhaustively with various types and forms of small switches and other accessories, and with their connection to lamps, motors, heaters, &c.

NEW COMPANIES

GROSSART & KAY, 196 St. Vincent Street, Glasgow. Capital £1,000. Private company. To carry on electrical engineering business, &c., formerly carried on by W. J. Grosart, trading as Grosart & Gray.

CURTIS & CO.—Private company. Capital, £2,000. To carry on business of electrical engineer, &c., formerly conducted by W. Curtis at 24 York Place, Portman Square. Office, 101 Leadenhall Street.

ORIENTAL M.T.C.—Capital, £10,000. Financiers, electrical engineers, &c. To adopt agreement with Radio & Electric Power Co. Private company. First directors, W. J. van Hoytema and A. C. Grover. Registered by A. J. Greenof & Co., Bush Lane House, Cannon Street, E.C.

BERG, SHEPHERD & CO.—Capital, £1,250. To acquire business of J. Berg carried on at 128 East Road, London, and to adopt agreement with J. Berg and F. H. Shepherd. Private company. Registered by Jenkins, Bakers, Reynolds & Co., 38 Old Jewry, E.C.

INGLEBY & CO., Elland Road, Leeds. Capital, £10,000. To take over an existing electrical engineering business.

PHŒNIX TELEPHONE & ELECTRIC WORKS, 6 Chatsworth Road, Brondesbury. Capital, £50,000. Manufacturers of electrical machinery and telephonic apparatus and appliances. H. O. Oppenheimer, of the above address. is chairman and managing director.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Oxford Electric Co.—Interim dividend for the June half year at the rate of 6 per cent. per annum less discount.

The L.C.C. School of Building.—The London County Council, in sending us the prospectus of the L.C.C. School of Building, Ferndale Road, Brixton, S.W., call our attention to the increased facilities that are now being given for the study of reinforced concrete construction. An elementary as well as an advanced evening course is given by Mr. H. Kempton Dyson (Secretary of the Concrete Institute), assisted by Messrs. R. G. Keevill and A. E. Crabbe.

The India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
MANUFACTURE
TELEGRAPH and TESTING INSTRUMENTS.
ILLUSTRATED PRICE LIST ON APPLICATION.
HEAD OFFICES: 106, Cannon Street, London, E.C.
WORKS: Silvertown, London, E.

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TRADES DIRECTORY
OF
ADVERTISERS IN "ELECTRICAL ENGINEERING."

(One Free Entry is given to every Advertiser. Entries under additional headings, 6d. per insertion.)

ACCESSORIES (Electric Light and General Supplies).
Cable Accessories Co., Ltd., Britannia St. Works, Tividale, Staffs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.

ACCUMULATORS.
Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Electrical Power Storage Co., Ltd., 4, Great Winchester St., E.C.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Tudor Accumulator Co. Ltd., 119, Victoria St., S.W.

AIR COMPRESSORS.
Belliss & Morcom, Ltd., Birmingham.

AUCTIONEERS AND VALUERS.
Wheatley Kirk Price & Co., 46, Watling St., E.C.

ALUMINIUM.
British Aluminium Co., Ltd., 109, Queen Victoria St., E.C.

ARC LAMPS AND ACCESSORIES.
Beck Flame Lamp, Ltd., Suffolk House, Laurence Pountney Hill, E.C.
British Thomson-Houston Co., Ltd., Rugby.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.
Jandus Arc Lamp and Electric Co., Ltd., Hartham Works, Holloway.
London Electric Firm, Croydon.
Oliver Arc Lamp Ltd., Cambridge Place, Burrage Rd., Woolwich.
Union Electric Co., Ltd., Park Street, Southwark, S.E.

ARMATURE REPAIRS.
Marryat & Place, 28, Hatton Garden, E.C.

CABINET WORK.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.

CABLES.
Aubert, Grenier and Co., 68a, Lincoln's Inn Fields, W.C.
British Insulated and Helsby Cables, Ltd., Prescot, Lancs.
India Rubber, Gutta Percha, & Telegraph Works Co., Ltd., 106, Cannon St., E.C. and Silvertown, E.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O., Kent.
Macintosh (Chas.) & Co., Ltd., 22 & 23, Jewin St., E.C.
Rickard (Wm.), Ltd., Ashbourne Road Mills, Derby.
Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.
Union Cable Co., Ltd, 27, Eagle Wharf Rd., N.

CATALOGUES AND PROCESS ENGRAVING.
Swain (John) & Son, Ltd., Shoe Lane, E.C.

CONDENSING PLANTS.
Belliss & Morcom, Ltd., Birmingham.
Willans & Robinson, Ltd., Rugby.

CREOSOTED POLES.
Wade (Richard), Sons & Co., Ltd., Garrison Side, Hull.

DYNAMOS, see Motors and Dynamos.

EBONITE.
Traun (Heinr.) & Sons, 23a, Goswell Rd., E.C.

ENAMEL (Anti-Sulphuric).
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

EXHIBITION STANDS.
Erdman (M.) & Son, 26a, Theberton Street, N.

FLEXIBLE METALLIC TUBING.
United Flexible Metallic Tubing Co., Ltd., 112, Queen Victoria St., E.C.

GAS AND OIL ENGINES.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Diesel Engine Co., Ltd., 179, Queen Victoria St., London, E.C.
M.A.N. Co., Caxton House, Westminster, S.W.

HEATING AND COOKING APPARATUS.
Bastian Electric Heating Syndicate, Ltd., Palmerston House, Old Broad St., E.C.
British Prometheus Co., Ltd., Salop St. Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Purcell & Nobbs, 87–89, Cleveland Street, W.
Simplex Conduits Ltd., 113—117, Charing Cross Rd., E.C.

INSTRUMENTS.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Standardizing and Testing Institution, 62—70, Southampton Row, W.C.
Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
Ferranti, Ltd., Hollinwood, Lancs.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon St., E.C.

INSULATING MATERIAL.
Weidmann (H.), Rapperswil, Switzerland.

INSULATING VARNISH.
Blume (Chas. H.), The White Building, Sheffield.
Pinchin, Johnson & Co., Ltd., 26, Bevis Marks, E.C.

INSURANCE.
Phœnix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LACQUERS.
The Fredk. Crane Chemical Co., 22 & 23, Newhall Hill, Birmingham.

LAMPS (Incandescent).
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Manfg. Co., Ltd., Trafford Park, Manchester.
Brush Electrical Engineering Co., Ltd., 1, Kingsway, W.C.
Cryselco, Ltd., Kempston Works, Bedford.
Drake & Gorham, Ltd., 66, Victoria St., W.C.
Electrical Co., Ltd., 122/4, Charing Cross Rd., London, W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Imperial Lamp Works (Brimsdown), Ltd., Kingsway House, W.C.
Krupka & Jacoby, 11, Queen Victoria St., E.C.
Siemens Bros. Dynamo Works, Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.
"Z" Electric Lamp Manufg. Co., Ltd., Orient House, New Broad St., E.C.

LIFTS AND CRANES (Electric).
Stannah (J.), Skin Market Place, Bankside, S.E.
Waygood (R.) & Co., Ltd., Falmouth Road, S.E.

MACHINE TOOLS.
Drummond Bros., Ltd., Churchill Works, nr. Guildford, Surrey.
Taylor & Challen, Ltd., Constitution Hill, Birmingham.

METERS.
Aron Meter Co., Ltd., 80A, Salusbury Road, Kilburn, N.W.
Bastian Meter Co., Ltd., Kentish Town, N.W.
British Thomson-Houston Co., Ltd., Rugby.
Electrical Co., Ltd., 122/4, Charing Cross Rd., London, W.C.
Ferranti, Ltd., Hollinwood, Lancs.

MINE EQUIPMENTS AND APPARATUS.
British-Thomson Houston Co. Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Ellison (George), Warstone Lane, Birmingham.
Ferranti, Ltd., Hollinwood, Lancs.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Johnson & Phillips, Ltd., Victoria Works, Charlton, S.O. Kent.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Union Electric Co., Ltd., Park St., Southwark, S.E.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.
Adnil Electric Co., Artillery Lane, London, E.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Electromoters, Ltd., Louisa St., Openshaw, Manchester.
General Electric Co., Ltd., 67, Queen Victoria St. E.C.
Ingleby & Co., Elland Road, Leeds.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.
Vickers, Ltd., River Don Works, Sheffield.
Wright & Wood, Ltd., Century Works, Halifax.

PACKING.
United States Metallic Packing Co., Ltd., Bradford.

PATENT AGENTS.
Lorrain (J. G.), Norfolk House, Norfolk St., W.C.
Raworth (J. E.), 30, Broadway, Westminster.

PRESSPAHN, &c.
Weidmann (H.), Rapperswil, Switzerland.

PUMPING PLANT.
Willans & Robinson, Ltd., Rugby.

STEAM CONSUMPTION RECORDERS.
Lea Recorder Co., 28, Deansgate, Manchester.

STEAM ENGINES AND TURBINES.
Belliss & Morcom, Ltd., Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
Howden (Jas.) & Co., Ltd., 195, Scotland St., Glasgow.
Vickers, Ltd., River Don Works, Sheffield.
Willans & Robinson, Ltd., Rugby

SWITCHGEAR.
Adams Manufacturing Co., Ltd., 106, New Bond St., W.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Brown, Boveri & Co., Ltd., Caxton House, Westminster.
Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, S.E.
Ellison (George), Warstone Lane, Birmingham.
Ferranti Ltd., Hollinwood, Lancs.
Reyrolle & Co., Ltd. Hebburn-on-Tyne.
Union Electric Co., Ltd., Park St., Southwark, S.E.

TECHNICAL BOOKS AND JOURNALS.
Blackie & Son, Ltd., 50, Old Bailey, E.C.
Cassell & Co., Ltd., La Belle Sauvage, E.C.
Constable (Archibald) & Co., Ltd., 10 Orange St., Haymarket, W.
Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C., and 121a, Victoria St., S.W.
Electric Journal, 422, Mansion House Chambers, E.C.
Electrical Engineering Abstracts, 57–58, Chancery Lane, London, W.C.
Griffin (Charles) & Co., Ltd., 12, Exeter Street, Strand, W.C.
Indian Industries and Power, 204, Temple Chambers, E.C.
International Institute of Technical Bibliography, 57 & 58, Chancery Lane, E.C.
Lewis's Scientific Circulating Library, 136, Gower Street, W.C.
Longmans, Green & Co., 39, Paternoster Row, E.C.
National Telephone Journal, Telephone House, Victoria Embankment, E.C.
Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C.

TELEPHONES.
British Insulated & Helsby Cables, Ltd., Prescot, Lancs.
British L.M. Ericsson Mfg. Co., Ltd., 82–85, Fleet St., E.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Graham (Alfred) & Co., St. Andrew's Works, Crofton Park, London, S.E.
Sterling Telephone & Electric Co., Ltd., 200, Upper Thames St., E.C.
Western Electric Co., Ltd., North Woolwich, E.

TESTING LABORATORIES.
Electrical Standardizing & Testing Institution (Faraday House), 62–70, Southampton Row, W.C.

VACUUM CLEANERS.
Duncan Watson & Co., 62, Berners St., W.

VULCANISED FIBRE.
Mosses & Mitchell, 122–124, Golden Lane, E.C.

WATCHES.
Leecla Watch Co., 215, Old Street, Ashton-under-Lyne.

WIRELESS TELEGRAPH APPARATUS.
Marconi's Wireless Telegraph Co., Ltd., Watergate House, Adelphi, W.C.

WIRING CONTRACTORS. See page iv.

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Supplement to "Electrical Engineering" of Sept. 21, 1911.

THE ELECTRICAL EXHIBITION OF 1911

PART I.

Published by

THE PROPRIETORS OF "ELECTRICAL ENGINEERING," 203-206 TEMPLE CHAMBERS, LONDON, E.C.

AND ALSO ON SALE AT STAND NO. 152, ELECTRICAL EXHIBITION, OLYMPIA.

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ACCIDENTAL DAMAGE,

whether caused to persons or things, is quite one of the greatest of life's tribulations. Proper care will avoid a great part of the damage which would otherwise occur, through sheer lack of consideration of the difficulties to be encountered.

The waiter in the illustration might, with care, have avoided the pitfalls which lay at his feet; the engineer can as easily provide for contingencies resulting in damage or breakdown to parts of the installation under his care or supervision by the adoption of suitably designed and constructed fittings.

In factory and mill work this is especially the case. Obviously it is necessary in such situations to provide that lamps (especially when metallic filament lamps are used which are valuable) shall not be accidentally broken by careless employees, or that the wiring itself shall not become unduly exposed to risk of mechanical injury.

One of the firms which have taken this phase most seriously is undoubtedly Simplex Conduits, Limited, if it is possible to judge from the complete manner in which they have dealt with the question.

It is not possible for any single firm to place at the disposal of their customers a more complete range of watertight mill and factory fittings. One typical example is illustrated.

To outward appearances there would seem to be no substantial difference between it and any fitting of the type (which, when all is said and done is well known) of the same nature manufactured (in one or two cases) and factored (in most cases) by other people.

But examination of the construction of the fitting demonstrates where the difference lies. In those supplied by Simplex Conduits, Limited, the quality of the casting would reflect credit on any foundry, whilst there is that about the general finish, weight of the brass parts, and assembling that leaves the observer without any doubt whatever of the fact that there has been no attempt to "scamp" the fitting in a vain endeavour to reduce price.

Price, however, has none the less been considered. There are instances where it is of necessity the deciding factor, and, on the other hand, where quality tells. Simplex Conduits, Limited, are well able to fill the bill in either case. There is to be seen at their exhibit a range of cheap cast-iron fittings, listed at a figure calculated to compete everywhere, and another range made of malleable iron, with vitreous enamelled reflectors and various adjuncts which go to make a high quality article.

These fittings may be had plain or with shade and wire guard and with plain down tube or bent arm for use as a bracket lamp. When head room is limited a useful pattern is shown in which the lantern portion of the fitting is part of the box into which the conduit directly screws. This type affords special protection for the conductors against mechanical injury or damage by moisture.

Space permits no more than a mere reference to the wide range of fittings of a similar type manufactured for the reception of high candle-powered lamps or clusters of lamps and of various designs to suit the many tastes and requirements of electrical engineers.

These include both cast-iron and spun metal fittings, outside lanterns for attaching to street posts, cargo fittings for ship and colliery work, and so on. In all cases suitable bracket arms for supporting these fittings either with a spigot, a double-pole switch box for going on top of a post, or with a metal band for attaching to a pole are available.

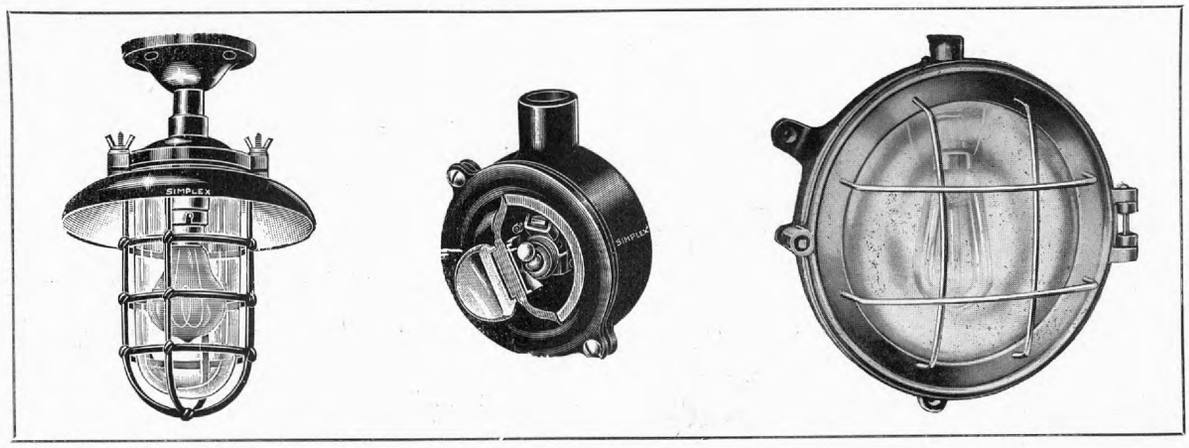
In watertight switches and wall-plugs some excellently designed fittings are put on the market and exhibited at stands Nos. 148 and 163 at the Electrical Exhibition.

Type No. 7484, illustrated herewith, is unique in that it has the smallest projection of any watertight switch on the market. The switch is actuated by a quarter turn of the brass milled head, and so arranged that a perfectly quick break is assured. The design gives such perfect watertightness that the switch may be safely operated even under water.

No article dealing with the manufacture of watertight fittings would be complete without reference to those suitable for shipwork. Simplex Conduits, Limited carry out brass-casting work of the same high quality that characterises their iron fittings. As requirements vary so largely it is impossible for the Company to show more than one or two typical patterns, of which one is illustrated below.

Careful examination of the actual fittings just described will carry the conviction that each one is calculated to fulfil its object, *i.e.* the prevention of ACCIDENTAL DAMAGE. Factory and mining engineers should not fail to visit

STAND Nos. 148 and 163.



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THE ELECTRICAL EXHIBITION OF 1911

IT may be regarded as a foregone conclusion that the Electrical Exhibition which will be opened at Olympia (London) next Saturday will be a success. Its two primary objects will be fulfilled: to bring home to the general public the enormous strides that have been made in electric lighting and other applications of electricity during the last few years, and to draw together into closer touch the various sections of the electrical industry. So far as the first of these objects is concerned, it must be remembered that it is six years since a great electrical exhibition has been held in London. During those six years electric light has ceased to be a luxury. Thanks to the development of the metal filament lamp it has become the most economical method of illumination, not only for large buildings, shops and warehouses, but also for the average dwelling house. The Londoner will not come to the exhibition merely to inspect the latest advances in this fascinating branch of applied science; he will regard the display at Olympia from a more personal point of view, and will visit Olympia largely for the purpose of informing himself of the most recent improvements so that he may derive, as a consumer of electricity himself, a direct benefit from his knowledge of these. He will be able to see that electric cooking has now passed far beyond the experimental stage, and that electric power can serve him not only as applied on tramways and railways and for industrial purposes, but also for such homely uses as the working of vacuum cleaners, boot brushes and the domestic laundry. At the Manchester Electrical Exhibition in 1908, one of the most conspicuous features was the great improvement that had been made in the design of motors, control gear and accessories for power distribution in workshops, which appealed greatly to the industrial public in the Midlands. In London this year such exhibits will not be lacking in number, but we predict that it will be the domestic applications of electricity which will attract the larger proportion of the public.

We are also confident that the second object of the exhibition will be attained, namely, the bringing together of the various sections of the industry. The exhibition has been organised by the British Electrical and Allied Manufacturers' Association—by which name the National Electrical Manufacturers' Association is henceforth to be known—but the chief officials of the electric supply authorities have taken an active part, and the Electrical Contractors' Association is also represented. There is no doubt that the exhibition will be a common meeting ground for the manufacturer, factor, and the contractor, as well as an exhibition for the consumer, and that one of its effects will be to improve the cohesion and solidarity of the different branches of the industry, and generally to increase its efficiency as one great organisation for enabling the public to derive the utmost advantage for the application of electricity.

THE COMMITTEES, ADMINISTRATION, AND MANAGEMENT

THE President of the exhibition is Sir William H. Preece, K.C.B., F.R.S., who will formally open the exhibition at 2 p.m. on Saturday, and who will preside at the inaugural dinner on the previous day. An Honorary Advisory Committee consists of 56 members, including the engineers-in-chief to the various supply authorities in London, several consulting electrical engineers and other prominent men. The Executive Committee is constituted as follows, under the chairmanship of Mr. H. W. Butler:

H. BERRY (Berry, Skinner & Co.).
H. BEVIS (Pirelli, Ltd.).
JOHN CHRISTIE (Borough Electrical Engineer, Brighton, and President of the Incorporated Municipal Association, 1910-11).
A. C. CRAMB (Borough Electrical Engineer, Croydon, representing the Associated Municipal Electrical Engineers of Greater London).
JAMES DEVONSHIRE (Electrical Federation).
D. N. DUNLOP (British Westinghouse Electric & Mfg. Co., Ltd.).
T. E. GATEHOUSE.
T. J. GRAINGER (Sunbeam Lamp Co., Ltd.).
B. LONGBOTTOM (Electromotors, Ltd.).
P. A. LUNDBERG (A. P. Lundberg & Sons).
W. M. MORDEY (Past President of the Institution of Electrical Engineers).
F. H. NALDER (Nalder Bros. & Thompson, Ltd.).
H. OPPENHEIMER.
W. R. RAWLINGS (representing the Electrical Contractors' Association, Incorporated).
H. C. SIDDELEY (Lancashire Dynamo & Motor Co., Ltd.).
F. J. WALKER (General Manager of the St. James' and Pall Mall Electric Light Co., Ltd., representing the Conference of the Chief Officials of the London electric supply companies).
S. D. WHITE (General Electric Co., Ltd.).

Consulting Electrical Engineer:—ALBION T. SNELL.
Honorary Consulting Electrical Engineer:—S. G. CASTLE RUSSELL.

The Business Management and Organisers of the exhibition are the International Trade Exhibitions, Ltd., whose manager, Mr. H. L. Benjamin, has been working in conjunction with Mr. F. B. O. Hawes, secretary of the British Electrical and Allied Manufacturers' Association, both of whom have been indefatigable in dealing with the innumerable details which an exhibition of this character involves. As was the case at Manchester, the actual exhibitors themselves are to participate in the profits of the exhibition—a benefit which, we believe, the exhibitors derive in no other trade exhibition of this character. After organisation and administration expenses have been deducted from the gross profits, the balance goes to the British Electrical and Allied Manufacturers' Association, who will doubtless allocate sums to the benevolent funds connected with the industry, as has been done in previous years, and this year it is not inconceivable that a part of the profits will be retained towards the cost of extending the scope of the Association before the balance is distributed.

SOME OF THE FEATURES OF THE EXHIBITION

While the main attractions at the exhibition, at any rate to the large body of our readers, will be the exhibitors' stands, mention may be made of some of the other features. A large electric sign, erected by the Imperial Lighting Co., will cover the whole front of the building. It will be in the form of a very large "Union Jack," in the centre of which will be the words "Electrical Exhibition, September 23 to October 21." The letters will be 3′ 6″ high, and will be fitted with metallic-filament lamps, and on both sides there will be coloured electric lamps on "fairyland" strip, with fairyland reflectors. At each end of the frontage there will be a 100-ampere searchlight, throwing the light on the dome of the building, and adjacent

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to these searchlights will be a large imitation electric fountain. Between the imitation fountain and the centre of the building will be representations of lightning flashes with a controller to make the lamps light in quick succession until the point of the flashes is reached, when an electric sign consisting of the words "Heating, Cooking, Lighting, Power" will immediately light up. After a short interval these words are extinguished, and the lightning flashes recommence. The total current consumed will be about 230 amps. at 220 volts, the searchlights working two in series.

In addition to the signs on the exhibitors' own stands, some fine signs will also be shown on the gallery rails. The British Thomson-Houston Co. will have on the gallery over the entrance to the exhibition a sign 32 feet long and 3 feet 6 inches high. It will contain nearly 3,000 Mazda lamps, and, by means of a flasher at ten-second intervals, seven different changes of wording will be shown.

Siemens Bros. Dynamo Works are also erecting a 32-foot sign on the gallery balustrade at the end of the hall, and on this their "focus" tantalum lamps will be employed. It will have in all 200 25-c.p. lamps of this pattern, and will be totally enclosed in a plate-glass covered case. The letters are of bevelled wood and gilt; they are 3 feet high, and each letter is wired separately. Messrs. Siemens have also an illuminated sign over their stand, and two other signs of a new type on the gallery at each side of the hall.

Two working electric lifts will be shown. R. Waygood & Co., Ltd., will have a full-sized passenger lift for conveying passengers to the gallery. This is operated by a car switch with self-centring detachable handle in the cage, the gates being fitted with electrical and mechanical locks to prevent the lift being worked while any gate is opened, and to prevent the gates being opened unless the cage is opposite the floor. The second passenger lift in operation is by Marryat & Place. It is erected in a steel tower about 40 feet high, and is fitted with special safety features, a two-speed arrangement, and an automatic floor-levelling device.

Electric cooking will be much in evidence. Several firms are showing cooking apparatus on the ground floor, and cooking demonstrations will also be carried on in the gallery.

An exhibit of great interest to the general public as well as to the electrical engineer visitors will be the Marconi apparatus. The Marconi Co. is erecting a station on the gallery and another on the main floor, and wireless messages will be sent between the two stations. The telewriter will also be shown at a stand on the ground floor. A historical Post Office exhibit on the gallery will, we understand, be even more interesting than on previous occasions, and the Exhibition telephone exchange will be in the building itself, on the ground floor.

An interesting negative feature at the Exhibition, if we may use the term, is that there will be no band. At the Manchester Electrical Exhibition three years ago there was an excellent band every day, but this was not an entire success; those who desired to listen to the music were disturbed by the loud electric bells, hooters, and the noise of moving machinery shown by the exhibitors, while the exhibitors near the band gallery frequently found it hard to talk to their visitors, and were also embarrassed by the crowd who came to hear the music, and prevented access of others to the stands near it. Not only will there be no band, but, with the exception of the electric piano in the electric home, there is to be no mechanical piano or orchestrion, and we anticipate that phonograph and gramophone exhibits will not be numerous.

No public lectures have been arranged on this occasion in connection with the Exhibition; the entertainments of this character will doubtless be sufficiently well provided by the exhibitors themselves. It is anticipated, however, that several electrical and allied societies will hold meetings at the Exhibition, but the details have not yet all been arranged. The Junior Institution of Engineers will visit the Exhibition on Tuesday next, and it is anticipated that there will be an attendance of over seventy members; and the Electrical Contractors' Association has also decided to have a meeting there, the date of which has not yet been fixed.

THE ELECTRIC HOME

The whole width of the gallery at the opposite end of the hall to the main entrance will be occupied by a suite of rooms which have been erected by Messrs. John Barker & Co., Ltd., of Kensington, in which the application of electricity to domestic purposes will be shown in its entirety. The exterior of this suite will be decorated in the French Renaissance style. The dining-room will be Georgian, with Queen Anne furniture; the drawing-room Colonial Adams, with panels filled with Rose du Barry wallpaper, the furniture being Adams; whilst the bedroom will be decorated in the simple Adams style, with Sheraton furniture. The hall will be broad and simple in treatment, with rough surfaced walls. There will also be a bath-room, kitchen, scullery, and laundry.

Current for this suite of rooms will be generated by a 4-h.p. paraffin electric lighting set, generating at 50 to 70 volts. Owing, however, to the Exhibition regulations, which prohibits the running of such a paraffin engine, a motor supplied from the Exhibition mains will be connected direct on to the shaft of the engine, and the set will be worked by this means. There will also be a 50-volt, 27-cell, E.P.S. battery, which will not, however, be charged, but will be shown as forming one of the necessary items of a country-house plant. An electrically-driven pump will also form part of the equipment. The engine-room, which will be ventilated by an electric fan, together with the battery-room and laundry, will be in a house separated from the living rooms by a garden. Practical demonstrations will be given of laundry work, using electric irons and other apparatus. The hall will be lighted by five-light Georgian ceiling fitting, with a handsome cut-glass bowl, and there will also be an electric hat pad, cigar lighter, and an electric log-fire. The equipment of the dining-room will include electric kettles, hot plates, coffee machines, plate warmers, &c., whilst the lighting will be by means of a six-light candelabra in the centre, and four three-light brackets. There will, of course, be an electric radiator. The special feature of the drawing-room will be the concealed lighting, by means of 66 lamps in the cornice. There will also be a number of floor standards, bronzes, &c. Demonstrations of electric massage treatment will be given in the bedroom, whilst one of the best-known lady cooks in London has been engaged to give cooking demonstrations in the kitchen. An electric light bath is fitted in the bath-room, and there will also be an entirely new water-heater, which Messrs. Barker are showing for Messrs. Eastman & Warne. A Therol water-heater is included in the equipment of the scullery.

OPENING OF THE EXHIBITION

An inaugural banquet will he held on Friday at the Trocadero, 7 p.m., at which the President, Sir W. H. Preece, K.C.B., F.R.S., will preside. All the exhibitors have been invited to this, in addition to the Honorary Advisory and Executive Committees, and a number of other distinguished patrons. Sir William Preece will formally declare the Exhibition open on

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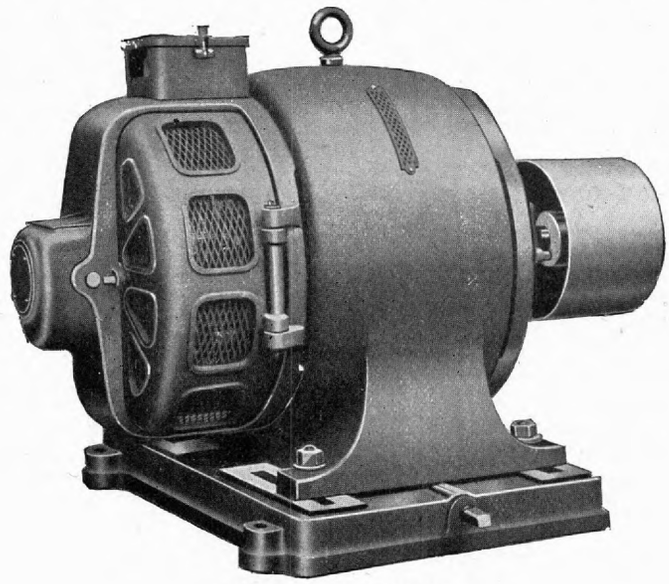
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Saturday at 2 p.m. It should be noted, however, that the doors of the Exhibition will actually be opened to the public at 10.30 a.m. on Saturday, and we desire to impress on all exhibitors the desirability of having their stands absolutely complete by that time.

ELECTRIC LIGHT AND POWER SUPPLY AT THE EXHIBITION

IT is only natural that the possibilities of electric light and power are being taken advantage of extensively at an electrical exhibition, and a few notes on the arrangements made for an adequate supply of current to exhibitors and for the general purposes of the exhibition will be of interest.

The whole of the supply for light and power, with some very small exceptions, where exhibitors are providing their own generating plant, is obtained from the electricity works of the Hammersmith Borough Council at Fulham Palace Road, and Mr. H. H. Bell, the Borough Electrical Engineer has made special arrangements to ensure continuity of supply by the provision of two separate direct feeders always fed respectively from completely separate and unconnected generating plant in the station. This supply is given to the New Olympia Co. at 2,000 volts two-phase 50 cycles, and inside the building is dealt with by the company and the exhibition authorities in the following way:—First of all there is a single-phase distribution all over the building for ordinary lighting and for the use of exhibitors at 220 volts. This is obtained from two separate sets of permanent transformers, one for each incoming main placed in different parts of the building so that the two supplies are distinct throughout, and the lighting is grouped on the two circuits so that the failure of one will throw no part of the building into darkness.

Three-phase and continuous current supplies will also be available throughout the exhibition from a special substation, itself forming an exhibit and situated on the east side of the main hall at stand 241. Here, within a red-brick building with armoured glass inspection windows, will be for the three-phase supply a group of transformers manufactured by the British Electric Transformer Co., arranged according to the Scott connection to transform from 2,000 volts two-phase to 220 volts three-phase, and capable of an output of 150 kw. In the same substation will be the plant for giving the continuous current supply. For this purpose first of all, a rather larger group of transformers, also arranged in the Scott connection, convert to three-phase at about 650 volts, and the supply is further transformed to six-phase in another transformer at a suitable voltage for the supply to a special rotary converter. This machine, which has been made by Messrs. Vickers, Ltd., has an output of 300 kw. at 220 volts continuous. A small induction motor is provided for starting up, and the machine, situated on the stand outside the transformer house, will form an attractive exhibit. It should be mentioned that the controlling switch-gear for the rotary converter was supplied by Messrs. Ferranti, Ltd., while Messrs Johnson and Phillips are responsible for the switch-gear on the high tension side of the transformers.

In addition to the 300 kw. obtainable from the rotary converter a further continuous current supply of 150 kw. is also available from two motor generators in permanent substations on opposite sides of the building, one conected to each of the main feeders from the Hammersmith Electricity Works, and thus taking full advantage of the duplication of the supply.

The distribution about the exhibition does not call for special remark; substantial steel conduit tube is used throughout, and there will be junction boxes at convenient points in the floor of the main hall, under the galleries and in the roof of the annexe. The exclusive contract for the meters, main switches, &c., on the actual stands was given to Messrs. Ferranti, Ltd.

As mentioned already, a few exhibitors will generate current by generating plant on their stands. The plant in question will include gas and oil engines, but there will be no working steam plant and no boilers of any kind in the exhibition.

The charges to exhibitors are according to the following schemes: Alternating current for small demands can be obtained for fixed inclusive sums of £2 2s. up to 0·28 kw., £3 15s. up to 0·56 kw., or £5 5s. up to 0·84 kw. maximum demand. Single- or three-phase supply by meter for larger loads will be charged, whether for lighting or power, at 2½d. per unit, and continuous current at 3½d. per unit, in addition to terminal charges, varying from £3 3s. for 2 kw. up to £20 for 20 kw., which include meters, &c. In the case of three-phase supply an extra amount will be charged for hire of distributors, which have to be specially run from the substation.

These charges will seem at first sight high as compared with those in vogue especially for power elsewhere, but it must be remembered that exhibition conditions are not favourable to cheap power supply. Not only has plant to be maintained at the generating station, which is only called upon during a small part of the year, but within the exhibition considerable sums have to be spent in temporary plant mains and connections which has only four weeks in which to recoup itself.

An excellent set of rules has been drawn up as regards the installations on the stands themselves, the rigid enforcement of which should eliminate all fire risk. Restrictions are placed on the capacities of the branch circuits, and certain requirements are imposed as regards switches, fuses, and conductors. "Fairyland" and similar strips are allowed, but unless the holders are metal backed, must be mounted on fireproof material. E.L.B. strip is only allowed in iron cases with glass fronts. Special regulations apply to the number of lamps for circuit in illuminated signs, and adequate precautions regarding fireproof construction are insisted on. Equally reasonable regulations apply to arc lamps and motors.

The whole installation is being carried out under the supervision of Mr. Albion T. Snell, consulting engineer to the exhibition, while Mr. S. G. Castle Russell is acting as hon. consulting electrical engineer. Many of the detailed arrangements are due to Mr. F. B. O. Hawes, upon whom, as secretary of the executive committee, much work is devolving, and we must express our thanks to him for courteously putting information at the disposal of our representative at a time of great pressure of work.

BOOKSELLERS AND TECHNICAL BOOKS.

There are few booksellers, if any, who are in a position to keep in stock a complete library of the latest and best technical books. It would be an enormous convenience to engineers and students who wish to obtain a book on any particular subject if they could go to a bookshop with the confidence that they can immediately be shown there the latest, best, and most up-to-date books which treat of it.

Arrangements have been made by the Kilowatt Publishing Co., Ltd., to afford this facility to electrical engineers who are visiting the Electrical Exhibition at Olympia.

At Stand No. 152, which bears in bold letters the legend "Electrical Engineering," there will be open to inspection and purchase almost every good book on electrical and allied subjects. These have been selected under the guidance of the editorial and reviewing staff of ELECTRICAL ENGINEERING, which includes eminent specialists in all branches. The stand is situated near the centre of the hall, slightly to the right of the main avenue.

For Notes on Exhibitors' Stands, see p. 8.

For Key Plan and Alphabetical List of Exhibitors, see pp. 12 and 15.

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THE EXHIBITORS' STANDS

We have already mentioned some of the leading features at the Exhibition, and we append some notes giving the chief contents of the stands of some of the principal exhibitors. To avoid any invidious distinctions, we have arranged the firms in alphabetical order, and not in order of magnitude.

THE ADAMS MANUFACTURING CO., LTD.—Motor-controlling apparatus, many in action, and an example of the application of their metallic theatre dimmer.

JOHN BARKER & CO., LTD.—Completely furnished electric home, of which particulars are given on another page.

THE BASTIAN ELECTRIC HEATING SYNDICATE, LTD.—Heaters of various descriptions employing the Quartzalite resistance element. Electric irons and cooking appliances.

THE BASTIAN METER CO., LTD.—Electrolytic meters.

THE BENJAMIN ELECTRIC, LTD.—New forms of lampholders, cluster fittings, &c., not requiring internal wiring, special reflectors, window lighting fittings, &c.

THE BERRY CONSTRUCTION CO., LTD.—In addition to an electric cooking demonstration in the gallery, the company will exhibit their latest forms of "Tricity" cookers, &c., on their stand in the main Hall.

G. M. BODDY & CO.—Wire-drawn tungsten filament lamps.

THE BRITISH ALUMINIUM CO., LTD.—Samples of aluminium as used in the electrical industry. Cables, transmission line material, switchboard connections, and coils for railway motors.

THE BRITISH ELECTRIC TRANSFORMER CO.—Transformers of various kinds, and auxiliary apparatus connected therewith.

THE BRITISH PROMETHEUS CO., LTD.—High class electric cooking appliances and apparatus in action.

THE BRITISH THOMSON-HOUSTON CO., LTD.—An important feature of this exhibit will be the display of Mazda drawn-wire filaments lamps for all purposes. B.T.H.-Edison and Gem lamps will also be exhibited, and Holophane and other special shades and reflectors will be shown in conjunction with Mazda lamps. Other exhibits on the stand will include motors, instruments, heating and cooking devices, rheostats, and regulators, and automatic contactor switches in operation, as well as Tirrill regulators, transformers, arc lamps, and other examples of switchgear plant and apparatus forming a comprehensive display.

THE BRUSH ELECTRICAL ENGINEERING CO., LTD.—A Brush-Parsons combined action and reaction mixed pressure turbine, with continuous-current generator. A small generating set with reciprocating engine, motors, hoists, grinders, &c., and a demonstration of the collector gear of the Bremen system of railless trolley traction. Metallum lamps.

THE BRIMSDOWN LAMP WORKS.—Brimsdown metal filament lamps manufactured in Great Britain by the colloid tungsten process. An entirely new reflecting illumination strip.

C. W. BURTON GRIFFITHS & CO.—Machine tools.

CALLENDER'S CABLE & CONSTRUCTION CO., LTD.—Underground junction boxes, feed pillars, a special colliery winding-drum, samples of special alloys, preservative paints, and insulating materials. The company will also exhibit the "Fors" accumulator, which they manufacture for Messrs. Richard Pape, Ltd.

DRAKE & GORHAM, LTD.—Frisby's patent mechanical current gauge, magnetic clutches, quartz heating apparatus, Price's heaters for greenhouses, &c., Holophane glassware, vacuum cleaners, decorative fittings, arc lamps, and accessories.

DUNCAN, WATSON & CO.—Prominent features will be a vacuum cleaner mounted on a rotating platform over the stand, and an electric fountain.

THE DUSSEK BITUMEN CO.—"Trinidite" joint-box compound, refined Trinidad bitumen, resin oil, bituminous preservative paint, grease, &c.

EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD.—Metal filament and carbon incandescent lamps, arc lamps, switches, instruments, and fittings.

THE ELECTRICAL APPARATUS CO., LTD.—Prepayment and other meters, motor control gear, including slow-motion, automatic, and single-phase starters. A new induction speed controller, switch-fuses, and cinematograph resistances.

ELECTRICAL ENGINEERING (Kilowatt Publishing Co., Ltd.).—Copies and bound volumes of ELECTRICAL ENGINEERING. Framed technical illustrations and cartoons, and a carefully chosen selection of books (which will be on sale) on all branches of electrical engineering and allied subjects.

ELECTROMOTORS, LTD.—Representative sizes of a specialised range of continuous-current motors, with demonstrations of their application to the driving of various types of machinery. Pipe-ventilated motors, ship-lighting sets, electric pumps, hoists, fans, &c.

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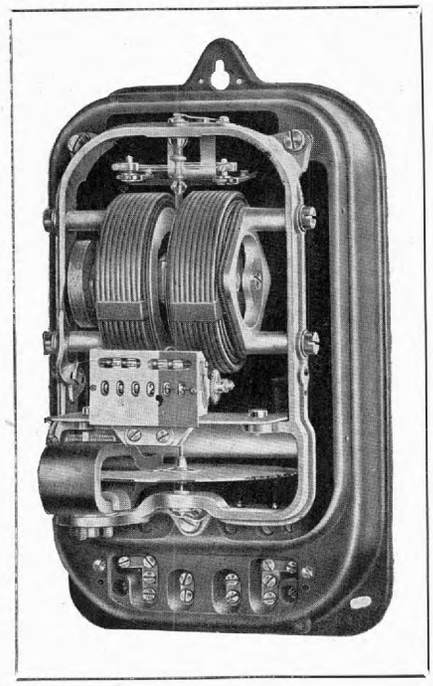
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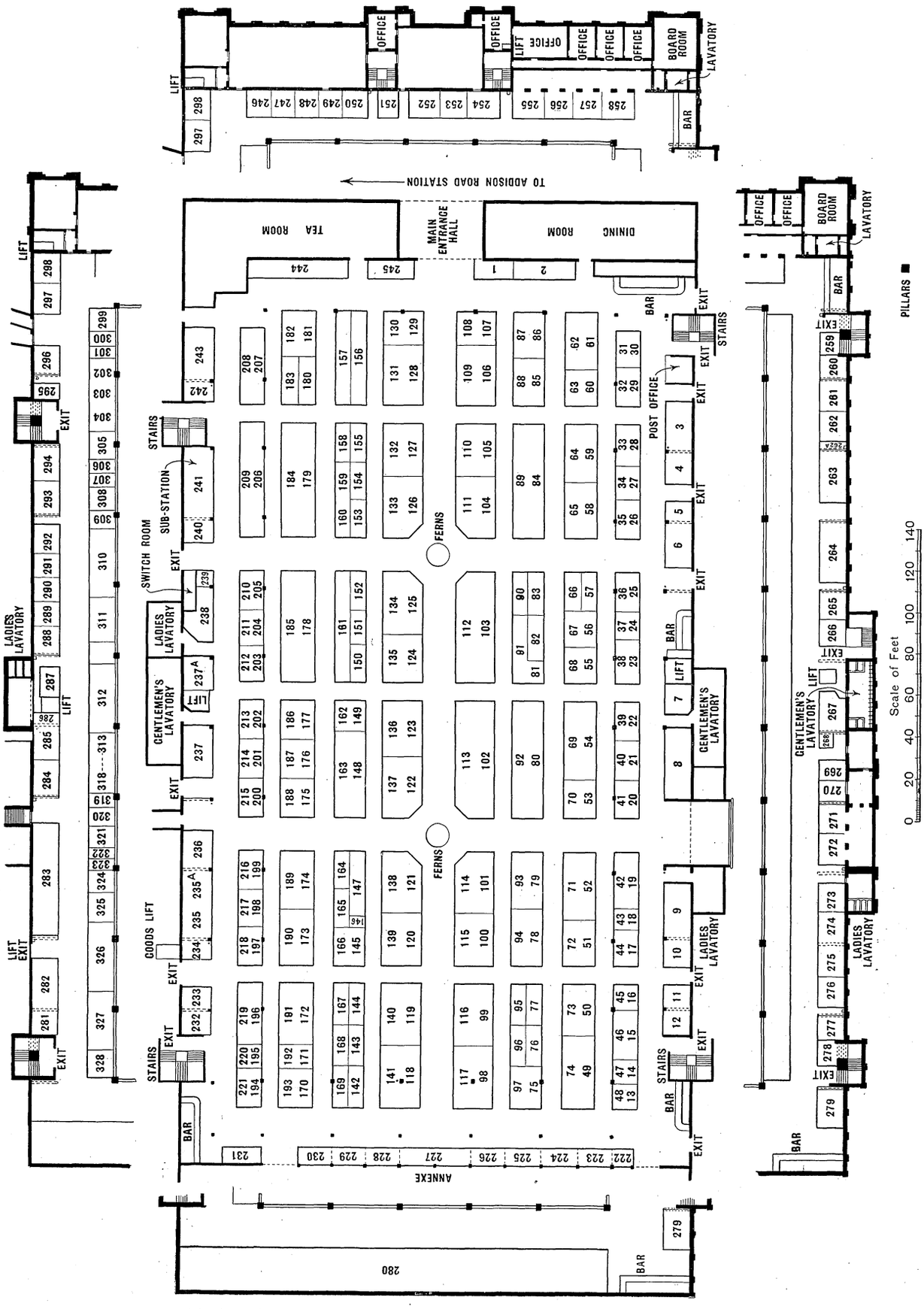
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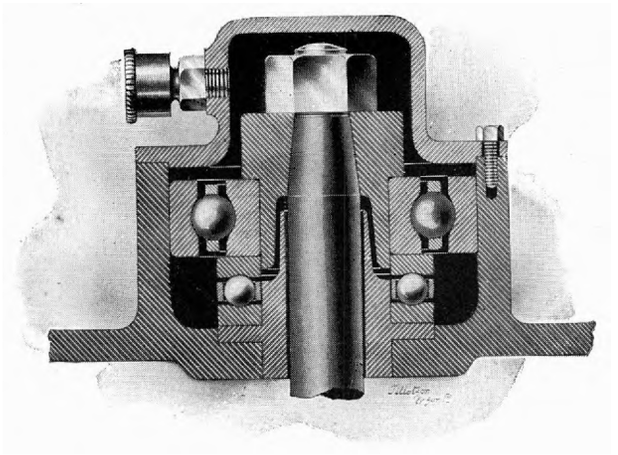
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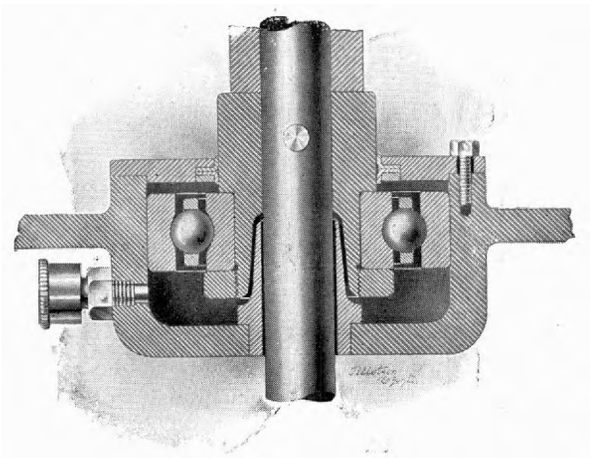
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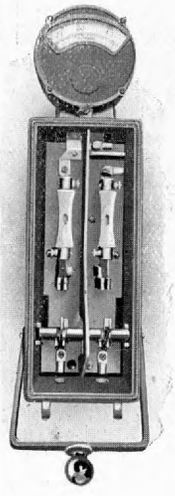
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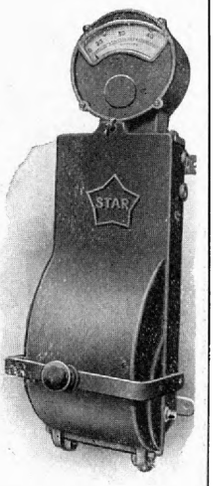
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Pirelli, Ltd.	172 & 191
Pooley & Austin	49 & 74
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Proctor, James, Ltd.	23 & 38
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ELECTRICAL ENGINEERING

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SUMMARY

WE issue to-day the first of five special supplements dealing with the Electrical Exhibition at Olympia (London), which will be opened on Saturday, and will remain open until October 21st. The formal opening is on Saturday at 2 p.m., but the exhibition will be open to the public from 10.30 a.m. onwards, and will be open each day from 10.30 a.m. to 10 p.m. The price of admission is 1s., except on Tuesdays, before 6 p.m., when the price has been raised to 2s. 6d. This week we publish a complete list of exhibitors, a key plan showing the positions of their stands, and brief notes on the apparatus &c. which some of the chief exhibitors are showing. Among other features will be an "electric home," showing applications of electric lighting, heating, cooking, and power. This will include a working electric kitchen in charge of one of the best lady cooks in London, and a working electric laundry. Two Marconi wireless stations, on the gallery and ground floor respectively, will be in intercommunication. We also mention a few particulars concerning some of the electric signs that are being erected. On the exhibitors' stands a great number of novelties will be shown. An article in the supplement also gives details of the arrangements that have been made for the electric light and power supply to the exhibition.

A VERY compact form of portable photometer with which candle-power and illumination measurements can be made has been brought out under the name of the Luxometer. (Page 523.)

A SHORT article describes a particularly simple form of arc lamp lowering gear. (Page 523.)

METALLISED carbon filament lamps, with an efficiency of about 2·8 watts per candle-power, are being put on the market in this country. (Page 524.)

A CONVENIENT form of vibratory rectifier, permitting of the charging of small accumulators, &c., from alternating current supply, is described in an illustrated article. (Page 524.)

AN electric boot polisher is illustrated on page 525.

THE Shoreditch Borough Council on Tuesday decided to adopt the scheme put forward by the Electricity Committee for the substitution of electricity for gas for street lighting throughout the whole of the Borough. (Page 525.)

A LETTER from Messrs. A. P. Lundberg & Sons suggests a simple means of obtaining control of lights from two points without any disturbance of the wiring. (Page 525.)

THE BRITISH THOMSON-HOUSTON Co. have introduced an insulating compound by using reclaimed rubber, which is mixed with a dry oil and heated until a reaction between the materials takes place and a cement is produced. This can be thinned by mixing with a solvent. Another specification published by the Patent Office last week relates to supporting wires for metal filaments by A. Mond. Sir Oliver Lodge has amended certain claims in one of his patents on wireless telegraphy, the conditions on which Mr. Justice Parker recently granted an extension of seven years. The following patents expire during the current week after a full life of fourteen years:—One provides a lattice grid for secondary batteries, by S. H. Hart; another by T. Sloper refers to telephone switch-hooks; and a third, by the British Thomson-Houston Co., relates to wattmetres which are made astatic to be independent of stray magnetism. (Page 526.)

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IN our Electric Traction Notes, we refer to the fact that the Board of Trade have issued a new model form of regulations and bye-laws regarding electric tramways, and we note the more important changes made.—The Sheffield Tramways Committee have transferred £26,541 to relief of rates from last year's profits, and the Ayr Tramways Committee £1,083.—Dividends are declared by the Metropolitan Electric Tramways and the Gateshead and District Electric Tramways Co.—Among other matters referred to is the large increase in tramway traffic in Buenos Ayres and the further consideration of the Glasgow tramway extension scheme. (Page 527.)

UNDER Telephony and Telegraphy (including Wireless) we refer to the scheme of the United States Naval Department for wireless communication between shore stations and aeroplanes. We also give particulars of the working arrangement entered into between Atlantic Cable Companies. (Page 527.)

THE Hammersmith Council have agreed to lend Messrs. Gwynnes a large quantity of electric motors, the Company entering into a five-years' agreement for supply.—The Winchester Corporation have taken over the undertaking of the local company.—It is stated that water-power rights equivalent to 592,000 kw. have been granted in Japan.—A street lighting scheme is under discussion in Carnarvon.—The Ayr Electricity Committee have now paid off £6,767 borrowed from the rates during the early years of the undertaking. (Page 529.)

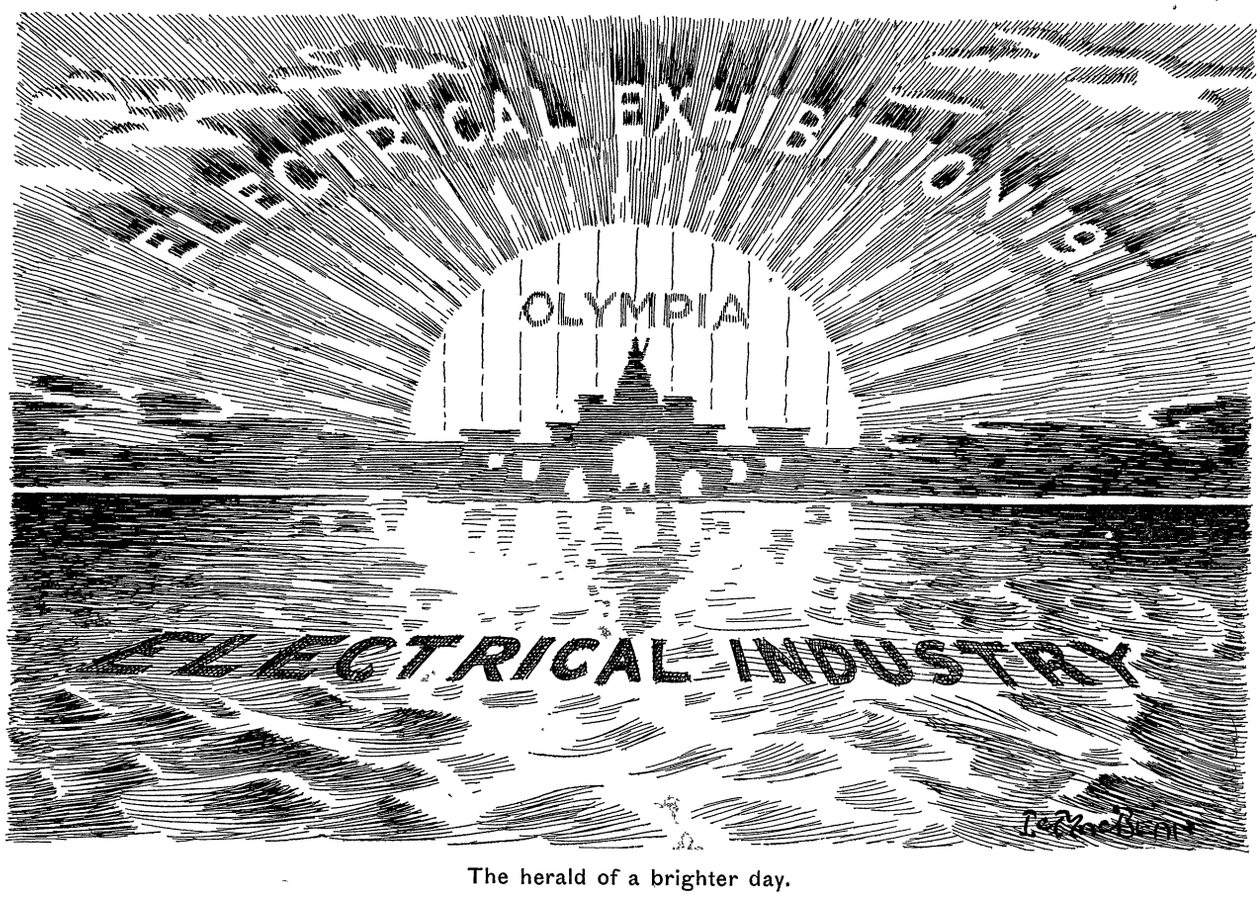
FIVE 5,000-kw. turbo-alternators are required by the New South Wales Tramways Department; a motor-driven air pump, and an electrically-driven circulating pump, &c., are required at Brighton; a scheme of electrically-controlled lighthouse signals is to be prepared by the Londonderry Harbour Commissioners, and a loan of £5,250 has been sanctioned at Torquay. The telephone system at the Hackney workhouse is to be extended.—A year's supply for electrical accessories is required at York. (Page 529.)

THE accounts of Messrs. Dick, Kerr & Co. for the year to June 30th show a net profit of £25,934, and the June half-yearly accounts of the Yorkshire Power Co. a net profit of £4,950. (Page 530.)

British Association Committee on Practical Standards.—Mr. A. P. Trotter informs us that his name has been attached to the Report of the British Association Committee on Practical Standards for Electrical Measurements, without his authority, and doubtless as the result of a mistake. But it compels him to state that he withdrew from the Committee in July, 1910, because he strongly disagreed with some of their resolutions, and with the mode in which their business was conducted.

Electrical Engineering Courses in London.—The prospectus of the South Western Polytechnic Institute for the coming Session gives particulars of the day and evening classes held in electrical engineering in the premises in Manresa Road, Chelsea, S.W. Special arrangements can be made for students engaged in central stations so that they can attend the day classes when they are on night duty. The evening as well as the day courses are suitable for the City and Guilds of London examinations, or as a preparation for the engineering degree of the London University. Another prospectus to hand is that from the Northern Polytechnic, Holloway. It gives details of the London University day and evening classes, and special courses which are arranged for the matriculation, and for the Intermediate Science and Engineering Degrees.

The Northampton Polytechnic Institute, St. John's Street, London, E.C., have also issued their syllabus, giving full details and equipment for all the courses in the coming session. There are day and evening classes in electrical engineering and electro-chemistry, and automobile work and radio-telegraphy are included in the former. Lectures on illuminating engineering are given in the evening courses. The new generating station, which was opened last winter, is now available for senior students. The day classes commence on October 2nd, and the evening classes on September 25th.



The herald of a brighter day.

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THE LUXOMETER

THE widespread interest now being taken in the measurement of illumination, both interior and exterior, has led to a demand for an inexpensive instrument, which, while not claiming to be a standard in the same respects as such instruments as the Trotter Portable Photometer (see Electrical Engineering, Vol. I., page 849), could yet be relied upon to give results of ample accuracy for most purposes, and which was, at the same time, not only light and thoroughly portable, but above all easy to use, and it is with the object of supplying such a want that Messrs. Everett, Edgcumbe & Co., Ltd. (117, Victoria Street, Westminster) have brought out the instrument described in this article, known as the Luxometer.

The principle is similar to that of the Trotter Photometer, but the parts as seen in the illustration are differently arranged. A screen illuminated by a standard lamp within

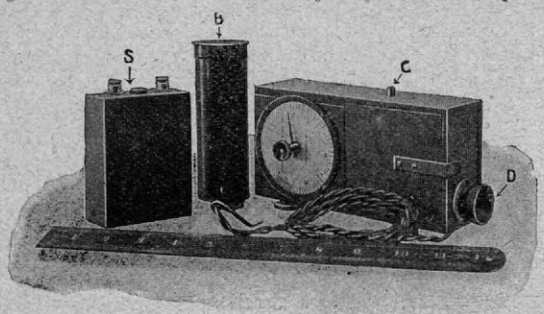


Fig. 1.—Luxometer Outfit Complete.

the instrument is viewed at an angle which can be varied till the effect balances that of a fixed external screen illuminated by the source to be measured, and the result is read off direct from the pointer attached to the head by which the internal screen is rotated.

The extreme compactness of the apparatus is strikingly shown in Fig. 1, which shows the complete outfit, including the Luxometer (C) itself, the battery (S) supplying the standard lamp, and the daylight attachment (B), the use of which is mentioned below. It may be added that the weight is only 1¼ lbs. An open direct reading scale is provided, about 6 in. long, and in standard instruments this is graduated up to 10 or 20 foot-candles, as preferred, with two ranges. It is specially opened out at the lower part, so that great accuracy is possible, even when measuring feeble illuminations. When in use the instrument is held in the hand, no stand or other support being required. For transport, both the photometer and the battery can be carried in the pocket, or they can be supplied fitted in a small leather case with shoulder strap if preferred. Illumination measurements can

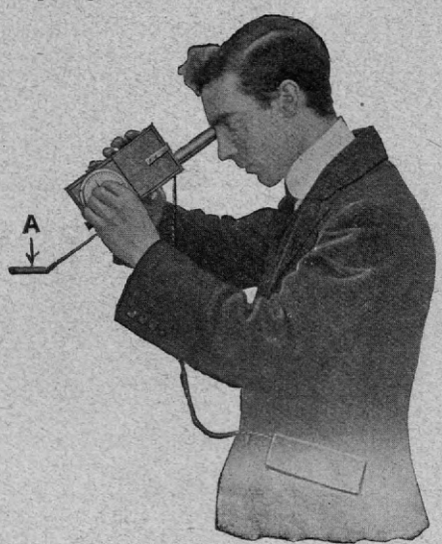


Fig. 2.—The Luxometer in Use.

be made at any angle, and they are practically independent of the colour of the light. Candle-power as well as illumination measurements can be readily made, and the surface brightness or intrinsic brilliancy of any surface can be instantly measured by viewing it through the instrument instead of the fixed screen (A). For this purpose, a simple attachment can be provided whereby what is spoken of as the "window efficiency" of a room can be determnied. Merely to state that the illumination observed in a certain room lit by daylight was so many foot-candles is meaningless, depending as it does entirely upon the state of the sky. By means of this attachment, on the other hand, a definite figure can be obtained for the ratio of the actual illumination at any particular point in the room to the daylight illumination outside. The value of the daylight outside is for this purpose measured by attaching the daylight tube, which is so proportioned that the illumination from one thousandth part of the hemisphere of the sky reaches the instrument, the instrument being pointed at the clear sky.

Mr. P. J. Waldram, to whom the development of this method is mainly due, has made a number of measurements in this way, and the following figures obtained by him will be of interest :—

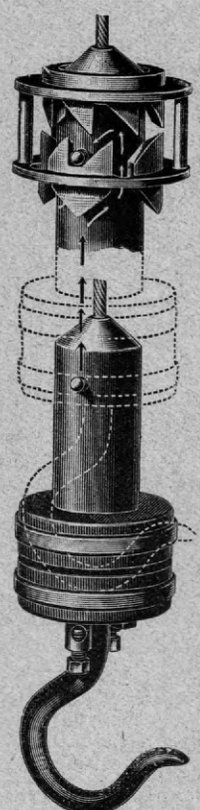
	Window efficiency.
Patent Office Library, centre	... 0·005
British Museum Reading Room ...	... 0·007
Ordinary offices (centre of room) ...	... 0·001
Speaker's Chair, House of Commons	... 0·0009
Woolsack, House of Lords	... 0·0006
Charing Cross Station, Booking Hall	... 0·0001 to 0·0003
Surveyors' Institution (centre of library)	... 0·0015

In order to simplify the adjustment, a yellow-tinted external screen is provided, and should be used when daylight observations are being made in place of the white screen. By this means the colour of the daylight illumination is reduced to something near that of the standard lamp inside the instrument, so that an accurate balance is easily obtained. No allowance need be made for the colour of the screen, owing to the fact that the same colour is used both inside the room and in obtaining an outside reading, so that its effect cancels out.

Of all the standard lamps which have been tried with portable photometers the electric lamp has proved itself to be by far the most satisfactory, and some recent investigations by Mr. A. P. Trotter show that such a lamp, worked off a portable accumulator, fulfils all requirements. The cell supplied with the Luxometer is of a special "non-spillable" type contained in a celluloid or ebonite case, so that it can be carried in the pocket without fear of spilling.

ARC LAMP LOWERING GEAR

AN attractive new list from the London Electric Firm (George Street, Croydon) deals with very great completeness with arc lamp suspension and lowering gear of every class, a subject in which the firm have for some time specialised. The most important feature of their apparatus is the "one working part" suspension device, which in one of its simpler forms is illustrated here. As will be seen, the self-sustaining and disengaging qualities are obtained by means not depending in any way on springs, levers, balls, catches, or clutches, while the whole is of remarkable simplicity. This is used in conjunction with a substantial self-sustaining winch, also entirely without ratchets or springs. Several types of the suspension are made, with and without contact gear for various conditions of service, and a special feature of the series is the collection of special fittings for span wire suspension, such as that illustrated in Electrical Engineering, December 22nd, 1910, page 805, in connection with the lighting of Cheapside. Several counterweight systems have been devised, and considerable ingenuity has been expended on arrangements for adapting lowering gear to ordinary arc lamp standards. The catalogue contains numerous illustrations of installations of this apparatus, and a very complete series of accessories is included. Very large numbers of these gears are in use by over 100 corporations and supply companies, as well as Government departments, railway and dock companies, etc.



"One Working Part" Arc and Metal Filament Lamp Lowering Gear.

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THE GEM LAMP

THERE is a considerable field for something less expensive than the metal filament lamp, but more efficient than the ordinary carbon. This want is now met by the B.T.H. Gem lamp, with its metallised carbon filament, giving an improvement in efficiency equivalent in one step to that obtained in the previous 20 years' development of the carbon filament lamp. The "Gem" filament is produced by subjecting the ordinary carbon filament to the intense heat of the electric furnace. This process removes the residue of

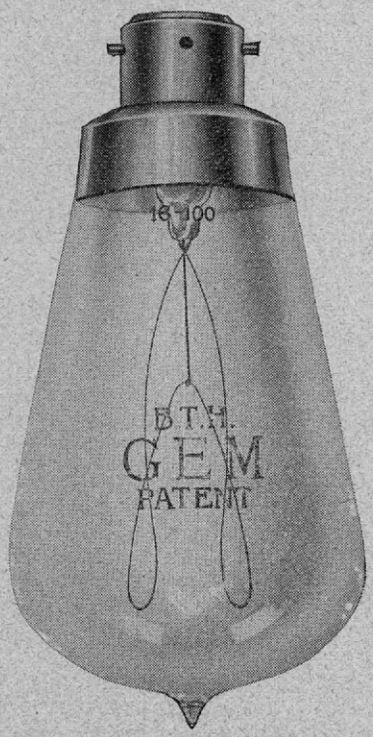


FIG. 1.—"GEM" LAMP.

ash and hydro-carbons, and renders the filament capable of withstanding much higher temperatures, and therefore of operating at a much higher efficiency than the ordinary carbon filament of equal life. The practical result of this is the production of a 16 c.p. lamp consuming only 45 watts (efficiency 2·8 watts per candle). This gives a saving of some 15 watts over the ordinary carbon lamp. The "Gem" filament is also less susceptible than ordinary carbon lamps to variations of voltage, as it has a resistance characteristic

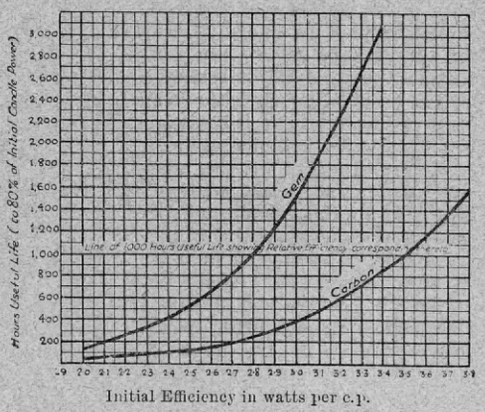


FIG. 2.—COMPARATIVE CURVES FOR GEM AND CARBON LAMPS, SHOWING LIFE IN HOURS GIVEN BY A 50-WATT LAMP WITH CARBON OR GEM FILAMENT OVER THE LIMITING RANGE OF EFFICIENCY FOR EACH FILAMENT.

similar to that of metals, increasing with increase in temperature, contrary to the ordinary carbon filament.

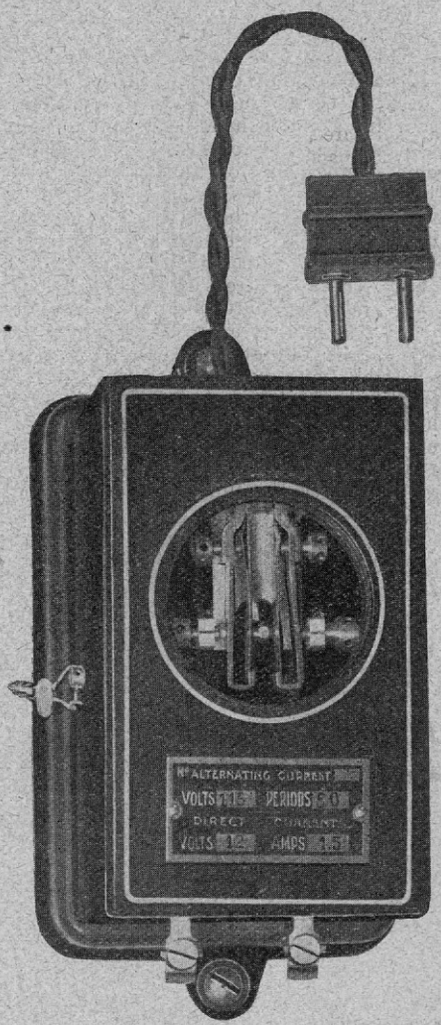
Although a relatively new development in this country, the "Gem" lamp can hardly be described as untried, for 8,000,000 of these lamps are already in use in the United States. It is interesting to note that the "Gem" lamp has been adopted by the leading lighting supply stations in New York, Chicago, and other large American cities as the standard supply lamp in place of the regular carbon lamp.

The new list issued by the British Thomson Houston Co. describes the new lamp and gives a table showing the saving effected thereby. The lamp can be supplied in the 16-c.p. 45-watt size, with a life of 1,500 hours, or in a 20-c.p., 50-watt size with a life of 800 hours. The voltage at which the present lamps are made is from 100–130 volts only. The lamp can be used in series in 200–250 circuits, and will be found to give a more brilliant and better quality of light than the ordinary carbon lamp.

The field of use for the "Gem" lamp practically covers that at present held by the ordinary carbon filament lamp. It can be satisfactorily employed in all classes of service to which the carbon lamp is adapted, and where for various reasons it is not desirable to employ the more expensive metal filament lamps. There are many situations where a low-priced, durable, and yet more economical lamp than the ordinary carbon is desired, and it is in this field that the "Gem" lamp has special application.

A VIBRATORY RECTIFIER

A CONVENIENT piece of apparatus designed to convert from alternating to continuous current for such purposes as the charging of small accumulators has been put on the market by the Adnil Electrical Co., Ltd. (Adnil Building, Artillery Lane, E.C.). A form of the instrument for giving continuous currents up to 1·5 amperes at 12 volts, when connected to a 115-volt, 50-cycle single-phase circuit, is illustrated here. The apparatus consists essentially of a trans-



THE ADNIL VIBRATORY RECTIFIER.

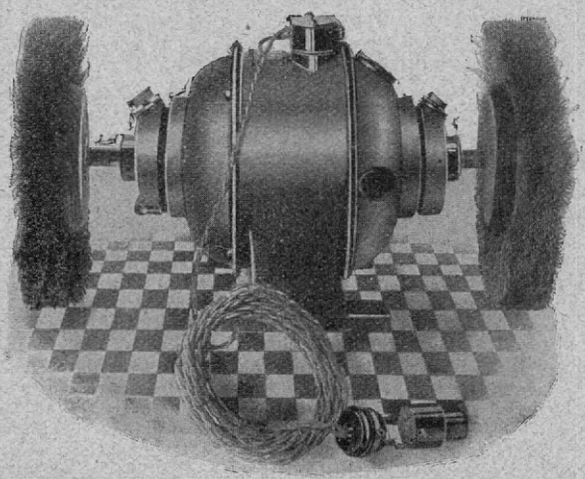
former with vibrating contact. A stray field in the transformer operates the armature and contact system of the rectifier at the zero points of the alternating current curve, producing a rectified current. By this system of operating the vibratory contacts by the transformer field, perfectly synchronous working can be adjusted by mechanical means, such as small brakes, springs, etc., without the use of auxiliary apparatus. The efficiency on load and on open circuit corresponds to that of transformers

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of similar output. The direct current generated is suitable for charging accumulators, for lamps, and other non-inductive applications, and with the additions of condensers it can also be used for inductive loads such as small motors, etc. The use of all auxiliary apparatus as required in other rectifiers is dispensed with. In the event of no voltage on the alternating current line, due to interruption or short circuit, the accumulator cannot discharge through the rectifier, as it is automatically switched off. Larger sizes are also made for electro-plating and similar work up to 40 amperes at 6 volts. Another important feature is that when arranged for connection to three-phase circuits, a practically continuous current without pulsations can be obtained from the secondary terminals.

AN ELECTRIC BOOT POLISHER

We illustrate here a useful domestic appliance in the shape of an electrically driven boot polisher, which Simplex Conduits, Ltd., have recently put on the market. These are made in various styles and sizes with motor suitable for



Simplex Boot Polisher.

alternating current single or three-phase, as well as for continuous current. The motors are from $\frac{1}{8}$ to $\frac{1}{3}$ h.p., and run at from 1,400 to 2,750 r.p.m. The apparatus is supplied complete with flexible lead ready for connection to either a two-pin socket or a lamp-holder by means of a special adaptor.

ELECTRIC STREET LIGHTING IN SHOREDITCH

Gas to be entirely Superseded

THE Shoreditch Borough Council, at their meeting on Tuesday, adopted the important recommendation of the Electric Lighting Committee, set out on page 510 of our last issue, that electricity shall be substituted for gas in all the streets in the Borough north of Old Street. When this scheme is completed there will be no street lamps in Shoreditch.

In moving the adoption of the Electricity Committee's report, the Chairman of the Committee stated that it was only intended to deal with the district in sections, and that the whole of the work of conversion would occupy about three years. Nevertheless, the Committee desired the Council to accept the principle of the complete use of electricity in the streets, in order that they might be free to go ahead with the work as time and circumstances warranted. The saving to the rates would be about £230 per annum, compared with the present gas charges when the new scheme is in full operation, whilst the advantage to the electricity undertaking in having mains in every street for the supply of energy for power and lighting must weigh with the Council as a most important factor. The proposed charge is 37s. per 50-c.p. lamp per annum, including lighting and maintenance, compared with the present price for gas of 40s. 3d. per lamp per annum.

There was little opposition, although one or two speakers desired the Electricity Committee to deal with the matter piecemeal, and to be continually coming to the Council for sanction to add a few further streets to the electrical scheme. On the other hand, however, several Councillors mentioned the fact that they were being approached repeatedly by ratepayers asking when electricity would be available in their district, and in view of the large number of small cabinet-making factories which exist in Shoreditch, it was evident that the ideas of the Electricity Committee were not intended to be seriously challenged. The net result of the discussion was that an amendment to refer the recommendation back to the Committee in order that a smaller scheme might be prepared was withdrawn, and the Committee's recommendation was carried unanimously.

The new scheme will be continued on the lines of that already working, viz., by the replacement of the incandescent gas mantles in the existing lamps by 50 and 100 c.p. metal filament lamps. The existing lanterns have been adapted in a very simple manner, the hole at the top of the existing reflector being covered by a plate, and the lamp-holders suspended from this. Water-tight switches are used in each lantern with the usual knock-over lever arrangement which the lamp-lighters switch on and off.

CORRESPONDENCE

To the Editor of Electrical Engineering.

Sir,—In effecting the *maximum* reduction in the initial cost of electric light installations, the *minimum* amount of control is left to the user. This lack of convenience is most often found in bedrooms, staircases, passages, etc., and such becomes painfully apparent to the "unsatisfied consumer" as he becomes better acquainted with his installation, and meets friends who have been lucky enough to have had theirs better carried out.

What can be more exasperating, for example, than to find in a bedroom that control of light is obtainable at the door only, this necessitating getting into bed in the dark, and having to get out of bed before light can be obtained again.

It is not an uncommon occurrence to find houses where the only switch control of the hall and staircase light is provided at the front door, the lack of control from the upper floor necessitating the use of the time-honoured candle to go upstairs to bed by, or when descending again during the night.

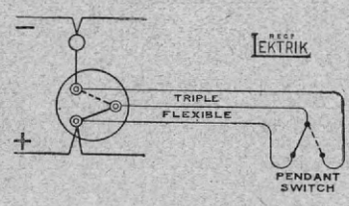
These are but two cases, and many others might be cited.

Had greater conveniences been provided, we think that the "unsatisfied consumer" would have been a satisfied one instead, and proud of the conveniences of his installation, which he would point out to his friends on all occasions, and thus indirectly prove a good canvasser for electricity as a lighting medium, to the benefit of contractors generally, and his own contractor in particular.

As it is, however, when noticing these weak points in his installation, he interviews a contractor with regard to having an improvement made, but is usually informed that the alteration will mean pulling his walls about and upsetting the decorations, etc. Consequently the desired addition is seldom effected, or else postponed for attention when the next decoration upheaval takes place, he meanwhile having to make shift with the installation as it stands.

It is a simple matter to convert the present single-way switch control to that giving control from two points, without any disturbance of the wiring. The conversion simply involves the substitution of a two-way surface switch for the single-way one.

A hole is bored in the wood block and a triple flexible led off from the switch on porcelain buttons, or through insulated screw eyes, to the desired extension point consisting of a two-way pear switch for bedroom use or one of surface pattern for ordinary use.



The simplicity of the adaptation is clearly shown in the diagram attached, *where it will be noticed that the leads are not interfered with in any way when making the change*, and that, contrary to usual custom, the "common" terminals of the two two-way switches are inter-connected.

To leave the switch point as it was originally is a simple matter, the two-way switch being made to act as a single-way one by short-circuiting two of the terminals, the flexible and extension switch being disconnected. This provides for the case of the obstinate landlord who requires the installation left as it was found.

We think that this simple method, if commonly known, would assist in providing the contractor with some genuine friends amongst his clients, whose recommendations, following their own satisfaction on the improved conditions, would extend business in the neighbourhood.

We are, Sir,

Yours respectfully,

A. P. Lundberg & Sons.

477 to 487, Liverpool Road, Islington,
September 12th, 1911.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Sept. 14, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

23,404/10. **Supporting Wires for Metal Filaments.** A. MOND. These are made of thin nickel or carbon, and are covered with a layer of a chromium compound, which is then heated to incandescence by a current and decomposed into an oxide of chromium.

24,637/10. **Metallic Filaments.** WESTINGHOUSE METALLFADEN GLÜHLAMPENFABRIK G.M.B.H. (*Austria*). After the decarbonising process, filaments containing traces of carbon are purified in hermetically sealed vessels, in which a high degree of exhaustion is produced by a vacuum pump. The vessel is heated to a temperature of 1,200° C. to 1,300° C. until all the carbon is eliminated.

176/11. **Insulating Compound.** THE BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) A drying oil, such as linseed oil, is heated with waste rubber until a temperature is reached at which an exothermic reaction takes place, when a cement is produced. After cooling this can be thinned by mixing it with asbestos and sulphur, then pressing it, and finally vulcanising the compressed mass.

Amendment

11,575/97. **Wireless Telegraphy.** SIR OLIVER LODGE. Following Mr. Justice Parker's order, in extending this patent for another seven years, this specification has now been amended by striking out claims 3, 4, 5, and 8, and renumbering the other claims accordingly. A full report of the judge's decision appeared in ELECTRICAL ENGINEERING, May 4th, 1911, p. 234.

Opposition to Grant of Patents

11,591/08. **Rotary Fans.** J. KEITH. This patent has been granted in spite of opposition. It describes a fan wheel which is in the form of a truncated cone internally and externally, the blades of which are tapered and scooped. These are connected by a disc at their deeper ends, and at the shallow ends by a ring. The straight inner and outer edges of the blades lie on conical surfaces differently inclined to the spindle axis of the fan.

12,289/09. **Table Fan.** J. KEITH. The Law Officer has confirmed, on appeal, the decision of the Comptroller to grant this patent. The specification was abstracted in ELECTRICAL ENGINEERING, March 10th, 1910, p. 172.

18,969/10. **Reduction of Organic Bodies.** H. HIGGINS. As a result of opposition, the right to grant on this application has been surrendered. The specification (abstracted in ELECTRICAL ENGINEERING, September 14th, 1911, p. 516) relates chiefly to the reduction of the unsaturated fatty acids.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: KÖRTING and MATHIESEN AKT.-GES. [Alternating current] 10,290/11; SIEMENS BROS. DYNAMO WORKS, 14,685/11.

Cables and Wires: ALFRED WISEMAN, LTD., and HARRIS [Attaching wires to insulators] 29,114/10; CARR [Cable couplings] 744/11.

Dynamos, Motors, and Transformers: STIRK [Shunt regulators] 19,863/10; BRITISH THOMSON-HOUSTON Co. and MARTIN [Induction variable speed] 25,683/10; AKT.-GES. BROWN, BOVERI, ET CIE [Periodicity transformers] 600/11.

Electric Ignition: HERZ [Sparking-plug insulations] 25,539/10; ROBERT BOSCH (*Firm of*) [Interrupters] 7,632/11; MOORE and AMBROSE, SHARDLOW, & Co. [Terminals for] 12,984/11.

Electrometallurgy: SAVELSBERG [Sintering iron, and other ores] 20,133/10; NIBLETT and ELECTROLYTIC APPARATUS SYNDICATE [Bleaching apparatus] 28,277/10.

Heating: BERRY, 18,115/10; ELECTRIC and ORDNANCE ACCESSORIES Co. and MORRISON, 21,469/10.

Switchgear: MCLEAN and MADGEN [Switches] 24,994/10; SCOTT [Switches] 25,756/10; MCFARLANE [Switch quick-make and break] 27,825/10.

Telephony and Telegraphy: MARCONI'S WIRELESS TELEGRAPH Co., and ROUND [Receiving apparatus] 20,441/10; BOULT (*Mills*) [Call recorders] 28,368/10; ELLISON and THORROWGOOD [Single-wire telephone system] 3,730/11.

Traction: BLACKALL and JACOBS [Railway block telegraph indicator] 21,554/10; SIMONET [Actuating signals and recording passage of trains] 7,674/11; MCCOMB [Automatic brake and power control attachment] 10,665/11.

Miscellaneous: WALKER, and R. WAYGOOD & Co. [Lift control] 20,118/10; EBORALL, and BROWN, BOVERI, & Co. [Ring spinning machines] 20,249/10; Soc. Anon. "Phi." [Electro-magnets] 23,831/10; JUSTICE (*Wilkinson*) [Timing and signalling devices] 26,620/10; ADAMSON, RAMSBOTTOM & Co., and RAMSBOTTOM [Hoists, winches, &c.] 27,299/10; CURTIS [Miner's head lamp] 2,485/11; J. HALDEN & Co., and WATTS [Photographic printing] 10,701/11; BAILEY [Submarine signalling] 12,575/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Transformers: SIEMENS SCHUCKERTWERKE GES. [Boosting] 18,868/11.

Electric Ignition: CAMBESSÉDÈS, 19,025/11.

Electrochemistry: SCHEITLIN [Furnaces] 18,804/11.

Fuses: SANTO, 19,120/11.

Telephony: STEINBERGER [Mouthpieces] 14,591/11.

The following amended Specifications can now be obtained.

AKT.-GES. BROWN, BOVERI, & Co. [Spinning machines] 7612/08.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

21,704 of September 22nd, 1897. **Secondary Batteries.** S. H. HART. This patent describes a lattice plate or grid, which is cast in a metal mould and retains the maximum amount of active material, and it is arranged to withstand buckling or distortion due to mechanical strains or rapid electrolysis. The grid has an alternate cellular structure, with diagonal truss bars intersected by lateral bars. The projections which are left on each side of the grid after casting are pressed inwards, forming claws for retaining the material.

21,974 of September 25th, 1897. **Telephones.** T. SLOPER. A switch hook is so arranged that when the receiver is on the hook a current entering the home line rings a bell to call attention. When it is taken off, the bell circuit is disconnected, and the circuit containing the microphone, induction coil, and receiver is closed by means of two contacts, which are connected by the switch when the receiver is removed from the hook.

22,216 of September 28th, 1897. **Wattmeters.** THE BRITISH THOMSON-HOUSTON Co. (*H. W. Pratt, U.S.A.*). The armature is wound in two sections, arranged one above and one below a **U**-shaped field coil. This acts on both sections, and produces rotation in one direction, and any stray magnetism acts upon them differentially. In combination with the armature and field coil there is a damping device, in which two conducting discs and magnets are arranged so that the stray magnetism weakens the effect of one disc and strengthens that of the other, thus balancing the damping effect.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: G. WEGELIN [Carbons] 12,184/98; J. O. GIRDLESTONE, 12,223/07; A. H. BRZESKI and A. COLLIN, 12,369/07.

Distributing Systems and Cables: C. TURNBULL [Regulation] 12,290/02; LANCASHIRE DYNAMO & MOTOR Co. and W. STANSFIELD [Distribution] 12,420/07; G. DAVIS [Cables] 12,711/07.

Dynamos and Motors: H. H. LAKE (*General Electric Co., U.S.A.*) [Alternating current] 12,294/02; BRITISH THOMSON-HOUSTON Co. (*Allgemeine Elektricitäts-Ges.*) [Collecting-rings; commutators] 12,334/04; H. W. LAKE (*W. Hallock, New York*) [Field magnets for inductor alternators] 12,374/07; S. GRIFFIN, 12,402/07.

Electric Ignition: F. R. SIMMS, 12,433/98 and 11,135/05; R. CARPENTIER, 12,539/07.

Instruments and Meters: F. CONRAD and W. M. BRADSHAW [Meters] 11,036/05 and 11,036A/05; A. LEHMANN [Battery voltmeter] 12,368/07; A. BARR [Dynamometer for measuring torsion] 12,495/07.

Switchgear: J. S. RAWORTH [Switches] 11,614/05; L. HARRIS [Starting switch] 12,895/06; J. S. and A. RAWORTH [Machine switches] 12,443/07; E. LAWLEY-PINCHING and W. H. WALTON [Switch] 12,462/07.

Telephony and Telegraphy: J. KITSEE [Submarine telegraphy] 12,748/06; J. BURRY [Type-printing telegraph receivers] 12,342/07; H. A. YARNELL [Transmitters for wireless tleegraphy] 12,389/07; T. A. SEDGWICK [Signalling, transmitter] 12,406/07; A. J. GRANT (*G. A. Haggarty*) [Clutch for rotating transmitter] 12,407/07; L. MAICHE, 12,529/07.

Traction: BRITISH THOMSON-HOUSTON Co. (*Allgemeine Elektricitäts Ges.*) [Signal and point control] 12,238/07; J. G. CARR [Signal contacts] 12,435/07.

Miscellaneous: O. IMRAY (Mechernicher Bergwerks-Actien-Verein) [Magnetic separators] 9,968/00; J. TATLOCK and A. G. HORNE [Fire alarms] 12,172/07; J. HAAR [Recording sounds] 12,259/07; S. STEPHANOW [Lantern signalling] 12,356/07; H. TURNER [Plug couplings] 12,531/07; C. C. COTTON and W. C. KENNEDY [Spinning] 12,690/07; L. B. MILLER [Current rectifier] 12,712/07.

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ELECTRIC TRACTION NOTES

The Board of Trade Model Form of Regulations and Bye-Laws regarding electrical power on tramways has been slightly modified. A sub-clause has been added to Regulation II., providing for the use of trailer cars for the conveyance of salt, sand, and other stores for the purpose of the tramway undertaking, without the consent of the Board of Trade, and this renders necessary a few consequential alterations in III. and IV. relative to head and rear lights. The note to V. to the effect that, unless specially favourable circumstances exist, a speed of eight miles per hour is generally prescribed, has been taken out. Regulation VII. is amended in order to make it clear that the minimum height of top of the trolley wire from the road surface does not apply where the lines pass under bridges, and it is made clear that Regulation XI., which aims at preventing trolley standards from becoming electrically charged, does not apply to the trolley base on the top cover of double-deck cars. Two new regulations have been added, as follows:—XIV. "Every guard wire shall be bonded to the rails through its support at each end and at intervals of not more than five spans." XV. "Every pole supporting a gas-lamp bracket shall be efficiently bonded to the rails."

The Sheffield Tramways Committee was able to transfer £26,541 to the relief of rates out of its profits for the year to March 31st last.

The profits from the working of the Ayr tramways last year enabled £1,963 to be added to depreciation and renewals fund, and £1,083 to be transferred to the relief of rates.

An interim dividend has been declared upon the ordinary shares of the Metropolitan Electric Tramways at the rate of 6d. per share, less tax. The Gateshead and District Tramways Co. have declared an interim dividend on the ordinary shares for the June half-year at the rate of 5 per cent. per annum.

The Glasgow Tramways Committee returned their scheme of extensions to the Council in the same form that it was referred back to them a week ago. There was originally some opposition to the considerable extensions of the tramway undertaking outside the city boundaries, but the Tramways Committee, having constituted themselves the tramway authority for an area having a radius of about eight miles, decided to persist in their scheme for giving these districts a tramway service. At the Council meeting on Thursday a number of the proposed extensions were again sent back to the Committee.

The General Assembly of the Province of Nova Scotia, says the *Board of Trade Journal*, have passed an Act authorising the subsidising of companies proposing to construct electric railways in Nova Scotia.

The number of passengers carried by the Buenos Ayres tramways during the June half-year shows an increase of nearly 20,000,000 over the corresponding period of last year.

There was a gross profit of £13,642 on the Leith Tramways last year, but after meeting capital charges there was a small deficit, bringing the total debit balance to £1,993. Although the costs per car mile were the lowest of any tramway undertaking in the country, they have shown a further slight decrease during the year, but the manager points out that he regards the expenses as being at their lowest, and looks forward to a tendency to an increase in the future. The life of parts of the track and overhead line, he points out, is approaching the time when it will be necessary to renew them, and this will involve a considerable expenditure.

Having unsuccessfully approached the Halifax Corporation with a view to tramways being constructed from Halifax to Elland, the Council of the latter place have now made overtures to the Huddersfield Corporation.

Death from Electric Shock.—An employee of the British Insulated & Helsby Cables, Ltd., was engaged on the top of a tramway pole upon the Newcastle tramways last week connecting up trolley wire when he accidentally came into contact with a live trolley wire, and fell to the ground. The medical evidence was to the effect that the man had received an electric shock, and the jury returned a verdict to this effect.

Royal Engineer Cadets (2nd London Division).—Recruits are wanted for this Corps, and youths between the ages of 13 and 18 years having a knowledge of electricity or telegraphy are asked to send in their names. The officer in command of the Corps, which, by the way, is not the same as the London Electrical Engineers' Corps, is Captain Beeman, R.E., and the headquarters are at the Duke of York's School, Chelsea, S.W.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The *Board of Trade Journal* states that a cable has been laid between the Westmann Islands and the mainland of Iceland. It is expected to be connected with the land telegraph system by the middle of September.

Efforts are being made by the Navy Department in America to perfect a system of wireless communication between shore stations and aeroplanes. According to the American *Electrical Review* and *Western Electrician*, experiments are to be carried out to ascertain whether or not the frame of an airship will act as an earth for the type of wireless apparatus used by the navy, and allow communication with the shore. Models of aeroplanes will be suspended by insulated ropes between smokestacks at the navy yard, and an effort will be made to send a message to the wireless stations at San Francisco and Yerba Buena. A point to be decided, is whether the aerial wires should be erected on top or suspended from the bottom of the aeroplane. Aviators think that, in the latter case, the wires may interfere with the propeller.

The official announcement has been made of the working agreement between the Anglo-American Telegraph Co., the Western Union Telegraph Co., and the Direct United States Cable Co. The effect of this is that the English companies pass into the control of the American concern under a lease of 99 years, at a rental of £262,500 per annum, which has been computed to meet the 6 per cent. preference dividends, 3¾ per cent. on the ordinary shares, and 1½ per cent. on the deferred shares. The combined capital of the three companies is no less than £26,400,000.

The Direct Spanish Telegraph Company are once again in difficulties, for on the 12th inst. their Falmouth-Bilbao section was temporarily down.—On the 16th inst. communication between Rome and Constantinople was interrupted, and on the 18th a failure occurred in the Bagdad-Bassorah lines, which were put in order again on the 19th inst.

Mr. Grindell Matthews has been continuing his wireless telephone experiments near Calais, whither he removed from Chepstow last week. It had been originally intended to communicate with the tug which was to have followed Wolffe on his attempt to swim the Channel, but on this being abandoned, successful experiments were conducted between Sangatte and Barraques, which were to be followed by attempts to communicate with Dover. Box kites were used to support the aerials.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

METAL FILAMENT LAMPS.—A most ingenious card from the Brimsdown Lamp Works (Kingsway House, W.C.) depicts first of all a gentleman endeavouring to read in a bad light. By pulling a tab, however, he is shown seeing things in the better light of a Brimsdown Lamp.

ALUMINIUM.—A list of sizes of aluminium tubes is contained in a leaflet from the British Aluminium Co., Ltd. (109 Queen Victoria Street, E.C.).

MERCURY VAPOUR LAMPS.—The Westinghouse Cooper Hewitt Company, Ltd., in a leaflet which they have issued concerning their system of lighting, make the plea that the light of these lamps is better than daylight. The various stages of the textile trade are discussed in which their lamps can be used to advantage, and each is illustrated with pictures, every one of which tells a story.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

DRIVING ROLLER CHAINS.—A pamphlet from Hans Renold, Ltd., Manchester, gives a description of their chain gear, which has replaced the belt drive at the works of Messrs. Christie & Co., Tilbury. The chain used is a ¾ in. pitch bush roller. The driven wheel has 50 teeth, with a speed of 680 r.p.m., and the driving wheels have 13 teeth, while the jockey wheels have 25 teeth. This gives a speed of over 2,000 ft. per minute. We understand that by this conversion the machine turned out as much work in just over an hour as was previously done in from 1½ to 2 hours, and that complete satisfaction has been given.

ADVERTISING DESIGNS.—We have received from Messrs. Marcus Heber Smith an attractive new circular outlining their sphere of activity, to which we have already made reference in ELECTRICAL ENGINEERING, Aug. 17th, page 466.

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LOCAL NOTES

Australia: *Sydney Trams.*—The N.S.W. Tramways Department have decided to erect a new power station, in order to meet the rapidly increasing demand owing to the development of the electric tramways system. The station will ultimately contain ten 5,000-kw. alternators, of which five are to be erected in the first instance.

Ayr: *Electricity Accounts.*—The electricity accounts for last year show a net profit of £2,256, of which £1,146 has been handed over to the rates. This sum represents the final instalment of £6,767, to which extent the rates were drawn upon in the early years of the undertaking.

Bath: *New Plant.*—A Local Government Board inquiry was held last week concerning a loan of £7,900 for electric lighting purposes. It is proposed to instal a Diesel engine and generator, a motor alternator, and a booster. The generating set, which includes a Dick Kerr dynamo, will be supplied by the Diesel Engine Co., at £5,451. The engine will be of the three-cylinder type of about 350 h.p. per cylinder.

Bournemouth: *Electric Lighting.*—The Poole Rural District Council are offering no objection to an application by the Bournemouth and Poole Electricity Supply Co. for an extension of time for putting into operation the Wimborne and District Electric Lighting Order granted in 1905.

Carnarvon: *Street Lighting.*—The Electricity Committee have been discussing the question of street electric lighting with the National Electric Construction Co., who are working the Council's electricity undertaking. One scheme, involving 20,000 c.p., will mean an increase in the rates of a 1d. in the £; whilst another, in which 9,000 c.p. would be used, which is double the present gas illumination, will mean no extra burden on the rates. A special meeting is to be held to consider the matter in detail.

Hove: *Proposed Pier Tramway.*—Particulars have appeared in the daily papers of a proposal to construct a new pier at Hove. The scheme includes the construction of an electric tramway. The matter is at present under the consideration of the Town Council.

Japan: *Electric Power Supply.*—Reporting upon the trade of Japan for 1910, the British Acting Commercial Attaché states that last year witnessed a steady progress in the extension of water-power generation of electricity. In October the Kinugawa Hydro-Electric Power Co. was formed with a capital of £1,378,000 for the purpose of supplying the City of Tokio with electricity generated by the waters of the Kinu river. This Company was originally projected as a joint Anglo-Japanese concern, but the British capitalists subsequently withdrew, owing to their unwillingness to accept the conditions which the Japanese authorities attached to the charter. In April a Government Commission was appointed for the purpose of examining and making a report of the water-power resources of the country. The water-power for use of which charters have been granted is estimated at some 592,000 kw.

Kilsyth: *Electric Lighting.*—A London Company have intimated their intention to apply for an electric lighting Provisional Order.

Llandilo: *Condition of Electricity Works.*—Mr. J. Bowen, the Council's Consulting Engineer, has presented a report upon the condition and the future working of the electricity undertaking. He recommends the Council to continue working the electricity plant as now until the end of the present financial year, and then to undertake a re-arrangement of the plant, probably by the installation of a Diesel engine. By these methods he anticipates considerable savings.

London: *Hammersmith: Supply to Messrs. Gwynnes.*—In November, 1907, the Council agreed to lend Messrs. Gwynnes one 50-h.p., four 30-h.p., one 18-h.p., and three 10-h.p. motors, in addition to a spare motor and a motor generator, subject to an agreement to take from the Council a supply of energy for five years and pay not less than £1,000 per annum for the supply. Messrs. Gwynnes now propose to put down large additions to their electrical plant, and after negotiations the Council have agreed to lend the Company the necessary motors in consideration of a further agreement for five years upon similar terms to the previous one.

Portsmouth: *Electric Lighting Profits.*—The recommendation of the Electric Lighting Committee that £3,500 of the

SILVERTOWN

RUBBER INSULATING GLOVES

IT is of the utmost importance that **every glove** used in handling conductors working at high tension should be tested with a still greater tension under **working conditions**, so that all faults due to grit or bad joint in the seams, &c., may be detected. Realising the danger that might arise if this precaution were not taken, and the test carried out only superficially, we have for many years made it a practice to test all gloves in a thorough manner, either at 5,000 or 10,000 volts, and each glove we supply for use on electrical work is sold with a label certifying this test.



WHERE REQUIRED THESE GLOVES ARE FACED WITH LEATHER AS A PROTECTION AGAINST MECHANICAL DAMAGE.

Supplied in Sizes 7, 8, 9, 10, & 11.

Prices on Application.

Dynamos: Compound Wound, Shunt or Series, for Electric Light and Power.

Motors: Belt or Direct Drive, for all classes of Service.

Cables: Electric Light, Telegraph, Telephone, Submarine.

Wires: Insulated India-Rubber or Gutta-Percha, Cotton and Silk Covered.

Instruments. Batteries. Carbons.

PRICE LISTS ON APPLICATION.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

HEAD OFFICES: 106, Cannon Street, London, E.C.

WORKS: Silvertown, London, E.

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electricity profits for last year should be carried to the relief of rates has been adopted by the Corporation after some discussion.

Winchester: *Electric Lighting.*—The Corporation have now taken over the electrical undertaking from the Winchester Electric Light and Power Co. The transfer was celebrated by an inspection of the works by the Mayor and Council. Mr. R. Ayton is City Electrical Engineer.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia: *Melbourne.*—Tenders are invited for the supply of 8,000 yards of three-inch fibre conduit suitable for laying underground in concrete, and to be used for containing lead-covered cables. Particulars from McIlwraith, McEacharn & Co., Ppty., Ltd., Billiter Square Buildings, London, E.C.

The New South Wales Tramways Department are calling for tenders for five 5,000-kw. turbo-alternators in connection with the new power station which is being erected. Tenders close on October 30th.

Brighton.—The Electricity Committee recommend the reconstruction of No. 5 Turbine at the electricity works by the British Westinghouse Co., at a cost of £4,980. This machine is the oldest of the original machines in the power station. It is also proposed to spend £635 on a motor-driven air pump, £229 for an electrically-driven circulating pump, and £656 upon the necessary alterations to cables, foundations, steam-piping, &c.

Burnham.—The Council are recommended to apply for an electric lighting Provisional Order.

Columbia.—The *Board of Trade Journal* states that the municipal authorities of Kiosucio have signed an agreement with Mr. G. Gartner authorising him to construct an electric power station for the supply of electricity for general purposes in that district.

Douglas (Isle of Man).—Messrs. Handcock & Dykes, of London, have been appointed Consulting Engineers to the Council in connection with a proposed scheme for public and private electric supply.

Great Harwood.—Mr. J. W. Speight has prepared an electric lighting scheme for the Council.

Hawes (Darlington).—The Council have decided to consider the question of lighting the streets by electricity.

Russia.—Quoting from the report of H.M. Consul at Warsaw on the trade of Poland in 1910, the *Board of Trade Journal* states that in the Lodz district there is a good opening for steam turbines, and other electrical machinery generally. Very important orders for this class of machinery are consequently being placed in Germany, and it is very seldom that an English-made steam engine is heard of. The report adds that this state of affairs is not by any means due to the question of price.

Torquay.—The Local Government Board have sanctioned a loan of £5,250 for additional plant at the electricity works.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Belfast.—The Markets Committee invite tenders for the wiring for light and power of the new abattoir in Stewart Street. Particulars from Town Clerk, and tenders by September 26th.

Dumbarton.—Secondary school at Clerkhill. Architect, A. C. Denny, Dumbarton.

Edinburgh.—Ice skating rink at Murrayfield. Architects, Messrs. W. M. Anderson & Co., 102 Union Street, Glasgow.

Failsworth.—The Lancashire Education Committee are inviting tenders for a new elementary school. Architect, Mr. H. Littler, 16, Ribblesdale Place, Preston.

Glasgow.—Buildings at north-west corner of Park Street and Sussex Street.

Hall and offices at the corner of Harvie Street and Dalmarnock Road. Architects, Messrs. M'Kellar, Davies and Gunn.

Hastings.—Tenders are invited for the electric wiring of the workhouse premises at Ore. Particulars from the Acting Clerk, Union Offices, 11 Wellington Square, and tenders by October 18th.

Kendal.—Tenders are invited for additional works and considerable alterations and repairs at the workhouse. Architect, Stephen Shaw, Kendal.

Liverpool.—Tenders are invited for electric lifts, and the electric lighting at the Brownlow Hill workhouse. Tenders by September 30th to Vestry Clerk, Borough Offices, Brownlow Hill.

Paisley.—Conversion of skating rink into a cinematograph theatre. Architect, C. J. M'Nair, Glasgow.

Stockport.—New central library. Architects, Bradshaw and Gass, 19, Silverwell Street, Bolton.

York.—Tenders are invited for a twelve months' supply of arc lamp carbons, carbon brushes, electrical accessories, carbon filament lamps, meters and time switches, and motors and starters. Particulars from City Electrical Engineer, and tenders by September 23rd.

MISCELLANEOUS

Aldershot.—The National Electric Construction Co. will shortly take in hand the construction of the Aldershot light electric railway at an estimated cost of £78,500.

London: *Hackney.*—The Guardians invite tenders for the extension of the telephone systems at their establishment at Homerton. Particulars from the Clerk, Sidney Road, Homerton, and tenders by September 27th.

Londonderry.—The Harbour Engineer is to prepare a detailed report upon the proposed installation of electrically-controlled signals on certain lighthouses on Lough Foyle.

Manchester.—The Tramways Committee invite tenders for special track work. Particulars from the General Manager, and tenders by October 3rd.

Portsmouth.—A large scheme of tramway extensions has been passed by the Council.

TENDERS RECEIVED AND ACCEPTED

Australia: *Melbourne.*—According to the *Australian Mining Standard*, two important additions are about to be made to the electric light and power plant of the Melbourne City Council, tenders for which have recently been accepted. The more important is a battery, which is being supplied by Messrs. Siemens Bros. Dynamo Works, Ltd., at a cost of £16,487. The battery will have a capacity of 4,000 ampere-hours. The other addition to the plant consists of six 60 k.v.a. transformers, which are being supplied by the A.E.G. Electrical Co., of South Africa.

Mr. C. M. Webster, of Bradford, agent in the United Kingdom for the Compania Frabril de Carbones Electricos, Barcelona, has received an order from the Melbourne City Council for about 700,000 feet of flame arc lamp carbons.

Sydney.—The City Council are recommended to place an order with Messrs. Dick Kerr & Co. for two 4,000-kw. generating sets, at £17,285.

Belfast.—Messrs. Sharman Neill, Ltd., of Belfast, have received the order for an installation of electric clocks on the ss. *Vandyke.*

London: *Hammersmith.*—An order has been placed with Messrs. Hobdell, Way & Co. for covering the new Stirling boilers at the electricity works with non-conducting composition.

The tender of the Corona Lamp Works, Ltd., has been accepted for the lighting and stage effects at the Queen's Theatre, Shaftesbury Avenue.

We give below a list of some important orders recently received by the British Westinghouse Electric and Manufacturing Co., Ltd. :—L.C.C., 100 sets controllers, etc., and

OSRAM·LAMPS

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10 magnetic brakes; Metropolitan District Railway Co., one 1,200-kw. rotary converter, transformers, and switchgear; British Insulated and Helsby Cable Co., one 200-kw. rotary converter, transformer and switchgear; Port of London Authority, three 300-kw. rotary converters; Underground Electric Railway, one 1,500 kw. rotary converter and three 550-kva. transformers; National Telewriter Co., 50 1,406 G. double gear machines; Con. G.F. of S. Africa, one 275-kva. and one 940-kva. steam sets; Para Construction Co., lighting accessories; Thos. Barlow & Sons, two 312-h.p. slip ring motor, pulley transformer, and switch pillar; Powell Duffryn and Co., Elliot pit pump ventilation; Daimler & Co., switchgear and transformers; City of Santos Imp. Co., spare parts for equipments supplied; Metropolitan Railway Co., one 1,200-kw. rotary transformers, switchgear, etc.; Stalybridge Trams, transformers; West Ham Corporation, transformers and switchgear; Strain and Robertson (Alianza Co., Ltd.), transformers and switchgear.

The Synchronome Company, of 32 and 34, Clerkenwell Road, inform us that among other important contracts for electric time services which they have in hand at the present time are the following:—London & North Western Railway stations at Harrow, Pinner, and Bushey, and new offices at Euston; Webb Orphanage, Crewe; Royal Military College, Sandhurst; Vickers, Ltd., Westminster; Exchange Telegraph Company; Lever Bros.' new offices, Royal Liver Buildings, Liverpool; Temple Press, Rosebery Avenue; Manchester Municipal Girls' School; Sheffield Training College; Farrington's Girls' School, Ltd., Chislehurst; County School for Boys, Bromley, Kent; St. Felix School, Southwold; New Putney Hospital; Crawford Municipal Technical Institute, Cork; Coronation Clock Tower, Wednesbury; Liebig's Extract of Meat Co.'s new offices, Queen Street Place; S.S. *Laconia* for the Cunard Steamship Co.; The Royal Naval Barracks, Shotley.

APPOINTMENTS AND PERSONAL NOTES

Mr. H. Pilling has been appointed manager of the Accrington electric tramways, at a salary of £200 per annum, in succession to Mr. James Wilson, who retires.

Mr. H. Vickers, Assistant Electrical Engineer in the Wolverhampton Tramways Department, has been presented with a gold watch from the staff and men, on the occasion of his leaving to take up the appointment of Electrical Engineer to the Bournemouth Tramways.

Mr. Philip Kemp, M.Sc.Tech., has been appointed Lecturer in Electrical Engineering at the East London College (University of London) in succession to Mr. L. Murphy, who has resigned to take up the position of Managing Engineer to the Perry Barr Fan Works, Birmingham.

The Junior Institution of Engineers.—Mr. G. Marconi has been elected President of this Institution for the forthcoming session, in succession to Sir J. J. Thomson, F.R.S. Arrangements have been made for a party of members to visit the Olympia Electrical Exhibition on Thursday evening next.

International Congress for the Applications of Electricity, Turin.—At the opening meeting on Sunday, 10th September, the following were among those appointed to offices in connection with the Electrical Congress held last week at Turin:—As Vice-Presidents of the Congress: Mr. Alexander Siemens and Dr. S. P. Thompson, F.R.S. As President of the Section of Telegraphy and Telephony: Major W. A. J. O'Meara, C.M.G., Engineer-in-Chief to the Post Office. As Vice-President of the Section for Accumulators and Electrochemistry: Mr. W. Duddell, F.R.S.

Tax on Electric Light in France.—Included in a new series of taxes put forward by the French Minister of Finance is a general tax on electricity and other forms of light. Lighting for public or industrial purposes will not be subject to this tax, but private electric lamps will be charged from ½d. (10 watts) to 1½d. (300 watts) for carbon filament lamps, with double this tax on metal filament lamps. A special tax of 2s. 6d a yard upon the tubes used in connection with mercury vapour lighting is also to be imposed, according to the *Standard* Paris correspondent.



MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5, Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £57 5s. to £57 15s. (last week £58 to £58 10s.).

Metal Filament Lamps.—Messrs. G. M. Boddy & Co., who have now removed from 15, Gray's Inn Road, to 8, Leadenhall Street, E.C. (Telephone, Central 10,503), in continuing to follow the latest developments in incandescent lamps, have now adopted as a successor to the well-known lamp formerly known as the "Metalik," the Mazda wire-drawn filament lamp, the manufacture of which has been fully described in ELECTRICAL ENGINEERING (August 24th, page 469).

The Wandsworth Electrical Manufacturing Co., Ltd.—We understand that the agreement between this firm and Messrs. Galsworthy, Ltd., is now terminated by effluxion of time. The W.E.M. Co. have therefore made arrangements to open a depôt at 165 Wardour Street, W. Their new premises comprise commodious stores, and a large stock will be carried of all their manufactures. They have appointed their South of England representative, Mr. H. Bailey, as manager of the London depôt, with Mr. A. E. Blower as chief assistant.

Cinematograph Regulators.—We are requested to state that Messrs. Carney & Pearn's regulator, described and illustrated on page 509 of last week's ELECTRICAL ENGINEERING, is provisionally protected, and that the design is also registered. The sets are being made under special trade mark.

Dissolution of Partnership.—J. T. Walmsley, E. W. Lucas, and W. Walmsley, trading as the W. & L. Electrical Engineering Co., Granville Street, Swinton, near Manchester, have dissolved partnership. W. and J. T. Walmsley will continue.

Liquidations.—The statement of affairs in the winding-up of Messrs. J. G. Childs & Co., of Willesden Green, London, shows liabilities of £30,202, of which £22,978 are expected to rank, and no available assets. The total deficiency is put at £41,060. The Company was formed in 1901 to acquire the business of Mr. J. G. Childs, an electrical engineer. The failure is attributed partly to unremunerative contracts and to excessive expenditure in carrying on the business.

The liquidator in the winding up of the Electrical Instrument Manufacturers, Ltd., Freezywater, Waltham Cross, has been released.

Bankruptcies.—The trustee in the bankruptcy of V. G. Burkitt, electrical engineer, 38 Park Row, Bristol, has been released.

A first and final dividend of 3s. 9¾d. in the £ is to be paid in the bankruptcy of W. H. Illingworth, trading as the Yorkshire Metal Filament Lamp Co., 30 Pellon Road, Halifax. The dividend will be paid on September 26th at the Official Receiver's chambers, 12, Duke Street, Bradford.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Yorkshire Electric Power Co.—The June half-yearly accounts show net profits of £4,950, compared to £2,621 and £1,069 in the corresponding periods of the two previous half-years. After meeting preference dividend, a balance of £3,000 is carried forward.

Hove Electric Lighting Co.—Interim dividend on the ordinary shares at the rate of 8 per cent. per annum for the June half-year.

Bromley Electric Light and Power Co.—Interim dividend at the rate of 4 per cent. per annum on the ordinary shares, less tax, for the June half-year.

Dick, Kerr & Co.—The report for the year to June 30th shows a net profit of £25,934, after meeting debenture interest, &c., to which is added £42,258 from the last accounts. A dividend of 5 per cent. is recommended on the ordinary shares, carrying forward £36,892. Notwithstanding the continued competition in the electrical industry, these results are a considerable improvement over those of the past two years.

Obituary.—Herr Adolph Schweiger, a director of the Siemens Schuckert and Siemens Halske Works, and well known as a pioneer of electric railways, died on Sunday at Wiesbaden from apoplexy of the heart. He was 60 years of age.

The Sale of Electric Irons in America.—It is estimated that no less than 250,000 electric flat-irons were sold in the United States and Canada last year. This approximates, according to the *Electrical Review* and *Western Electrician* of Chicago, to one iron for every eight homes.

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Supplement to "Electrical Engineering" of Sept. 28, 1911.

THE ELECTRICAL EXHIBITION OF 1911

PART II.

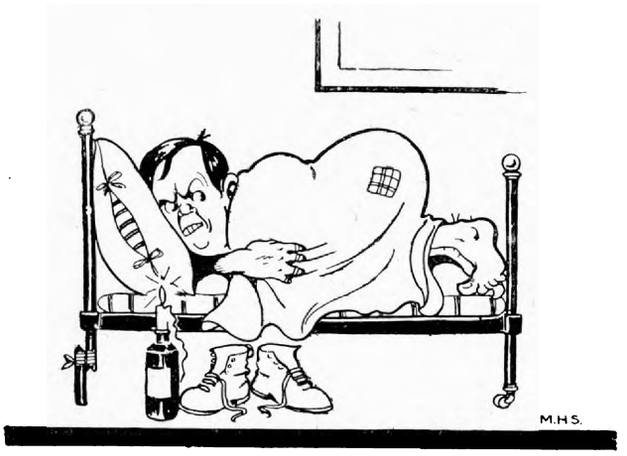
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DISCOMFORT

in the home is one of the objects which the man in the street is constantly striving to avoid, and if anyone is sufficiently fortunate to be in a position to assist him in achieving his desires, then whoever it may be should regard it as a public duty to see that everyone is thoroughly acquainted with his methods of achieving this object. There are many little ways in which our little comforts might be increased and our discomforts decreased, but it is impossible to take advantage of them since no attempt is made on the part of those responsible for their introduction to distribute knowledge of their existence. Chief amongst the causes of discomfort is the difficulty of maintaining the temperature of living-rooms at a comfortable and healthy degree. The ideal manner is by means of electric radiators or convectors. Yet these types of heaters are not so frequently met with as would be the case were the benefits resulting from their adoption, in preference to other means of artificial heating, well known.

No firm apparently has paid more attention to the subject of developing electric heating apparatus on commercial lines than Simplex Conduits, Ltd. It can be no longer the charge against electric heating that it is the "advantage of the few" on account of first cost. The several designs which are exhibited at the Company's stands, Nos. 148 and 163, at Olympia, conclusively prove that at last, if after some delay, the time has now been reached when even those of most moderate means can afford to purchase either a radiator or convector, as may best suit their particular tastes. In fact, it may be said that the time when electric heating apparatus will be reduced to the level of gas in regard to cost is within measurable sight, and a great deal of this progress should undoubtedly be placed to the credit of Simplex Conduits, Ltd., to whose efforts in this direction the trade in general is indebted.

The heaters referred to are constructed throughout at the Company's Garrison Lane Works, both as regards the metal-work and the elements themselves. This particular section of the Company's business is confined to one department, and as the result considerable advantage accrues to the buyer, not only in the matter of price, but in the question of design and efficiency in working.

One big disadvantage under which electric heating has laboured up to the present moment, has been that in the construction of the finished article more than one firm, perhaps several, have had a hand, with the inevitable result that the price, having to withstand many profits, has been unduly inflated, whilst the completed appliance has not improved in its migration through several hands.

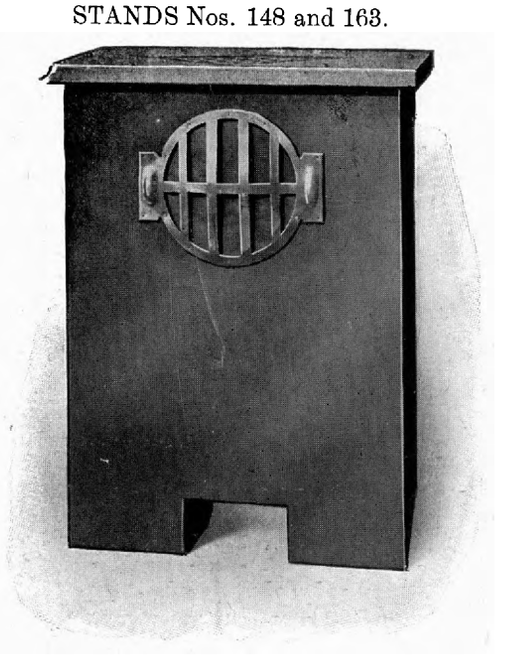
In the illustration is shown the Convector type of heater, capable of maintaining a room of the usual size found in surburban houses, at a healthy, comfortable temperature, which is retailed at a couple of pounds.

Attempts have been made, and successfully in so far as mere price is concerned, to produce electric heaters approaching these figures before, but, for the reasons already stated, the result has not been to reflect any credit upon electricity, but rather the opposite. For example, however cheap an appliance of this nature may be, the average consumer, even though he be limited in pocket to the extent of a pound or so, is not content with an article which even in the kindest spirit cannot be described as anything but an eyesore.

In the designs hitherto put before the public, low price has been effected at the expense of design and such necessary adjuncts as ornamental work to break the hard, unsympathetic lines of the black iron, a red lamp to give a cheerful glow, a switch to control the heat, have been omitted—all these, which cannot be considered other than essential, have been included in the type of convector shown in the illustration. A point which should always be emphasised in connection with electric heating is the facility with which the heat can be controlled, thus forming a ready means of economising in the current consumed, and adjusting the heat of the room required for personal comfort to a nicety.

To those who require a cheerful glow the lamp radiator is most likely to meet with favour, and the variety of designs and the range of prices illustrated in the handy little catalogue produced by Simplex Conduits, Ltd., is such as to comply with the taste of every class of buyer. One point which might be emphasised, however, in this connection, is that, wide as the range may be in certain instances where price is but a secondary consideration, the Company are in a more favourable position than other manufacturers of similar goods in that they have, on their permanent staff, several designers who thoroughly understand what is required of them, and are therefore able to get out particulars and drawings of any special type of heater which may be required to suit special decorative schemes, upon the shortest possible notice. Buyers are then satisfied in dealing with the Company that they are actually in touch with the fountain head, and that the whole of the apparatus which they may order will be made throughout in the Company's works. In the case of those buyers to whom this fact is likely to bring a feeling of comfort, they should visit

STANDS Nos. 148 and 163.



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THE ELECTRICAL EXHIBITION OF 1911

(SECOND NOTICE.)

THE Electrical Exhibition at Olympia, London, was formally opened by Sir William Preece, K.C.B., F.R.S., at 2 p.m. on Saturday last. The speeches, however, were made at the inaugural dinner, which took place at the Trocadero Restaurant on the preceding evening, the report of which will be found on the next page. By now, the Exhibition is in a complete state, but at the time of the opening we regret to say that a great deal still remained to be done. This was partly occasioned by the fact that Olympia was only available for the purposes of the exhibition a bare fortnight beforehand, and in consequence the time for making arrangements for the very large supply of current was extremely short. The delay, however, was not entirely due to the electric supply, as the exhibition stand fitters seemed in almost every case to be very lax in carrying out their work to contract time. We would suggest that at future exhibitions the organisers should prepare a standard penalty clause, which they should invite all exhibitors to include in their contract for stand fitting. If this were universally done, the stand fitters would have no option but to accept it, and there is no doubt that a more satisfactory result would be obtained.

A general inspection of the stands shows that almost every exhibitor has put a large amount of individual thought into the arrangement of his exhibit. Moreover, besides the general display of standard electrical apparatus and accessories of the present day, a number of novelties are to be found at the exhibition. It is true that the specimens of the heavier class of electrical plant are comparatively few in number, but the completeness of the collection of lighter apparatus and accessories is perhaps of more importance in an exhibition of this class, which is to interest, not only the electrical engineer, but also the general public.

So far, however, the general public has not yet visited the exhibition in large numbers. Approximately the same amount of gate money was taken at the turnstiles as at the electrical exhibition at Manchester three years ago, but the total attendance has been very much less. At Manchester the distribution of free tickets by the Manchester Corporation and neighbouring local authorities owning electricity undertakings was very large indeed, and although we understand that the London electric supply authorities are distributing some thousands of tickets, yet this distribution was apparently started rather late, and the desired effect has not yet been obtained. We understand that a further large free distribution of tickets by the supply authorities is being arranged for in return for more favourable terms of purchase being granted. We trust that the Exhibition Committee will not attach too much importance to the gate money, and will be more generous themselves in the distribution of free tickets among the trade through the exhibitors. At present some exhibitors are complaining that in addition to the large amount of money they have spent in taking space and preparing an attractive exhibit, they have to make an enormous outlay in tickets at 4s. a dozen, to bring customers and potential customers to the exhibition, for no free tickets have been distributed to exhibitors except the bare number required for their own stand attendants.

At the instance of several exhibitors a meeting was held on Tuesday afternoon to discuss the question of the poor attendance on the first two days, and to urge the organisers to spend more money in advertisements in the daily papers and in other means to attract the public. We understand that no definite conclusion was arrived at, and that the subject will again be discussed in a few days' time, but in the meantime it was decided to add an attraction in the form of a Hungarian band, which performed yesterday for the first time.

EXHIBITION TELEPHONE DIRECTORY

A NUMBER of firms at the exhibition have had their stands connected to the telephone exchange, but by an unfortunate oversight no directory of telephone numbers has been included in the exhibition catalogue. At the suggestion of one of the exhibitors, we supply this need. Exhibitors can communicate with one another and with the whole of the Metropolitan exchange area.

Name of Firm.	*Telephone Number. (Olympia.)*
Adams Manufacturing Co., Ltd.	63
Allen West & Co., Ltd.	2
Armorduct Manufacturing Co., Ltd.	4
Barker, John, & Co., Ltd.	51
Bat Meter Co., Ltd.	7
Benjamin Electric, Ltd.	77
Bi-Metals, Ltd.	15
Brimsdown Lamp Works	20
British Electric Transformer Co., Ltd.	41
British Prometheus Co., Ltd.	6
British Thomson-Houston Co., Ltd.	5
Bullers, Ltd.	8
Callender's Cable & Construction Co., Ltd.	55
Concordia Electric Wire Co., Ltd.	9
Churchill (Charles) & Co., Ltd.	48
Dorman & Smith	30
Drake & Gorham, Ltd.	49
Dussek Bitumen Co.	40
Edison & Swan United Electric Light Co., Ltd	13, 14
Efandem Co.	44
Electric & Ordnance Accessories Co., Ltd.	39
Electrical Apparatus Co., Ltd.	54
"Electrical Review"	47
Electromotors, Ltd.	12
Elliott, Bros.	42
Engineering & Arc Lamps, Ltd.	64
Everett Edgcumbe & Co., Ltd.	11
Ferranti, Ltd.	16
Foster Engineering Co., Ltd.	10
Galsworthy, Ltd.	65
Gent & Co., Ltd.	17
Globe Electric Co., Ltd.	18
Hands, A. C.	19
Harrison, Haydn T.	59
Hartnell, Wilson, & Co., Ltd.	57
W. T. Henley's Telegraph Works Co., Ltd.	3
Holophane, Ltd.	45
Jandus Arc Lamp & Electrical Co., Ltd.	22
Johnson & Phillips, Ltd.	21
Laing-Wharton, Ltd.	43
Lancashire Dynamo & Motor Co., Ltd.	24
Litholite, Ltd.	23
Lucy, W., & Co., Ltd.	37
Magic Appliances, Ltd.	25
Marconi's Wireless Telegraph Co., Ltd.	58
Mirrlees, Bickerton & Day, Ltd.	52
Morgan Crucible Co., Ltd.	26
Nalder, Bros. & Thompson, Ltd.	27
National Phonograph, Ltd.	53
Ozonair, Ltd.	65
Peyton & Peyton, Ltd.	50
Phœnix Dynamo Manufacturing Co., Ltd.	30
Pooley & Austin	28
Pope's Electric Lamp Co., Ltd.	1
Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd.	38
Simplex Conduits, Ltd.	31
Sterling Telephone & Electric Co., Ltd.	32, 75
Sun Electric Co., Ltd.	29
Sunbeam Lamp Co., Ltd.	33
Union Cable Co., Ltd.	34
Union Electric Co., Ltd.	46
Venner & Co.	35
Waygood, R. & Co., Ltd.	56
Western Electric Co., Ltd.	36
Westinghouse Cooper Hewitt & Co., Ltd.	76

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THE INAUGURAL DINNER

THE inaugural dinner was held at the Trocadero Restaurant on Friday evening. Sir William H. Preece presided, and was supported by the majority of the members of the Executive Committee and several exhibitors. "Success to the Electrical Exhibition" was proposed by Sir Albert K. Rollitt, who emphasised the value of an exhibition such as this in spreading education, encouraging invention, and discovering geniuses. The benefits of an exhibition, he explained, were derived through organisation: religion was organised piety, politics organised public opinion, commerce organised shop-keeping, and an exhibition was a gigantic shop-window—in this case a shop-window embracing 80,000 sq. ft. of floor space, and in which some 250 firms were represented. Sir Albert's speech was punctuated with a selection from his inexhaustible stock of anecdotes; and among his digressions from the main subject of his speech was a reference to the street lighting of Oxford Street (London), Sir Albert remarking that he knew no better street lighting than this.

During his reply to the toast, Sir William Preece said that on January 1st, 1912, he would be able to celebrate his Diamond Jubilee as an engineer, as he had been in harness since 1852. He also referred to his recent visit to South Africa, where, he mentioned, there was at present great engineering activity and a large field for British manufactures. Mr. Hugo Hirst proposed the health of the electrical supply authorities at whose instigation these exhibitions were started. At the commencement they had been in the habit of asking manufacturers to send small consignments of goods, which they exposed in spare rooms or shops. The exhibitions organised by the National Electrical Manufacturers' Association were largely the result of the failure of these smaller ones. The exhibitions of 1905 and 1908 had been successes, and so would the 1911 exhibition. The question arose, however, whether future exhibitions would continue successful unless there were a change of method. He suggested that, in the future, instead of the exhibition being divided into individual stands at which every exhibitor showed every class of apparatus he made, it should be divided into sections—lighting, heating, cooking, power, &c.; each manufacturer could put his name on what he was showing, but there would be a uniformity in the display which was now lacking. Concluding his remarks, Mr. Hirst said that whatever comparisons might be made between electrical systems in this and other countries, there was no doubt that our central stations, their organisation and management, were far in advance of anything that could be found abroad.

Mr. Frank Bailey (Engineer-in-Chief of the City of London Electric Lighting Co.) and Mr. Alderman Pearson (Chairman of the Bristol Electricity Committee) replied. Mr. Bailey said that the electric lighting companies controlled 14 millions of capital. During the last 14 or 15 years they had doubled their output and halved their coal consumption, in spite of the statements made by the Coal Smoke Abatement Society.

Mr. W. H. Butler proposed the Chairman's Health, to which toast Sir William Preece briefly replied. "The Press" was proposed by Mr. F. H. Nalder, and Mr. T. E. Gatehouse, of the "Electrical Review," responded. Mr. W. M. Mordey then toasted the Visitors, coupling with the toast the names of Mr. Alexander Siemens and Sir Hiram Maxim. Mr. Siemens, in acknowledging the compliment, protested at being considered a visitor in view of the large extent to which his firm is exhibiting; Sir Hiram Maxim indulged in some reminiscences of the early days of electric lighting in the United States, in which he spoke feelingly of the jealousy of the general public at that time if any other than Edison were bold enough to indulge in electrical invention.

SOME OF THE EXHIBITS

The General Electric Co., Ltd.,

67 QUEEN VICTORIA STREET, E.C. (STAND NOS. 103, 112, 125 & 134.)

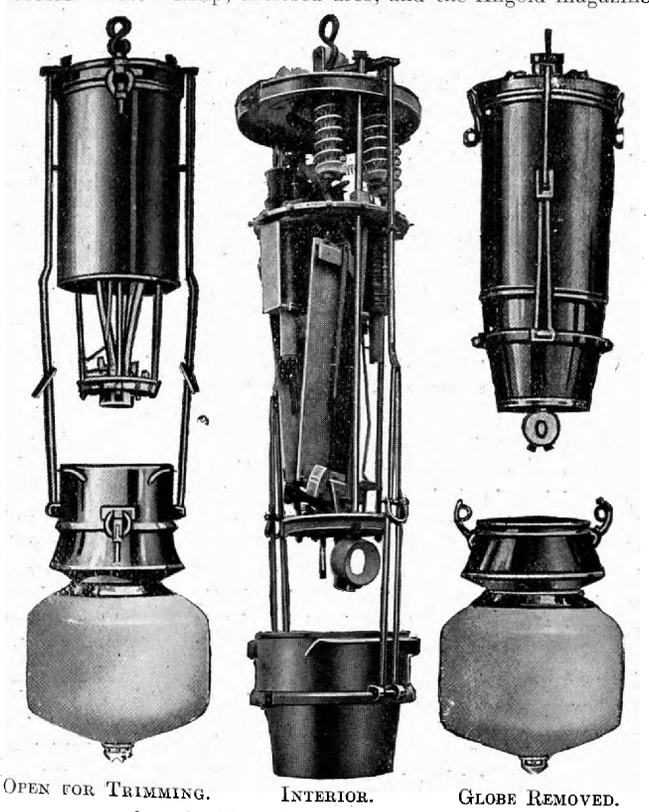
16-*c.p.* 220-*volt Osram Lamp.*—This lamp is one of the surprises of the exhibition, and it has already created considerable sensation. The lamp is already being manufactured in quantities; it is a commercial article, and not merely an experimental curiosity, and the General Electric Co. is prepared to accept orders for deliveries in quantity. Particular interest also attaches to the fact that the lamp has a wire-drawn tungsten filament wound in one length without a joint. The lamp takes 20 watts, and is considerably smaller than the 32-watt Osram, measuring $4\frac{5}{8}$ in. from the end of the cap to the trip, and $2\frac{1}{4}$ in. in diameter. Its filament is a pure tungsten wire 0·015 mm. in diameter, and it has ten turns—the same number as a 32-watt 220-volt lamp. The strength of the filament is remarkable, and it will stand the same amount of vibration as a carbon filament lamp. The new lamps are being sold at the same price as the 200-volt 32-watt lamps; as there will doubtless be a large demand for them, we advise our readers to send in their orders at the earliest possible moment.



Fig. 1.—200-volt 16 c.p. Drawn Filament Osram Lamp. About one-third size.

Other Osram Lamps.—As might be expected, since an 8-c.p. 110-volt tungsten lamp would have the same diameter filament as the 16-c.p. 220-volt lamps, this size is also being manufactured. At the present time, however, deliveries in large quantities are not possible. An interesting exhibit to show the strength of the Osram filament is two model tram-cars, upon each of which is a 32-watt 220-volt Osram lamp. The model is arranged so that the cars collide with the lamps out; they are then automatically lighted, the cars are drawn apart, and the process is repeated with the lamps extinguished. The fact that the shock occurs with the lamps extinguished and the filament cold will appeal to those who know that the filaments can stand vibration far better lighted than when cold. Other lamps are exhibited in all sizes.

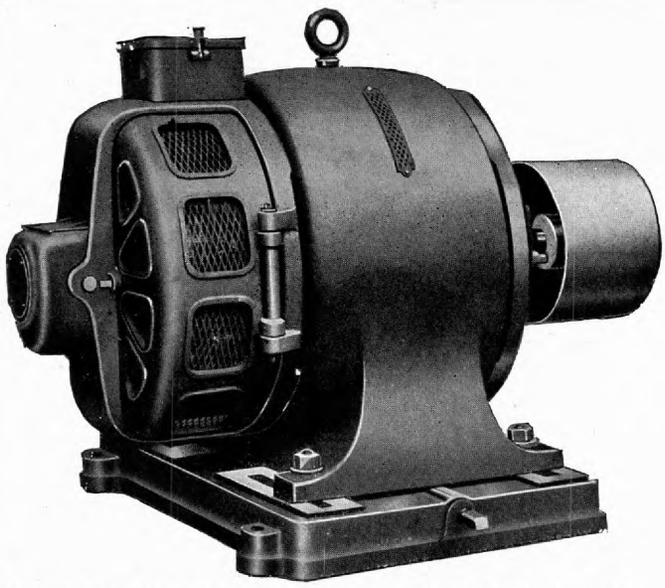
Arc Lamps.—The arc lamps exhibit includes the cheap and useful "Butt" lamp, enclosed arcs, and the Angold magazine lamp. The latest pattern of the last-mentioned lamp will burn 100 hours in the 8-ampere size, and 85 hours in the 10-ampere size. Nine pairs of carbons are used, 15 in. long, and these are ordinary cheap flame carbons without metal core, so that the cost of carbons is only about 0·133 per hour. The feeding of the carbon is effected by a travelling push-bar



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Angold Magazine Flame Arc Lamp.

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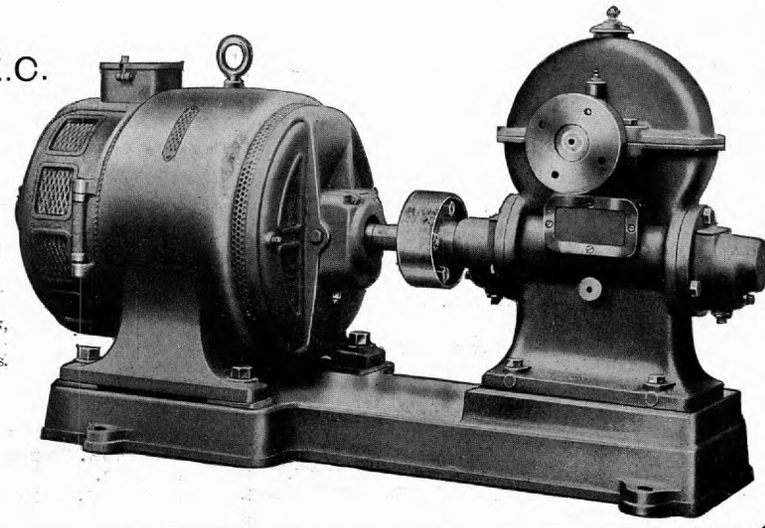
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LIVERPOOL	121, HIGH STREET, WAVERTREE.
LEEDS	ASHFIELD, MYDDELTON, ILKLEY.
GLASGOW	68, GORDON STREET.
BELFAST	38, CHICHESTER STREET.

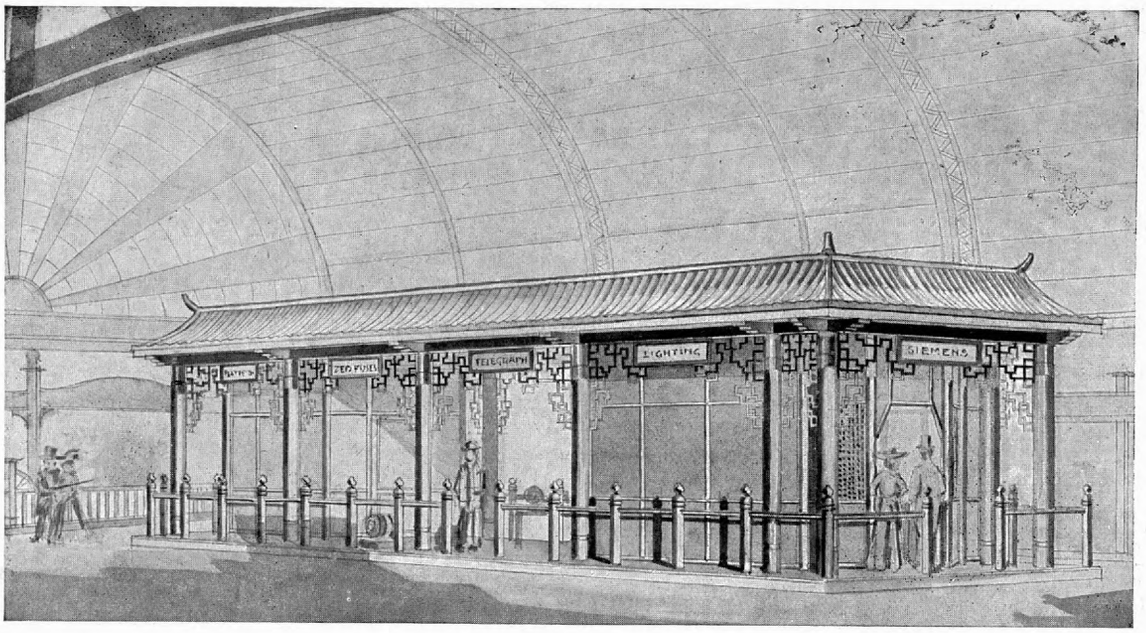
HOLLAND ...	G. W. E. GIBSON, 55, STADHOUDERSPLEIN, THE HAGUE.
NEW ZEALAND	JAS. J. NIVEN & CO., NAPIER AND BRANCHES.
AUSTRALIA ...	T. K. STEANES, PITT STREET, SYDNEY.
TRANSVAAL ...	REATH & CO., HOWARD BUILDINGS JOHANNESBURG.
NATAL	A. B. JONES, LTD., DURBAN.
ARGENTINE ...	ANGEL MUZZIO E HIJOS, ROSARIO.



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SIEMENS

ELECTRICAL EXHIBITION, OLYMPIA.



STANDS Nos. 179, 184, 206 and 209.

EVERYTHING ELECTRICAL

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and attachments, which engage in turn with the upper ends of each pair of carbons. The push-bar has a vertical traverse of about 13 in., and when it has forced the burning pair below the level of the magazines the next pair come into position above the short burning ends. At the same time, the traverse of the push-bar is reversed, and it is carried up until above the level of the second pair of carbons, when it is again reversed and the operation repeated, the new carbons feeding down the short ends of the burning pair, ultimately ejecting them; whereupon the new pair light up. The traverse of the push-bar is accomplished by means of a reciprocating solenoid core, coupled to a phosphor-bronze rack rod, which forces the push-bar up or down, step by step, in the manner of a ratchet jack, the pressure transmitted through to the carbon being in the neighbourhood of 20 lb., which should be an ample margin for overcoming all possible irregularities in the carbon surfaces and clogging of the parts. The upward traverse is continuous, and goes on whilst the arc remains burning, but the downward feed is intermittent, according to the needs of the arc, and is controlled by a catch on the usual differential arc regulating lever.

The upper part of the case is fastened by snap catches for easy removal. It can be taken right away from the lamp whilst the lower half of the case remains hanging on its suspending links. The lower half is now distinct from the corona, and partly consists of a taper iron casting turned with a bevel seating which engages with a similar turned seating on the lamp base. The suspension of lamp consists of an iron hanger which has a certain amount of free action. When the lower case is let down the lamp hangs on the short crossbars bridging the bosses on the lamp crown, but when the lower case is pulled up into position the suspension links (which replace the usual chains) act as levers, and the whole weight of the lamp is thus lifted and sustained by the lower case, the pressure coming on the turned seatings, which are therefore kept quite fume-tight. The outlet for the fumes is at the top of the corona, and in this way a strong draught is produced, which carries the fumes away from the globe surface and keeps it quite clean. The corona is provided with a seating for the globe to ensure a watertight fit. The economiser is so arranged that it can be swung clear of the blow magnets and carbons, thereby facilitating cleaning.

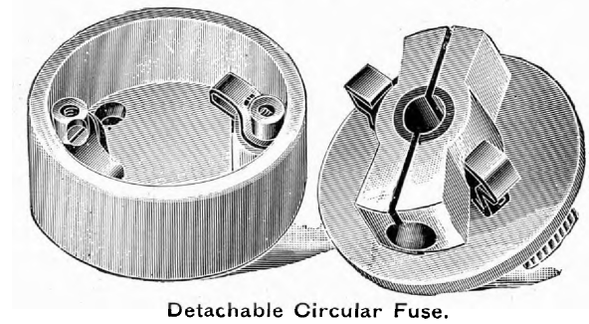
Electric Cooking and Heating.—The electric ovens and other cooking and heating apparatus made by the General Electric Co. are so well known that a detailed description is unnecessary. These appliances are exhibited in all patterns and sizes, and the radiators are exhibited in all finishes, from the cheapest to the most highly finished. Among the cooking



"Convertible" Set (Electric Iron, Kettle, Saucepan and Frying Pan.)

apparatus we may mention particularly the inexpensive and useful "convertible" set illustrated. This comprises an electric iron kettle, saucepan, and frying-pan. The separate utensils can be placed upon the upturned surface of the iron, which becomes, for the time being, an electric hot-plate. This *multum in parvo* is sold at the moderate price of one guinea.

Other Exhibits.—Among the company's other exhibits is, of course, a large and representative selection of fittings. Some fine, heavy Georgian fittings will command attention, and mention must be made of an interesting series of cane fittings which are a decided novelty and of pleasing appearance. The new "Slick" switches, with their extremely small projection, are shown in all varieties of covers and finishes. The latest patterns of fuses and distribution boards merit inspection, and the detachable circular fuse which we illustrate will also be found of considerable utility. The "Kleenall" vacuum cleaner is shown in operation, as is also a parquet floor polisher, consisting of a brush and a vertical motor, which should prove invaluable for large drawing-rooms and public halls. Motor fans, and in fact practically every domestic application of electricity, are also shown. Space will not permit us to do full justice to all the company's exhibits,



Detachable Circular Fuse.

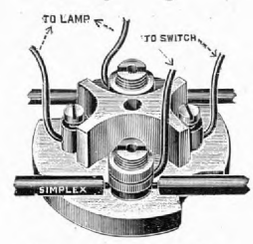
and we recommend those of our readers who visit the exhibition to set aside adequate time for their inspection of the General Electric Co.'s stand.

Simplex Conduits, Ltd.,

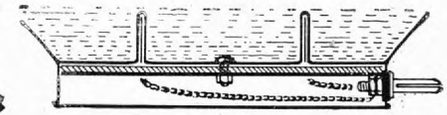
GARRISON LANE, BIRMINGHAM. (STAND NOS. 148 & 163.)

Conduits and Fittings.—This firm exhibit their steel conduits, and their many lines of lighting and power supplies. Among the conduit accessories in which considerable development has been made, and for which the demand has increased considerably of late, are porcelain interiors for use with junction boxes as a means of effecting a lasting and safe joint between conductors. In the majority of cases these interiors are intended for use with the smaller sizes of wire, but a number of types are also available for heavier cables up to 19 strands. Our first illustration shows a typical pattern recently introduced, designed to fit into standard Simplex circular junction boxes. There are two externally threaded main terminals carried on each side of a china divisional fillet, and these terminals have a central slot. By means of this formation it is not necessary to sever the circuit wires: all that is required is to bare the insulation about a quarter of an inch, and drop the exposed conductor into the slot mentioned, and the conductor is then clamped in position by means of a screwed ring. Two subsidiary terminals are provided for connection to the switch and to the lamps; these interiors save considerable time in making the necessary connections.

Heating and Cooking.—In the subsidiary accessories, not necessarily designed for the conduit system, the Simplex Com-



Porcelain Interior.



Arrangement of Heating Element in Kettle.

pany exhibit a considerable range, and have specialised more particularly on the better quality English-made accessories. A new 3-pint 500-watt copper kettle, which is attracting much attention, is substantially constructed, and will boil the full capacity of water in ten minutes; the price of the kettle is as low as 13s. 6d. The design of this kettle is such that the heating elements are practically surrounded by water, as seen in the diagrammatic illustration. Another useful appliance (illustrated on the next page) is a 600-watt toaster, which is sold for one guinea. It is nickel-plated all over and is capable of toasting two slices of bread at one time. The bread is placed in the removable sides, and held in position so that the minimum amount of heat is allowed to escape. The heating element is a ribbon of special resistance alloy wound spirally over strips of mica, and these are connected in series-parallel or parallel according to the voltage. It will toast two slices of bread of average thickness in about three minutes, and the consumption per slice works out at about 15-watt hours.

The Simplex Co. do not confine their heating and cooking exhibit to these light pieces of apparatus, however. Among the exhibits is a $13\frac{1}{2}$-kw. cooking range, intended to serve for a dinner for thirty people. It consists of a double oven taking $2 \times 2\frac{1}{2}$ k.w., a two kilowatt or six-chop grill, also capable

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of being switched on in two halves, two regulable boiling rings taking ¾ and 1 k.w. respectively (the latter capable of boiling two pints of water in seven minutes), four vegetable boilers of from 850 to 1,250 watts, and a four-pot "bain-marie" taking 1 kw. In the ovens the heating elements are enclosed in iron plates at the sides, the grill is heated by exposed coils above it, and the vegetable boilers are fitted with coils in the bottom of each vessel arranged in a similar manner to those in the electric kettle already referred to, and so connected that the whole vessel can be drawn out of clip connecting contacts for cleaning.

Fittings and Shades.—A few months ago the company purchased the business of Jesson Birkett & Co., Ltd., and since then the fittings and art metal-work business has been steadily progressing. Examples of the products of this department form a prominent part of the exhibit. Mention should also be made of some highly artistic silk shades, which have been given the name "Mosaic," and other pat-

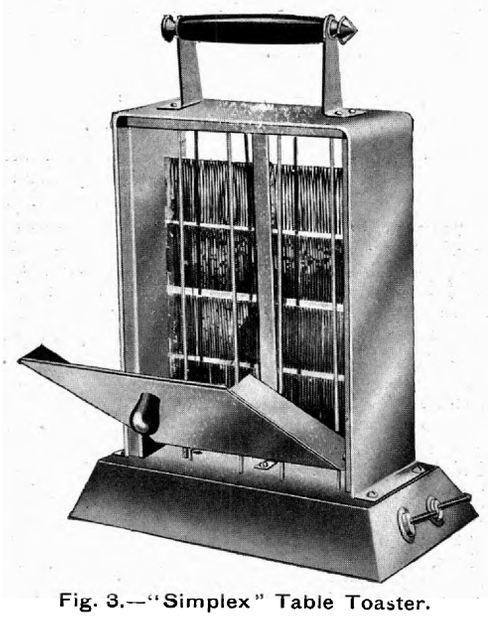


Fig. 3.—"Simplex" Table Toaster.

terns of silk and paper shades are shown, from "Nuremberg lanterns" to "Spookie" paper shades.

The radiators shown are mostly of the cheaper type calculated to suit the middle-class pocket, but a few specimens of fine designs, both in the case of radiators and convectors, are also shown.

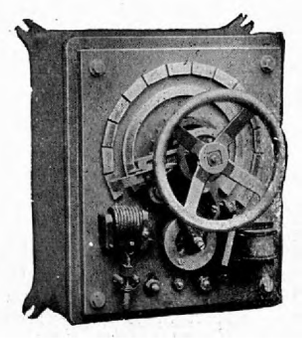
Fuse Wire.—Lastly, we must note the "bi-metal" fuse wire sold by the company under Hope's patent. It consists of a copper strand surrounded by a more fusible alloy. It will carry its rated full load current indefinitely, but as soon as the melting-point of the alloy is reached, with an increase of 10 per cent., the fuse melts quickly. For very short periods, we are informed, it will carry up to six times its full load of current, which makes it particularly useful for controlling motor circuits on which there are heavy starting currents. It is also said to be free from oxidisation and consequent ageing.

Siemens Brothers & Co., Ltd., and Siemens Brothers Dynamo Works, Ltd.,

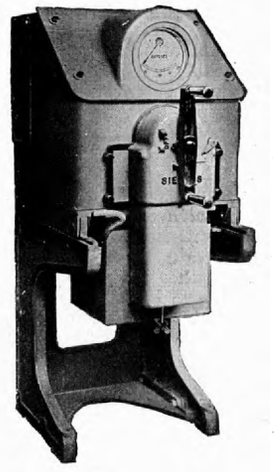
CAXTON HOUSE, WESTMINSTER. (STAND NOS. 179, 184, 206 & 209.)

The two large and artistically designed stands of the two Siemens firms probably represent more branches of electrical engineering than any other in the exhibition.

Power Plant, Switchgear, &c.—As is to be expected from exhibition conditions, the heavy plant from the Stafford works is not as well exemplified as apparatus of a lighter nature, although a fine collection of photographs remind the visitor of the great achievements of the firm in this direction. There are some interesting items of switchgear shown. The most notable among these is a complete mining switch pillar of the draw-out type similar to that illustrated here. The pattern shown is made for voltages up to 3,300, and currents up to 75 amperes. The front portion of the case, containing the oil switch current transformer, ammeter, &c., is arranged to be drawn forward bodily, at the same time disengaging the isolating contact plugs and rendering all the drawn forward part dead, without leaving any live parts easy of access, and the interlocking arrangements not only prevent this being done unless the switch is off, but only permit of the case being opened after it is fully drawn forward. The whole is built up of units, so that a number of such panels can be connected together to form a board of any size. Other oil switches are also shown. Among the low tension switchgear are several varieties of starters and complete motor control pillars. Of particular interest is the "flywheel type" slow motion starter, in which each successive step is timed by a heavy spring oscillating balance wheel. Among the smaller switches attention should be paid to a form of tumbler switch with exceptionally quick break, well shown by a large model. Motors of a large range of sizes, from the smallest

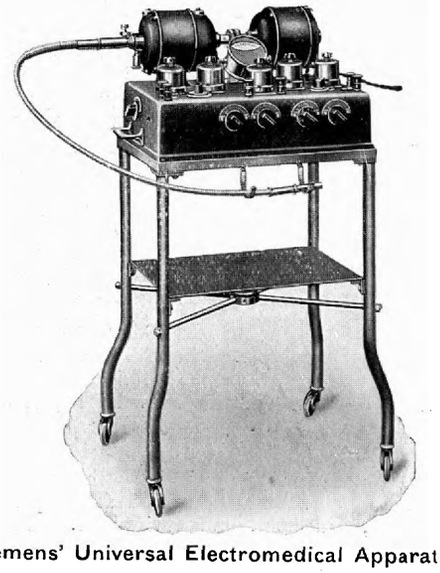


Siemens' Flywheel Pattern Starter.



Siemens' Carriage Pattern Mining Switch Pillar.

upwards, are shown, including special forms for particular purposes, such as the spring-supported individual drive loom motor, of which over 1,800 have already been supplied to the Lancashire and Yorkshire textile districts. Motor driven drills and other portable tools are also included, and a novelty is shown in action in the electrically driven rotary pump useful for country house water supply, &c., and other similar purposes.



Siemens' Universal Electromedical Apparatus.

This is arranged with a float switch to start and stop the motor as water is required, or, in an alternative arrangement, a switch connected to the draw-off tap causes the motor to run only while water is being drawn. Other applications of the electric motor shown in action include a sewing machine and a vacuum cleaner.

Heating Apparatus, Fans, Fuses, &c.—A good show of radiators is on view, and other heating apparatus includes kettles, hot-water jugs, grillers, flat-irons, cigar-lighters, &c. Fans are also well represented, and a good deal of interest will attach to the series of examples of the Zed cartridge fuse, which is steadily increasing in popularity, and is now shown in larger sizes than before up to 160 amperes.

Cables and Wires.—Almost every class of cable made for any purpose is represented by samples from the Woolwich

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works, together with various cable accessories, jointing materials, &c., and a pair of braiding machines are shown in action covering flexible wires. Not the least interesting exhibit of this department is the board demonstrating the well-known Stannos system of wiring with metal-cased conductors of a flexibility rendering them adaptable to the most difficult situations. The details of this system, with which by now all our readers must be familiar, are extremely well thought out, and the increasingly large extent to which the system is being used shows that its good qualities are appreciated.

Batteries, Telegraph and Telephone Apparatus, and Line Material.—The well-known Obach and other dry cells made by the firm are, of course, represented, as well as various forms of fluid primary cell. Among these, attention should be drawn particularly to the Neotherm cell, in which an outer iron case lined with grid fitted with copper oxide forms the positive electrode, and an electrolyte of sodium hydrate is used with a zinc negative. With the action of the cell the copper oxide depolariser becomes reduced to metallic copper, but can be regenerated from time to time by the whole iron case being placed in a furnace to reoxidise the copper. The cell is capable of heavy discharge rates, is compact, and is specially recommended for yacht lighting and similar work. The company's special non-incrusting zincs should also be mentioned, and these are made in most sensible shapes, thickest where they are most liable to eat away. A few of the telegraph instruments for which the firm have so long been famous are shown, and an excellent display is also made of telephones and bells of a variety of forms, including specially protected telephones for use in proximity with high-tension lines, mining telephones, loud-speaking telephones, and intercommunication apparatus. Iron poles, insulators, and other telegraph and telephone line material are represented, and an interesting corner of the stand shows details of the complete system of electric railway signalling which the company have developed. Prominent among these is a signal actuated by a small motor driven by twelve large dry cells, useful where the signal is at a considerable distance from the cabin.

Instruments, &c.—Space does not permit of a recapitulation of all the patterns of instrument shown, including as it does moving iron, moving coil, and induction type apparatus, but attention may be drawn to a very compact portable testing set, in which a complete potentiometer with a standard cell is contained within the apparatus by means of which the multiple range milliampere and voltmeter may be checked at the time and place it is used for comparisons with instruments to be tested, or other accurate measurements.

Electro-medical Apparatus.—A special feature of one of the Siemens stands is the display of electro-medical apparatus. Demonstrations are given of Röntgen ray working in a special room at one end, within which is a lead-lined cabinet provided with a window and containing all the apparatus required, well screened from operator and subject. High frequency apparatus is also shown, and a particularly compact practitioner's outfit is exhibited in the Universal electro-medical apparatus illustrated opposite, which contains complete equipment for the supply of current for cautery, light, galvanisation, electrolysis, cataphoresis, ionisation, faradisation, &c., and a motor to drive a flexible shaft as required for various forms of operations and massage. Complete outfits are also shown for obtaining the high voltage high frequency currents required for the new process of diathermy, in which comparatively large currents at high voltage, rendered innocuous by their high frequency, are passed through the body to produce local heating effects.

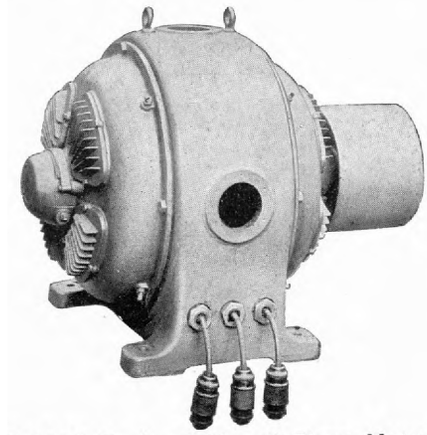
Lamps, Fittings, &c.—Arc lamps of several patterns are shown, and of course the well-known tantalum and one-watt metal filament lamps are well represented and effectively displayed. On both stands a great number of fittings are shown, including lustre patterns, cut glass electroliers, and other fittings in Elizabethan, Jacobean, Queen Anne, Georgian, Sheraton, Chippendale, and modern English styles, Dutch candle fittings, Louis XIV., XV., and XVI. and Empire styles, and examples of Oriental fittings. Fittings for marine work are also shown, as well as outside fittings for shop and street lighting, glass and silk shades of all descriptions, and the latest designs of holophane glassware. The most effective demonstration of electric lighting on the stand, however, is the completely furnished and artistically decorated little room entirely lighted by tantalum candle lamps in most graceful fittings. Over the stand is an internally illuminated sign bearing the word Siemens, and in a smaller frame the design of the famous satisfied consumer is outlined in a most effective way with miniature lamps. The company have also three large signs illuminated by Tantalum lamps on the gallery balustrade.

The British Thomson-Houston Co., Ltd.

RUGBY. (STAND NOS. 124 & 135.)

Lamps, Fittings, &c.—One of the most important features of the stand is, as might be expected, a fine display of Mazda lamps with their strong wire-drawn filaments, the manufacture of which was fully described in ELECTRICAL ENGINEERING (August 24th, page 469). They are shown in a variety of sizes, some in combination with holophane reflectors, and some with the new "Mazda-lux" reflector, which consists simply of an aluminium-spun hood over the lamp of a scientifically designed shape to obtain the required distribution of light, enamelled outside, but with the inner reflecting surface of unpolished aluminium. The efficiency of these reflectors is remarkably high, as shown by the photometric curves exhibited, and the beautiful distributing effect is well shown by the Mazda lamps in these reflectors mounted in the roof of the stand. The top of the stand is outlined most effectively by small coloured Mazda lamps, and some 3,000 Mazda lamps are included in the large flashing sign at the exit of the exhibition, which is arranged with a flasher to show at intervals of ten seconds no less than seven different changes of wording. The Gem metallised carbon lamp is also shown, and not the least interesting item on the stand is the Magnetite arc lamp, which was fully described in ELECTRICAL ENGINEERING (Sept. 14th, page 509).

Plant, Switchgear, &c.—Standard B.T.H. motors for continuous current two-phase and three-phase are on view on this stand in sizes down to small sewing-machine motors, but no large plant is shown. One of the enclosed type three-phase motors is illustrated here. There is, however, a good deal of interesting switchgear. Among this are examples of contactor panels for large motors (as illustrated in ELECTRICAL ENGINEERING, May 11th, page 251), equipped with contactors similar to those used for railway work. Separate contactors are also shown in sizes for currents from 15 to 2,500 amperes, fitted with auxiliary control contacts, causing them to close successively as the back E.M.F. rises. Solenoid type auto-



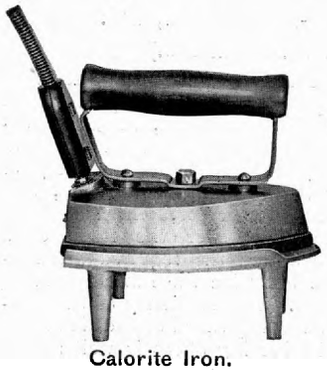
B. T.-H. Enclosed Type 3-Phase Motor.

matic starters are also shown, and a remote control automatic field regulating rheostat switch. There is also a new design of large crane controller, of similar appearance to a tramcar controller, with electric braking positions. The well-known Tirrill regulator is shown in its latest form, with circular actuating magnet and three vibrating contacts in parallel, and a selection of recording voltmeter charts show its marvellous powers of regulation. A mining switch-pillar, similar to that illustrated in ELECTRICAL ENGINEERING (Mining Supplement, May 4th, page XXXVI.), will also attract attention amidst the comprehensive selection of switchgear shown. An excellent display of B.T.H. meters of all patterns is made, including the new R.S. type for alternating current, which is a particularly simple and compact form of induction meter with very few parts. Other meters shown include mercury meters of the house service, portable and switchboard types, as well as prepayment meters.

Heating and Cooking Apparatus.—The British Thomson-Houston Co. have for long specialised in electric heating and cooking apparatus, and a thoroughly representative selection of these products is to be seen. The latest developments include not only the extremely durable "Calorite" irons, but also the application of the calorite element to kettles, such as the one illustrated here. In these the heating element is

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external to the kettle itself, and can be easily removed by withdrawing a few screws. New and well-finished designs of



Calorite Iron.



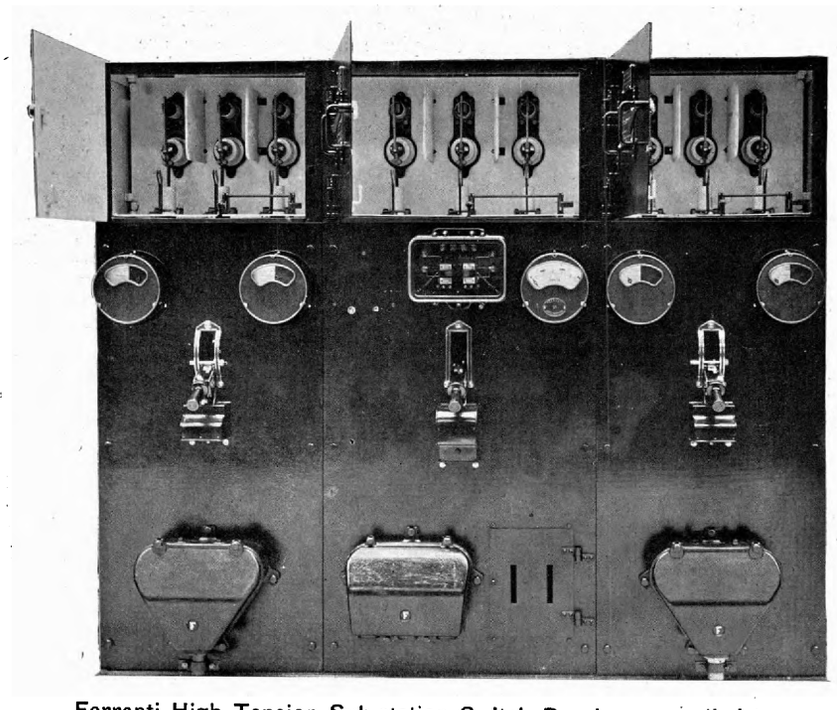
Calorite Kettle.

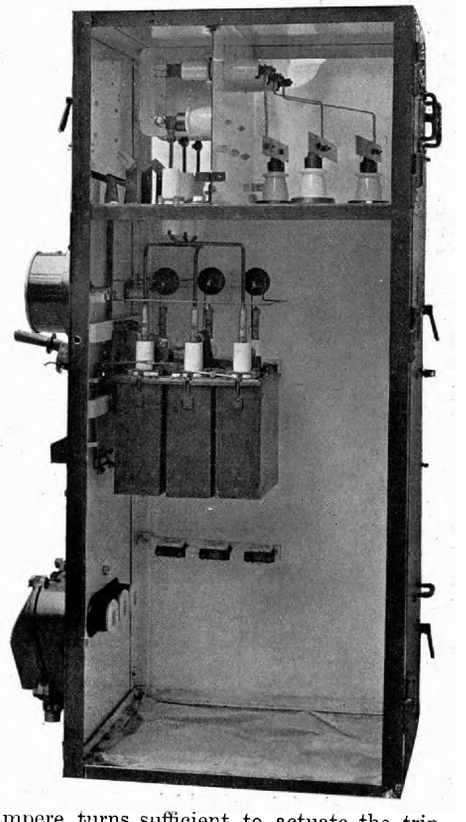
non-luminous radiators are also shown, some provided with switches for as many as six different heats.

Ferranti, Ltd.,

HOLLINWOOD, LANCASHIRE. (STAND NOS. 102 & 113.)

The arrangement of this stand, which is near the centre of the hall, is as original as it is effective, and a number of most interesting exhibits are shown exemplifying the varied branches of the firm's activities and presenting several novelties exhibited for the first time. There are no pillars, signs, or roofs to obstruct the view or give a feeling of being cramped. All round the stand, behind a rail, are oak panels inclined at an angle whereon are mounted the various pieces of apparatus; inside these are ample spaces for the reception of visitors and the display of further apparatus, while in the centre is an excavated tiled pit, where, without hiding other objects, full-sized high-tension switchgear is exhibited in a way suggesting a sub-station "atmosphere."





Ferranti High Tension Sub-station Switch Panels as supplied to Birmingham Corporation.

Switchgear, Contactless Starters, &c.—Among the novelties shown, attention may first be called to a complete enclosed motor control pillar equipped with the new Ferranti tube type "contactless" starter, a regulator also devoid of sliding contacts, and pair of automatic circuit breakers in place of a main switch. These starters, which present considerable advantages over the sliding contact type, are made in a variety of forms, all of very simple construction. The essential part is an enamel-lined steel tube containing a pile of specially made hard carbon discs in the moderate-sized starters about the size of a penny, which are caused to decrease in resistance by being compressed by a plunger worked by the starter lever. All the usual releases, slow motion devices, etc., can, of course, be fitted, and the apparatus is compact, simple, and durable. The contactless or compression regulators depend in a like manner on the compression of a pile of carbon discs, although their construction is slightly different. On other panels are shown enclosed switches of the pattern in use exclusively as main switches on the stands throughout the exhibition, of which an illustration is given opposite, and a new pattern of enclosed tubular fuse with the fuses enclosed in fibre tubes and the clips fitted with guides so that a fuse tube may be replaced easily in the dark. Other items shown include action transformer starters and circuit breakers, as well as switchboard instruments, relays, current and potential transformers, etc. In the pit in the centre is a group of three panels, forming one of about 90 sets made for the Birmingham Corporation, fitted with standard Ferranti oil switches, isolating switches in a top chamber with doors interlocked with the main switch, and other necessary appliances. The trip gear on the switches is worthy of attention, in that the trip coil armature acts on the catch through a system of gearing which renders a small number of ampere turns sufficient to actuate the trip. In the pit there is also a large remote control solenoid operated oil switch, with three separate oil chambers designed for a normal load of 3,500 k.w., but capable of breaking short circuit loads up to 20,000 k.w. A control panel of the push button type is mounted at another part of the stand, with a view to demonstrating the rapidity of action of the switch. Other demonstration boards on the stand are fitted up to show the action of the Ferranti-Field balance system of protection (see ELECTRICAL ENGINEERING, Vol. V., page 599), and the Mery-Price system and compression regulators are used to show the sensitiveness of the various relays, etc.

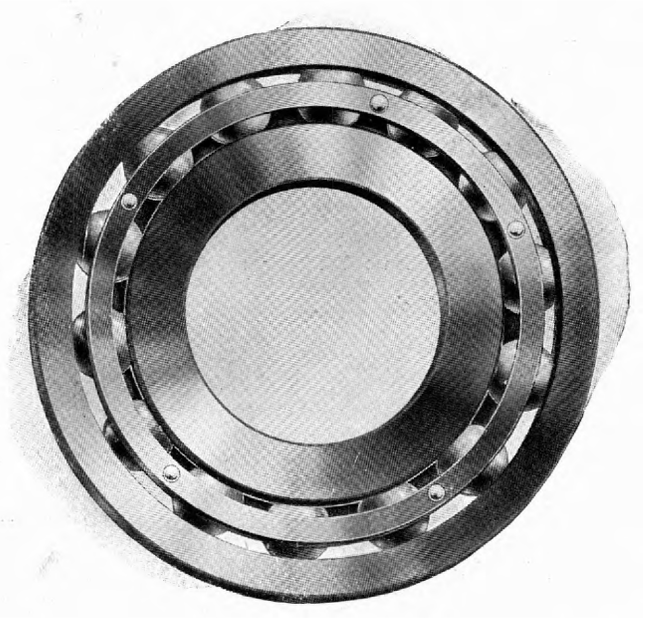
Heating and Cooking Apparatus.—The other half of the stand is devoted to the company's heating and cooking apparatus. The basis of their system is a substantial element made up of a flat strip of a special alloy wound edgewise, with bare edges on mica separating the turns. This in some cases is covered with quartz, and the whole shines with a red glow. These units, mounted in artistic metal-work, form the remarkably attractive new form of electric radiator. In the cheaper classes of cooker the same unit is made up into a 700-watt hot-plate stove, which is put on the market as low as 30s., and is used with special flat-bottomed aluminium utensils, also made in Messrs. Ferranti's own works. The large cookers have two heats obtained by series and parallel

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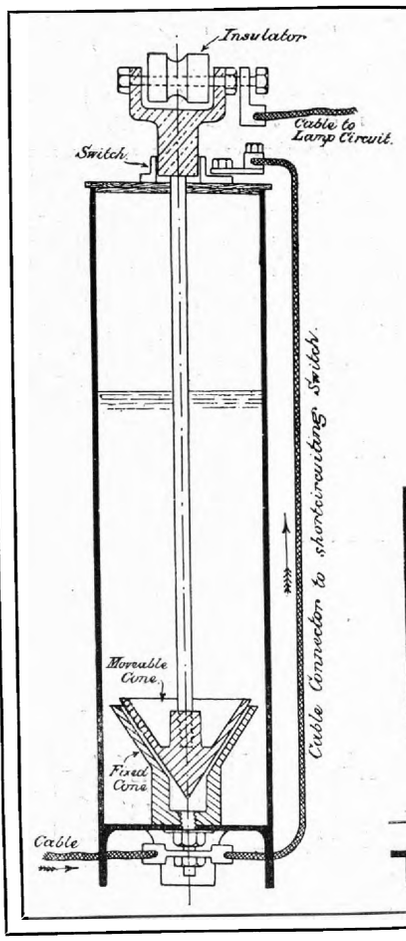


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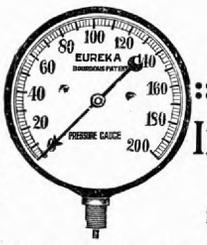
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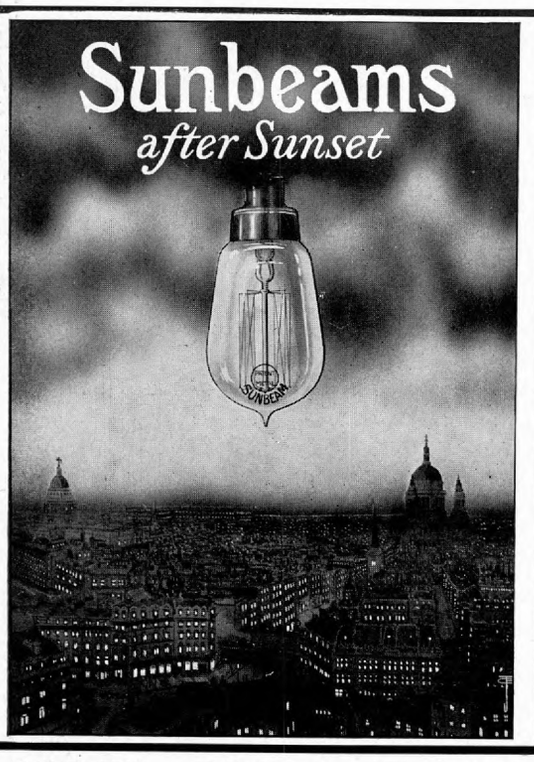
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connection. An attractive silver grill is shown, and the large ovens, also employing heating units of the same description. Both heavy lagged ovens and light sheet-metal ovens with reflecting surface are made, and the large complete ranges comprise features which should be seen to be appreciated.

Meters.—The remainder of this large stand is devoted to the manifold forms of the Ferranti meter, most of which are too well known to need description here. One or two novelties, however, are shown, including a new and particularly simple A.C. induction house service meter, which is standardised in a stout glass case, and a new clock switch, in which the mercury switch is in an entirely separate chamber from the mechanism, and the two arms have separate tightening nuts, greatly facilitating adjustment.

The British Aluminium Co., Ltd.,

109 QUEEN VICTORIA STREET, E.C. (STAND No. 266.)

Aluminium Conductors and Joints.—On this stand, which is in the gallery, the British Aluminium Co. are showing a variety of the forms in which aluminium, owing to its price now comparing favourably with that of copper for both bare and insulated conductors (see ELECTRICAL ENGINEERING, Nov. 24th, 1910, page 749), can be economically employed in the electrical industry. One of the most extensive fields for aluminium is for overhead transmission lines, and the company are exhibiting samples of conductors for this and other purposes for currents from 2 to 2,000 amperes, and showing the various ways in which they may be jointed. For stranded aerial cables the twisted strip joint is most to be recommended, but solid conductors are more usually jointed by butt welding, and welding can also be carried out with great success with a blow-lamp on conductors in place when erecting switchboard connections, &c., to make straight or T joints to attach sockets or lugs, &c., and special tools to hold and press together the parts during welding are exhibited. Cast welded joints are also made in some circumstances, and a variety of special clamps for making mechanical joints are shown. Numerous samples of insulated aluminium cables are also to be seen.

Aluminium Field Coils for Motors, &c.—Aluminium wire of square section with rounded edges is particularly suitable for field coils of railway motors, as owing to the thin film of oxide no insulation need be used between adjacent turns in any one layer, with a gain in space factor, allowing the aluminium coil of equal conductivity to occupy no more space than an ordinary coil of insulated round copper wire. The weights, however, are in the proportion of 29 to 70, and the aluminium coils have the further advantage of better internal heat distribution and a 20 per cent. lower temperature coefficient of resistance. Crane-lifting magnet coils of edgewise aluminium strip are also shown.

Other Applications of Aluminium.—The lightness of aluminium can be taken advantage of in the construction of trolley heads, and examples of aluminium heads weighing 6 lbs., compared with 8 lbs. for bronze heads, are to be seen. A number of other articles in the manufacture of which aluminium figures are shown, as sections for bow-collector contacts, meter discs, and other instrument fittings, cooking utensils, and vacuum cleaner parts.

W. T. Henley's Telegraph Works Co., Ltd.,

13 & 14 BLOMFIELD STREET, E.C. (STAND NOS. 178 & 185.)

A New Wiring System.—Messrs. Henley exhibit some samples of enormous power cables, some specimens of historic telegraph cables, an array of large feeder pillars, and other things that will appeal by their size, but we predict that the exhibit on their stand which will attract most attention is a new wiring system to meet the present demand for methods of reducing the cost of wiring the premises of small consumers. Although this system will have to compete with others already in the field, there is no doubt that it has distinctive features which will command attention. The foremost of these is the use of a new sheathing for the wire. It is in the usual form of a seamless tube round the cable, but it is composed of a "special" metal—apparently an alloy of lead with other metals—which is sufficiently flexible to stand a considerable amount of sharp bending, and is yet considerably harder than the ordinary pure lead sheathing.

Two different arrangements of wiring are provided for. The first a concentric system for use in cases where an insulated return can be employed, and the second a twin system. The wires in both cases are made in three sizes, 1/18, 3/22, and 3/20, and they are insulated with vulcanised rubber of good quality, but not actually Association grade, although the radial thickness of insulation conforms to the standards of the Engineering Standards Committee. The insulation consists of a lap of pure rubber and two of vulcanised rubber. In the case of

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the concentric system a strip of tinned copper foil is lapped over the insulation and is immediately in contact with the metal casing, so that it supplies the additional conductivity for the return circuit. The connection to the fittings is made in an extremely ingenious manner, as seen in the illustration below. A steel wood-screw is used, the head of which is drilled and tapped to enable a steel stud $\frac{1}{5}$-in. diameter to be screwed into and to project from it from $\frac{3}{4}$ in. to 1 in. The end of the strip in the cable is then punched with a small hole by a tool resembling an ordinary ticket-puncher, and is fixed on to

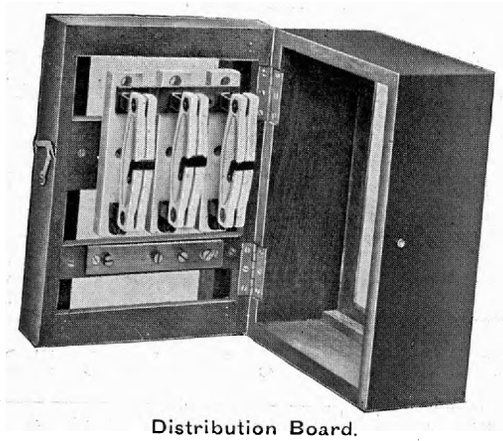


The "H.W.S." Fitting and Block.

this stud by means of washers and nuts, and if other cables lead to the same point, for looping in, &c., their outers are all fixed to the stud in the same manner, thus ensuring perfect electric continuity in a very simple manner. A spring washer is used underneath the top of the nut to overcome liability of the connections to be worked loose by the alternating current. Finally, the block is fixed to the wall by a conical nut, which screws to the stud and fits into the countersunk hole in the centre of the block.

In the case of the twin system no foil is used under the outer sheathing, and the latter is bonded by means of the clamp shown in the illustration opposite, the lug of which is screwed on to the stud behind the block in a similar manner to the strip in the case of the concentric system. These clamps are nicked so that when required for back entry they can be bent at a right angle. We also illustrate the simple protective covering, which can be used to hide the wires or to protect them when there is a risk of severe mechanical damage. It is made in six foot lengths.

Another illustration shows the simple distribution board

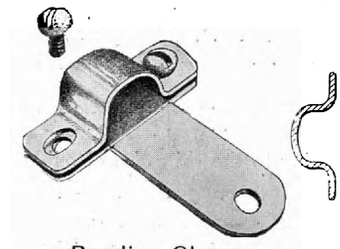


Distribution Board.

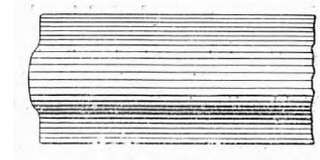
which is employed. The sheathing is connected up to the earthing bar seen at the bottom.

Cables.—A large number of cable samples are shown. Among these is a twin high-tension cable which has been tested to a pressure of 130,000 volts. It is made for Marconi's Wireless Telegraph Co., Ltd., for use at their high-power stations at Clifden (Ireland) and Glace Bay (Canada). The conductors are 0·02 sq. in. section. These are insulated to a radial thickness of $\frac{1}{4}$ in., with impregnated manilla paper. They are then laid up together and covered with a further $\frac{1}{4}$ in. of similar insulation, after which they are lead-sheathed and wire-armoured. The cable is to be used to take current at 40,000 volts pressure from the power house to the transmission house, the current being generated by dynamos connected in series for charging accumulators. The specification asked for a test of 56,000 r.m.s. volts between cores and between cores of lead, but Messrs. Henley's have tested it further, having applied 115,000 volts for three minutes and 130,000 volts for ten minutes. During the test the cable was bent in two places to a radius of 17 ins. A very heavy cable made for the Powell Duffryn Steam Coal Co., Ltd., is also shown. This has three cores, each 0·8 sq. in. section, and is one of the largest ever made for a colliery. It will be used at a pressure of 3,000 volts. The cable is paper-insulated and lead-covered and wire-armoured, and has a copper tape earth shield under the lead. Its overall diameter is $4\frac{1}{2}$ ins., and it weighs 145,600 lbs. per mile. Another sample of cable shown is a three-core shaft cable 0·4 sq. in. section, supplied to the Detchmond Colliery. In this case the insulation is vulcanised bitumen, and the cable is double wire-armoured. The overall diameter is $3\frac{1}{2}$ ins., and the breaking stress 120,000 lbs. The cable is made in one 380-yard length, and was delivered on a drum 9 ft. diameter. The gross weight was 119,000 lbs.

These are only a few of the large light and power cables which are shown. Some interesting specimens of old submarine cables are also exhibited, the oldest of these being a piece of the Ceylon cable laid in 1857. Among other exhibits shown



Bonding Clamp.



Protective Casing.

by this firm is a piece of cable with ozone-proof covering, which is enclosed under a glass cover with an ozone generator. On a part of the cable the ozone-proof covering has been removed, and the test shows how the latter protects the rubber from damage, whilst the exposed surface of the rubber is seriously attacked. A fine collection of junction-boxes, service-boxes, and fuse-boxes is shown, and also some feeder pillars. At the centre of the stand is an overhead pole, which is of the type supplied for the Bahia Blanca power transmission scheme described in ELECTRICAL ENGINEERING some time ago. This carries the 6,600-volt overhead wires, and the above pole forms the feeder pillar, in which three 3-phase underground cables are connected to the three sets of 3-phase lines which the pole supports.

The Brimsdown Lamp Works,

KINGSWAY HOUSE, W.C. (STAND NOS. 100 & 115.)

Metal Filament Lamps.—This is a large and effective stand in a prominent position, and is at once noticeable by the models of John Bull carrying a large Brimsdown lamp wherewith to "see things in a better light," which are familiar to our readers from the well-known Brimsdown poster. Lamps are to be seen showing the wide range of patterns which are turned out at the Brimsdown Works, and considerable ingenuity is displayed in the manner of their exhibition. These lamps, as is well known, are made under the "Colloid-Tungsten" patents, under which the Company possess the sole rights of manufacture in Great Britain, and the various stages of their manufacture were outlined in a special article in ELECTRICAL ENGINEERING (January 26th, p. 41), describing the Brimsdown Works. The advantages claimed for the process employed are the production of a particularly homogeneous filament of long life and high efficiency. And we are informed that the manufacturing facilities of the Brimsdown Works have been approved by the Admiralty, the War Office, the India Office, the Crown Agents for the Colonies, the London County Council, and other public bodies.

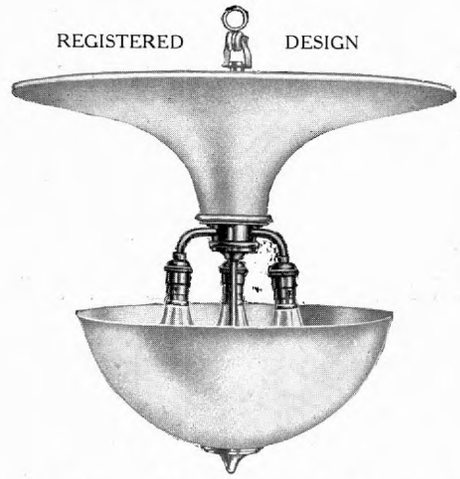
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At Stand No. 152, which bears in bold letters the legend "Electrical Engineering," there will be, open to inspection and purchase, almost every good book on electrical and allied subjects. These have been selected under the guidance of the editorial and reviewing staff of ELECTRICAL ENGINEERING, which includes eminent specialists in all branches. The stand is situated near the centre of the hall, slightly to the right of the main avenue.

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exhibiting for the first time is a reflector illuminating strip, of novel construction. Each metal unit, embodying reflector and screw-lampholder, is hinged to the next, so that the strip is flexible, and can be made up into letters or devices of any kind. The facia of the stand is entirely outlined with this strip, using small bulb Brimsdown lamps.

C. A. Parsons & Co.,

HEATON WORKS, NEWCASTLE-ON-TYNE. (STAND NOS. 203 & 212.)

Messrs. Parsons show a magnificently made model of a 6,000-k.w., 6,600-volt, three-phase turbo alternator, running at 1,000 r.p.m., capable of overload up to 9,000 k.w., as supplied to the Randfontein Estates Gold Mining Co., Witwatersrand. The model is complete with condensing plant, and the turbine represented is similar to the eight supplied to the York Road station of the Underground Electric Railways Co. of London. Parabolic search-light reflectors are also shown.

A PAVEMENT ARTIST

ON Saturday afternoon, shortly after the official opening of the exhibition, a solitary ill-clad figure of an elderly man was seen limping towards the main entrance, where he sat himself down and commenced very diligently to cleanse the flagstones. His next procedure was to start upon a drawing of an electrical lamp, having for a background a large Union Jack. Before giving any inkling of what this picture was intended to represent (although we surmised that it signified a request to support home industries), he transferred his attention to another paving stone, and after a considerable amount of juggling with multi-coloured chalks, he portrayed a silhouette of the City of London. The same electrical lamp was then drawn in on the sky. By this time, of course, a considerable number of people had gathered, and no doubt wondered what the affair was all about. The pavement man, however, was too much of artist to reveal his secret immediately, and kept the bystanders in suspense while he drew a picture of an old-fashioned candle, which drawing he termed "Past." By the side of this he again designed a metal filament lamp. Then, and only then, was the secret revealed. He wrote



A PAVEMENT ARTIST OUTSIDE OLYMPIA.

"Support Home Industries—Use Brimsdown" on the first design, on the second he wrote "After Sundown—Brimsdown," and then sketched in colours the words "See things in a better light—use Brimsdowns now—to-morrow, and all the time." He then displayed two Brimsdown show-cards with a large Brimsdown poster in the background.

The enterprising artist reaped the reward of his labours, and coppers were thrown to him by patronising electrical contractors, who, of course, by this time were able to recognise the advertisement behind the scheme. In return for the pennies thus contributed they were presented with a packet of Brimsdown playing cards, a packet of Turkish or Virginian cigarettes, a Brimsdown purse calendar, or a unique advertising novelty showing the remedy if your light is bad.

We have since been let into the secret that the decrepit old gentleman was no other than Mr. J. Conway Price, the advertisement specialist, of 151 Fleet Street. We believe that it is Mr. Price's intention to have the ninety-one coppers presented to him mounted and framed, to be kept as a souvenir, while the kind lady who flung him a sixpence will always be remembered.

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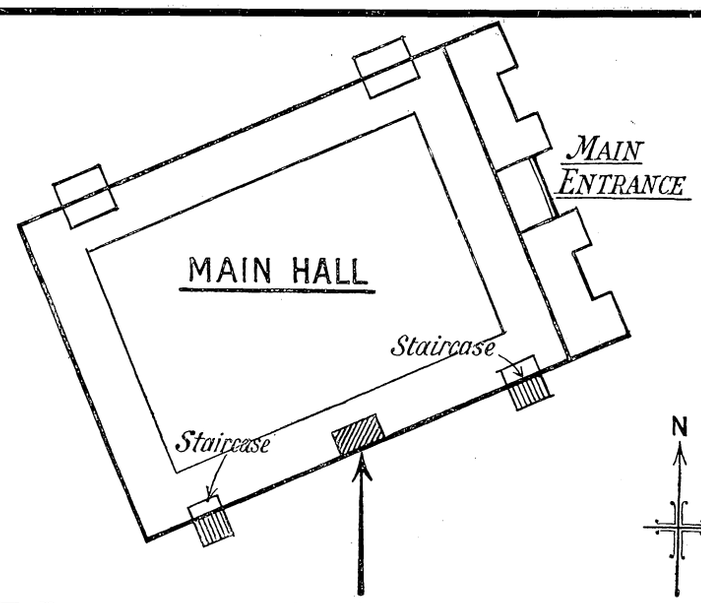
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SUMMARY

Particulars of the new 16 c.p. 220-volt 20-watt drawn filament Osram lamp shown by the General Electric Co. are given in our second notice of the Olympia Electrical Exhibition, contained in a special supplement given with this issue. Some general points in connection with the exhibition are discussed, a useful telephone directory of the exhibition is given, and a report appears of the inaugural dinner, which was presided over by Sir William H. Preece. In the first instalment of our detailed account of the exhibits several novelties are described. Notable among these is the new 220-volt 16 c.p. Osram lamp above referred to. We also review the General Electric Co.'s other exhibits. Another large stand where varied products are displayed is that of Simplex Conduits, Ltd., where heating and cooking apparatus is particularly well represented. Perhaps the stands where the greatest number of branches of electrical engineering are exemplified are the joint stands of Siemens Brothers & Co., Ltd., and Siemens Brothers' Dynamo Works, Ltd. The British Thomson-Houston Co. have also a good display, and one of the finest stands, both as regards its arrangement and the products exhibited, is that of Ferranti, Ltd., whose novelties include motor starters entirely without sliding contacts, and new radiators. The British Aluminium Co. demonstrate the applications of aluminium to the electrical industry, and not the least interesting item in the exhibition is the new wiring system of W. T. Henley's Telegraph Works Co., Ltd. Other stands described are those of the Brimsdown Lamp Works and C. H. Parsons & Co.

An electric power system, involving the distribution of 20,000 kw. amongst four towns, two steel works, and several villages, will be in operation shortly near Dresden. The current is transmitted 30 miles at a pressure of 110,000 volts from a steam station at a colliery. Particulars of the plant and transmitting line, the reason for adopting the high pressure, and other interesting details, are given. (Page 533.)

The action by the Electric Contractors' Association against the Sheffield Corporation in relation to the municipal wiring department of Sheffield is expected to come on early in October.—A lively debate in relation to the Marylebone Electricity Sales Department is expected at the next meeting of the Council. (Page 535.)

A report has recently been issued on the production of iron and steel in the electric furnace in Sweden. (Page 536.)

The result of the Tantalum Lamp show card competition is announced. (Page 535.)

The inaugural dinner of the British Electrical and Allied Manufacturers' Association will be held on Thursday, October 12th. Tickets can be obtained at the Electrical Engineering stand at the Olympia Exhibition. (Page 532.)

On the Nuremberg tramways, bow collectors are being substituted for roller collectors. Among other matters mentioned in our Electric Traction Notes are

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negotiations between the Hartlepool Corporation and the local Tramway Company, a proposal to electrify railways around St. Petersburg, and a tramway rail grinder, which is stated to grind out corrugations at a cost of ¾d. to a 1d. per foot. (Page 537.)

UNDER "Telephony and Telegraphy (Including Wireless)" we mention a statement that the British wireless patents of Messrs. Bellini & Tosi are being acquired by the Helsby Wireless Telegraph Co. We give some particulars of the wireless station which has been erected at the G.P.O., and mention some wireless telephone experiments by Mr. A. W. Sharman, and a dispute as to overhead wires in Southwark.

THE Marconi Wireless Telegraph Co. and J. H. Round have patented a means of reducing the effect of powerful atmospheric discharges in the receiving circuit.—A patent by the British Thomson-Houston Co. and J. Martin describes a means of increasing the range of speed variation of induction motors by arranging the three-phase stator winding for two or four poles, and the six-phase rotor winding, so that it acts as a single winding or as two three-phase windings.—Another specification published by the Patent Office last week describes a single line battery-ringing telephone system, in which the connections are arranged so that in calling part of the line is cut out. (Page 538.)

AN application has been made to the magistrate by a consumer on the St. Pancras mains for the appointment of an electrical inspector. There is a dispute as to the size of break in the switches on consumer's premises prescribed by the St. Pancras Electricity Department. (Page 539.)

THE Manchester Electricity Department are carrying out some interesting street lighting experiments with "Metroflam" arc lamps on posts, and also suspended across the roadways. Independent tests are to be made by an outside expert. (Page 539.)

THE Halifax tramways management is to be separated from that of the electric light undertaking.—The new electrical engineering laboratories at Heriot-Watt College, Edinburgh, are now completed.—A large new Canadian electric power plant has been put into operation.—The Heckmondwike Council are considering a proposal to take supply from the Yorkshire Power Co., in preference to extending their plant. (Page 539.)

A 2,000 ampere switchboard, field regulating rheostat, &c., is required at Belfast; cable, &c., at Grimsby; turbo-switchboards and parts by the Brisbane Postmaster-General; feeder pillars at Southend; electric pumps in Canada, and arc lamp carbons at Hackney. (Page 540.)

THE Cleveland & Durham Electric Power Co. show a net profit of £8,343 for the past year; no dividend is paid. (Page 541.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, SEPTEMBER 28TH.

Municipal Tramways Association.

10.30 a.m. Annual Conference at Newlands Car Depôt, Glasgow. (1) "Tramcar Meters," by R. G. and J. G. Cunliffe; (2) Report on "Tramway Track: Methods of Construction and Maintenance."

7.45 p.m. Annual dinner at Grosvenor Restaurant, Gordon Street.

TUESDAY, OCTOBER 3RD.

Faraday Society.

8 p.m. At Institution of Electrical Engineers, Victoria Embankment. (1) "The 'Paragon' Electric Furnace and Recent Developments in Metallurgy," by J. Härden; (2) "Progress in the Electrometallurgy of Iron and Steel," by D. F. Campbell; (3) "The Hering 'Pinch Effect' Furnace," by E. K. Scott.

THURSDAY, OCTOBER 5TH.

Iron and Steel Institute.

10.30 a.m. Autumn meeting at Institution of Civil Engineers, 25 Great George Street, Westminster. Among the Papers to be read is "On the Application of Electric Energy to the Manufacture of Iron and Steel in Italy," by Cav. Ing. Remo Catani.



The New General Electric Egg.

[The General Electric Co., Ltd., have now a 16-c.p. 220-volt 20-watt drawn filament Osram lamp.]

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A 110,000-VOLT TRANSMISSION SYSTEM IN GERMANY

A REMARKABLE electric power system, involving the distribution of 20,000 kw., both for lighting and power, amongst four towns, two steelworks, and several villages, is now being completed near Dresden, and is expected to be in operation by November next. Although the colliery at which the power house is situated is only about 30 miles from the extreme point of the supply area, a pressure of 110,000 volts, as is used by the Ontario Hydro-Electric Power Commission (see ELECTRICAL ENGINEERING of Aug. 31st last), has been adopted.

The system is being erected by an iron and steel firm, Lauchhammer Aktiengesellschaft, the owners of a large colliery at Lauchhammer, who decided to transmit electric power from the colliery to two of their works at Gröditz and Riesa, 19 and 31 miles distant respectively. Hitherto the requirements of these works could be sufficiently well supplied from local power stations which were fired with brickettes manufactured at the colliery, but the demand has now risen to 6,000 kw. at the Riesa works and 600 kw. at the Gröditz works, and arrangements have also been made to supply three municipalities, who have decided to purchase power in bulk up to a maximum of 12,000 kw. from the Lauchhammer Aktiengesellschaft for a period of 30 years. For the transmission of the 6,600 kw. for themselves, the company had decided upon a pressure of 65,000 volts, but in view of the demand approaching 20,000 kw. in the near future, it was ultimately decided to adopt a pressure of 110,000 volts. The consulting engineer, Herr E. G. Fischinger, in describing the system in recent issues of the *Elektrotechnische Zeitschrift*, of Berlin, explains his decision as follows:—The load at the steelworks will be an excessively fluctuating one, including several electrically-driven rolling-mills, and in view of the large momentary drops in voltage which may therefore be anticipated, it was thought advisable to use the very high pressure stated, so as to keep the maximum voltage drop on the transmission line to 5 per cent. (at a load of 15,000 kw. and a power-factor of 80 per cent.). For this voltage drop a copper conductor of 0·186 sq. in. section would have been required if a line pressure of 65,000 volts had been used, and the cost of copper would have been too great. A section of about 0·11 sq. in. was thought reasonable, but this involved a pressure of 85,000 volts, for which the same special construction as would be required for 110,000-volt apparatus was necessary. In consequence, a line pressure of 110,000 volts with a copper cross-section of 0·065 sq. in. (7 wires stranded, each 6 sq. mm. section) was adopted, the extra cost of the insulators being offset by the saving in copper. Another point influencing the decision was the type of insulator to be employed, as the suspension insulator consisting of a number of small units was considered better than one large pin insulator from the point of view of reliability. One interesting result of the employment of such a high pressure with a comparatively small conductor is that the "corona" discharge will become so great on a rise of pressure that the latter will probably be limited to 130,000 volts. As will be mentioned later, however, the line is further protected against a rise in pressure.

The power station at the colliery is constructed to accommodate four 5,000 kw. turbo sets, of which three are already installed. Twelve out of eighteen boilers of the Lancashire type, each capable of raising 12,000 lbs. of steam per hour at a pressure of 200 lbs. per sq. in., have also been erected. The steam is to be superheated to 750° Fahr. A novel feature of the steam plant consists in the method of removing the ashes. These fall down the inclined floors of the ash-pits and flues, and are delivered into water-tanks (below the surface of the water), from which they can be taken without raising any dust. On account of the difficulty of providing efficient foundations, no chimney stacks are provided, but each group of four boilers is provided with its own economiser and a Schwabach suction draught plant driven by a 50 h.p. motor. Each of the three turbo sets develops 5,000 kw. at 4,740 to 5,500 volts, and 80 per cent. power factor; two were supplied by the Allgemeine Elektricitats Ges., and the third by the Maschinenfabrik Augsburg-Nürnberg and Siemens-Schuckertwerke. The guaranteed steam consumptions with 170 lbs. steam pressure, 660° Fahr. steam temperature, and 91 per cent. vacuum, are 13·34 and 13·57 lbs. per kw. hr. respectively at full load, and 15·87 and 15·1 lbs. respectively at half-load, inclusive of the power required for the condenser pumps. The very cold water pumped up from the mine is used for the condensers, but has to be supplemented with water obtained from two Balke cooling towers.

From the generators the current is taken through armoured cables, oil circuit-breakers, and isolating switches to a double set of 5,000-volt 'bus-bars. At this point some 1,000 kw. is to be taken off for the supply of the local works and colliery, for which about 1,600 kw. is already supplied by an existing station. This 1,000 kw. is supplied through transformers arranged according to the Scott connection, as the local distribution is two-phase, 1,450 volts. Four large transformers with water-cooled oil circulation and with a capacity of 5,000 kw. each, will be provided to raise the pressure from 5,000 to 110,000 volts for transmission. On each side of each of these transformers is an electrically-operated oil switch and two sets of isolating switches, one to each set of 'bus-bars. The two out-going lines are connected through oil switches and isolating switches to the two sets of 110,000-volt 'bus-bars. Instead of using flowing water resistances to lead off static charges from the lines, the high-tension windings of the potential transformers at the generating station are connected in "star" and the neutral

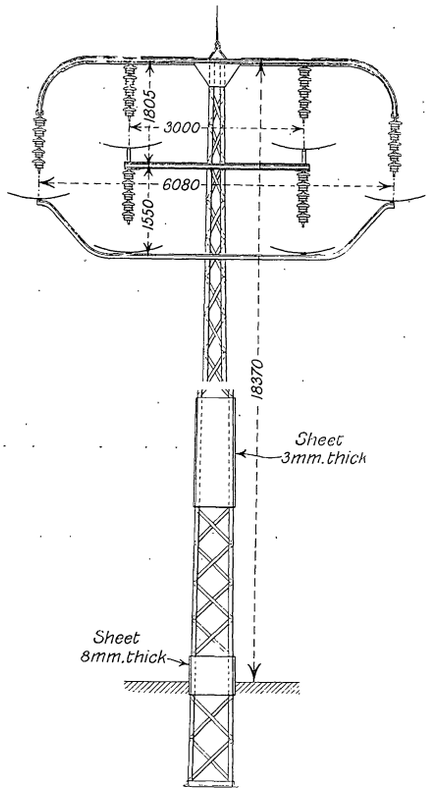


FIG. 1.—TRANSMISSION LINE TOWER AND INSULATORS.

point so formed is earthed. All the transformers and switch-gear for this station were supplied by Siemens Schuckertwerke.

The transmission line consists of two three-phase circuits on a single tower line. This construction was adopted mainly on account of the difficulty of securing wayleaves for two separate tower lines. All the towers are of steel lattice girder construction, as shown in Fig. 1, and the footings are embedded in heavy concrete bases. The conductors are spaced 5·85 feet apart only, which appears to be very close for 110,000 volts. Electrolytic hard-drawn copper is employed for the conductors. The possible saving by the use of aluminium was carefully considered, but on account of the very small proportion of the cost of the conductors to the total cost of the line, and the extra cost of the towers due to the greater sag, it was found that the economy effected in this case was so small as to make the use of copper, in the opinion of the engineers concerned, preferable. A standard span of 500 feet was chosen, but on account of the difficulty of obtaining wayleaves in certain cases, spans of 650 feet and more were often found to be necessary. The line crosses main railway lines four times and the river Elbe once. In the latter case, the span is 890 feet, requiring special towers 117 and 140 feet high on either side of the river respectively, as the conductors had to be hung at such a height as to clear

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the masts and funnels of ships. Fortunately, the line crosses the river at a part between two railway bridges where the masts and funnels are lowered if necessary. After considering various different methods of crossing, namely, steel conductors, special cradle construction, &c., it was decided that the safest and best method was to use heavier copper conductors (7 wires of 10 sq. mm. each), with strain insulators in duplicate, and to strain up the conductors so that there would be a factor of safety of 5 even with maximum ice and

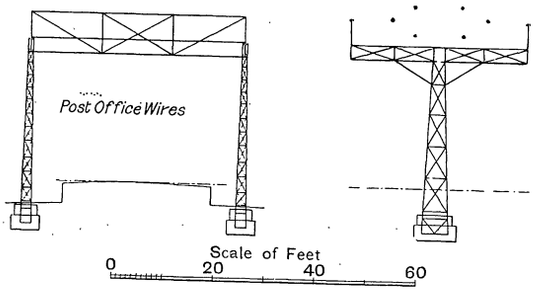


FIG. 2.—CRADLE FOR 110,000 LINE CROSSING ROAD AND TELEGRAPH LINES.

snow load. Across the railways, a special steel cradle construction is provided in accordance with the requirements of the railway authorities. Fig. 2 illustrates the steel cradle employed where the line crosses a street and telegraph wires.

The suspension insulators consist each of five of the units illustrated in Fig. 3, and were supplied by the Porzellanfabrik Kahla, Hermsdorf. The strain insulators were supplied by the Porzellanfabrik Ph. Rosenthal & Co., and consist each of six units, one of which is shown in Fig. 4. Strain insulators are used at the railway and river crossings, and also at all towers where the conductors deviate more than 5° from a straight line. The conductors are also pulled up to the towers by strain insulators at regular intervals along the line—about every mile—where the conductors are interchanged as regards position. In all, the conductors of each circuit are transposed over 30 times, and by this means not only are inductive effects on neighbouring telephone lines practically eliminated, but also the mutual induction and electrostatic influence of the two parallel circuits reduced to a negligible quantity. The particular arrangement of the conductors to effect this was especially devised by Prof. Ulbricht. It will be noticed that, by the bow-shaped form

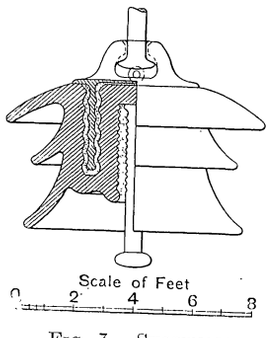


FIG. 3.—SUSPENSION INSULATOR UNIT.

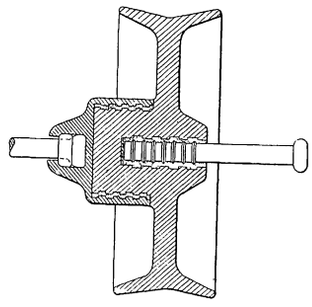


FIG. 4.—STRAINED INSULATOR UNIT.

of the upper cross-arm, the conductors are hung symmetrically, and inequality in the self-induction of the phases thus prevented. The complete set of six conductors is protected from direct lightning strokes by a single steel cable of 50 sq. mm. (0·0775 sq. in.) section, which also serves to interconnect and earth the towers, and each tower has a special earth-plate buried below the concrete foundation. To ensure the earthing of the conductor in the event of a break, steel bows are attached to the arm below the conductor, as is shown in Fig. 1. No tree was allowed to remain near the line which could touch it on falling.

The overhead lines terminate at the E.H.T. 'bus-bars in the first of the two main sub-stations, namely, that at Gröditz, a section through which is shown in Fig. 5. The conductors are pulled up to the wall of the sub-station by means of strain insulators, and connecting wires *A* lead in through the centre of plate-glass panels. Protection against direct lightning stroke or excess pressure is given by the horn-gaps *B* and electrolytic lightning arresters *C*. The duplicate 'bus-bars are shown at *D*, *E* is the choking coil to prevent pressure surges from reaching the apparatus, *F* is a 110,000-volt oil switch, and *G* is one of the oil-cooled transformers. The total capacity of this station is some 13,000 K.V.A. It should be noted that the wide spacing of the conductors and the size of the apparatus necessitates an extremely large building, in this case 155 feet long, 85 feet wide, and 72 feet high. From this station the overhead lines run again in duplicate to a similar but larger station at Riesa, with a capacity of 19,000 K.V.A. A 60,000-volt overhead ring main over 75 miles long, owned by the municipalities, runs through their district, and is fed at

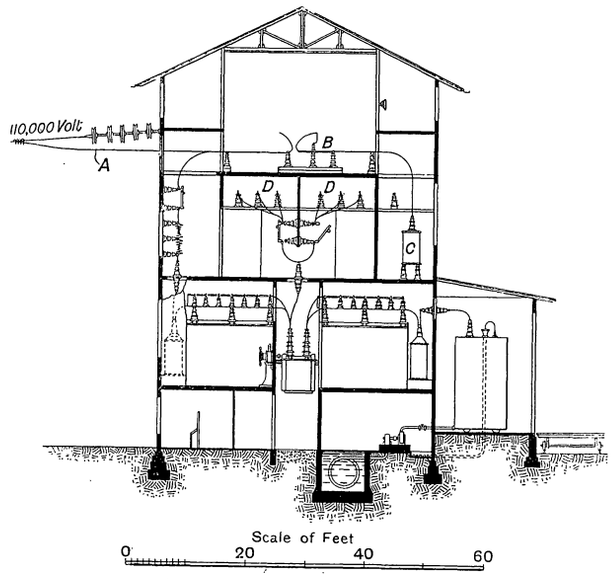


FIG. 5.—SECTION OF GRÖDITZ SUB-STATION.

each end by a single 7,000 K.V.A. transformer in each of the two main sub-stations. There are seven small sub-stations on this ring main feeding current at 15,000 volts to local sub-stations, which distribute at 220 volts. The power taken by the municipalities is measured at each main sub-station by Aron meters with maximum demand attachment.

The pressure regulation of the E.H.T. system is effected by maintaining automatically a constant pressure of 100,000 volts at a point bteween the two main sub-stations by means of Tirrill regulators in the generating station actuated by current transformers. In order that there shall be some means of regulating the pressure on the distributing networks, the municipalities have provided series regulating transformers in each of the seven 60,000/15,000-volt sub-stations on the 15,000-volt side of the main transformers, and these can produce a variation of 750 volts in either direction. It should be mentioned that the transformers and switchgear in the sub-stations at Riesa and Gröditz were supplied by the Allgemeine Elektricitäts Gesellschaft.

New High-efficiency Metal-filament Lamps.—The Deutsche Gasglühlicht Aktiengesellschaft have just put on the market in Germany a new series of high candle-power "Osram" lamps under the name of "Osram-Intensiv" lamps. These are in 200, 400, 600, and 1,000 c.p. sizes, and consume only from 0·83 to 0·87 watt per Hefner candle-power. At present they are obtainable for pressures between 100 and 160 volts only.

Tax on Electric Lamps in Germany.—The official returns of the German tax on illuminating apparatus for the year ending March 31st, 1911, are published in last week's *Elektrotechnische Zeitschrift*. Near 26 million carbon filament lamps were manufactured during the year. Somewhat over 9 million came under the tax, and produced a revenue of over 2 million marks (£100,000). Nearly 42 million metal filament and Nernst lamps were manufactured. Thirteen million were taxed and brought in 4 million marks (£200,000). The revenue from arc-lamp carbons was nearly 3 million marks (£150,000). The total revenue from electrical apparatus was 9 million marks, which, with 4 million from incandescent gas mantles, gives a total revenue of 13 millions (£650,000). This, it may be mentioned, is only just over half the revenue which was expected from this source. (See abstract of original Bill in ELECTRICAL ENGINEERING, Vol. IV., p. 678.)

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MUNICIPAL WIRING

Action against Sheffield Corporation

THE long-anticipated action by the Electrical Contractors' Association against the Sheffield Corporation in respect of the municipal electric wiring department in Sheffield will come on for hearing before Mr. Justice Eve early in the next sittings of the Law Courts, which begin on October 12th. The action will, of course, be nominally brought by the Attorney-General, at the instance of a Sheffield ratepayer. Mr. P. O. Lawrence. K.C., and Mr. Maurice Drucquer will appear for the Contractors, whilst Mr. Danckwerts, K.C., and Mr. J. Sarjeant will appear for the Sheffield Corporation. It is improbable that there will be much evidence as to fact, as the existence of a municipal wiring department at Sheffield is, of course, admitted. Consequently the action will mainly take the form of arguments which in effect will be an appeal against the judgment of Mr. Justice Nevill, in the Leicester case, which was reported in ELECTRICAL ENGINEERING, Vol. VI., June 16th and 23rd, 1910. This held that it is illegal for a municipality to carry out wiring work on consumers' premises in a case such as at Leicester, where the Corporation has no Parliamentary powers other than those contained in the general Electric Lighting Acts. It will be remembered that the Leicester Corporation accepted this judgment as final, and closed down their wiring department. The position at Sheffield is complicated, however, by the fact that the Corporation in 1898 acquired the undertaking of the Sheffield Electric Light and Power Co., and £6,000 of the purchase money was paid specifically in respect of the house-wiring department. When the undertaking was taken over by the Corporation the local contractors objected to this department being continued, but the Corporation resisted their demands, and have continued the wiring of consumers' premises ever since. We understand that it is the intention of the Sheffield Corporation, in the event of their losing the action, to continue the case to the Appeal Court, and, if necessary, to the House of Lords.

The Position at Marylebone

Much activity is being displayed by the Electrical Contractors in Marylebone against the continuation of the Council's electric wiring department. The whole matter is to be thrashed out at the meeting of the Council on October 5th, and in the meantime a meeting of contractors in the district, which was held on September 6th, under the auspices of the Electrical Contractors' Association, has passed certain resolutions protesting against the methods adopted in the management of the department, copies of which have been sent to the Mayor of Marylebone, the Manager of the Sales Department, and the Town Clerk, with a request that these resolutions shall be placed before the Electric Supply Committee and the Borough Council. So far as we are at present informed, the question in the first instance is not being made one of whether the Borough Council is trading in this direction without Parliamentary powers to do so. The electric lighting accounts recently published show that the loss on the Sales Department last year amounted to £2,212, the turnover being £16,959, and the expenditure £19,171. Councillors Oswald, Lewis, and Duncan Watson, who are leading the opposition to the department, maintain that the Council have no justification in trading as electrical contractors at a loss in opposition to ratepayers in the same line of business.

On the question of law the case is taken somewhat out of the category of the Leicester case, and it really resolves itself into a question of how far the Marylebone Electric Supply Department is exceeding its legal powers. The Marylebone Borough Council, by their special Electric Lighting Act of 1904, may provide all the necessary materials for the wiring and fitting of premises, but must not themselves actually carry out any wiring work on private property except between the main of the Council and the consumer's meter. On the other hand, the London County Council's General Powers Act of 1906, gave power to all Metropolitan Borough Councils to carry out electric wiring work without any restrictions. The Marylebone Electric Supply Department, however, in order to be on the safe side, have hitherto adopted the plan of providing all the necessary materials and placing the actual installation work in the hands of a contractor, who finds the necessary labour and is paid on the basis of time. It is understood that the Electric Contractors' Association are awaiting the decision in the Sheffield case, and should that be favourable they intend to proceed against the Marylebone Council in a similar way.

SIEMENS' "TANTALUM" SHOWCARD COMPETITION

WE are informed that approximately 2,000 designs were submitted by competitors for this competition, and we have pleasure in now announcing the names of the successful competitors. It will be remembered that a first prize of £75 was offered, with a second prize of £25, together with a prize of £5 for any designs of more than average merit which the firm decided to adopt and reproduce. Owing to the large number of designs received, the task proved somewhat difficult, and eventually it was decided to bracket the two best designs as being of equal merit, dividing the £100 prize between the two artists. Therefore a prize of £50 goes to Mr. L. Sutton Wood, 3 Featherstone Buildings, Holborn, W.C., and a similar prize of £50 to Mr. Frank M. Barton, 2 Montague Road, West Ealing, W., and we congratulate these gentlemen upon their success. We are informed that Mr. Barton's design will be attractively printed in several colours. Further accepted designs were submitted by Mr. Reginald E. Higgins, 8 Grenville Place, Maida Vale, W., and Mr. F. Insall, Water Lane, Brislington, Bristol, who are the recipients of prizes of £5. The designs of non-successful competitors will be duly returned, every care being taken to ensure their arriving in good condition.

Regenerated Carbon-filament Lamps.—The Prussian State Railway authorities have recently carried out exhaustive tests on carbon-filament lamps prepared by treating old lamps by a special process. They report that the majority of the lamps tested were not satisfactory.

Resistance of Metals at Low Temperatures.—Prof. H. K. Onnes, of Leiden, announces in the *Elektrotechnische Zeitschrift* that he has succeeded with the aid of liquid helium in reaching the extremely low temperature of 2·5° Absolute, as measured by a helium thermometer. Contrary to what was expected, the resistance of pure gold was found to reach a state of practically no resistance at about 4° Absolute, and to remain in a constant state from that point. The resistance of a column of mercury was carefully taken by several different methods at a temperature of 3° Absolute, and was found to be less than 1×10^{-7} of its value at 0° C.

Welding Armature Shafts.—Particulars of a modern system of welding fractured shafts without removing any part of the armature are given in a recent issue of the *Electric Railway Journal*. The coils are protected from the heat of the furnace by a sheet-iron hood, and the space between the end of the hood and the ends of the coils is filled with a heat-insulating mixture of clay and asbestos. The armature is also protected by short square blades attached to a pair of long-handled shears, which fit closely round the shaft. In addition to this, the shaft is also encircled by a perforated U-pipe, through which compressed air passes, producing a cooling effect by its expansion. A special portable oil furnace is used, working under a compressed air draught. The stump of the fractured shaft is inserted through a small aperture in the side of the furnace, and in 10 minutes a 3¼-in. shaft can be brought to a welding heat. Altogether five heats are required. After the successive heats the armature shaft is swelled for nearly the whole of its length by a 100-lb. horizontally suspended rammer, drawn down to about half its original thickness under a steam-hammer, and split down the centre to form the V-shaped scarfs for the wedge-shaped end of the piece which is to be welded on. For the final weld the shaft stump and the axle piece are brought to a welding heat in separate furnaces, and covered with a special powder. The axle is then taken to the furnace containing the armature shaft, and the wedge is driven firmly into place by the rammer. It is stated that more than 100 welds have been made by this process without a failure. The process takes two hours from the time the protective casing is put on until the shaft is ready for the lathe, the weld costing 34s. as against £10 to £14 for the cost of a new shaft.

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ELECTRIC IRON AND STEEL PRODUCTION

A LONG preliminary report on experiments commenced towards the end of last year at Trolhättan (Sweden) has been issued by the Jernkontoret, the Swedish Public Board of the iron industry. Owing to the unavoidable interruptions which prevent continuity of experiments in the early stages, no definite general conclusions are advanced, and the report simply contains an account of the work which has been done from November to April last. Investigations are being made as to the most favourable arrangements and dimensions of electric furnaces for iron and steel production, the best type and arrangement of electrodes, the energy required per ton of product of various grades, the possibilities of manufacturing steel of various compositions, the efficiency of the furnace and maintenance costs, and other questions upon which the production of iron and steel on a large scale through the agency of electricity must depend. It has already been established, as was recently reported in ELECTRICAL ENGINEERING, that the product of the electric furnace is well adapted to the manufacture of steel, and the large scale experiments at Trolhättan (in which the power supplied from the electricity works for the purposes of the research is no less than 2,200 k.v.a.) are already bearing out this conclusion.

SOME LIQUID STARTERS AND CONTROLLERS

WE have had an opportunity of inspecting some new liquid starters and controllers made by Messrs. Tetley & Co. (Falcon Electrical Works, Bedford Street, Greengate, Salford). At the time of our visit a number of 265 h.p. controllers of this type were being completed for delivery to a large mill. These are of the pattern shown in Fig. 1,, and are for 500-volt three-phase circuits. They are combined with switches and ammeters on one support; there is an interlocking arrangement which makes it impossible to switch

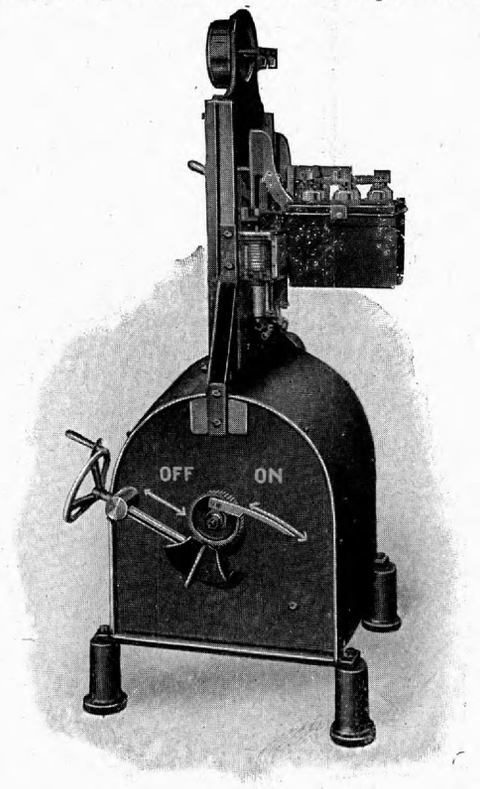


FIG. 1.—LIQUID STARTER AND CONTROLLER WITH MAIN SWITCH AND AMMETER.

on unless the blades of the liquid controller are out of the liquid, and a free handle device makes it impossible to hold the switch down if the overload or no-voltage trip coil is releasing the switch. Two overload coils are used, one in each of two of the three phases. The blades of the liquid controller are attached to a square vulcanite sleeve, which is vulcanised on to a steel shaft, and they have a peculiar shape, the result of prolonged observation and trial, enabling the current to be increased evenly and gradually. At the end of the travel of the blades a short-circuiting bar unites all three windings of the motor to one common point. The starter is strongly and mechanically made, and, we understand, compares very favourably in price with a metallic resistance starter. Particular attention has been given to ensuring that the current density in the blades is not too high, for, although they are immersed in liquid, too high a current density gives rise to rapid corrosion—a point not always realised. The liquid recommended is a solution of soda, about 6 to 10 parts of water to one of saturated soda solution.

This starter is also supplied with knife switches and fuses in place of the oil switch with tripping coils, and is also supplied separately, without switches and fuses.

Messrs. Tetley & Co. are also now manufacturing a liquid starter with automatic release, so that the blades are auto-

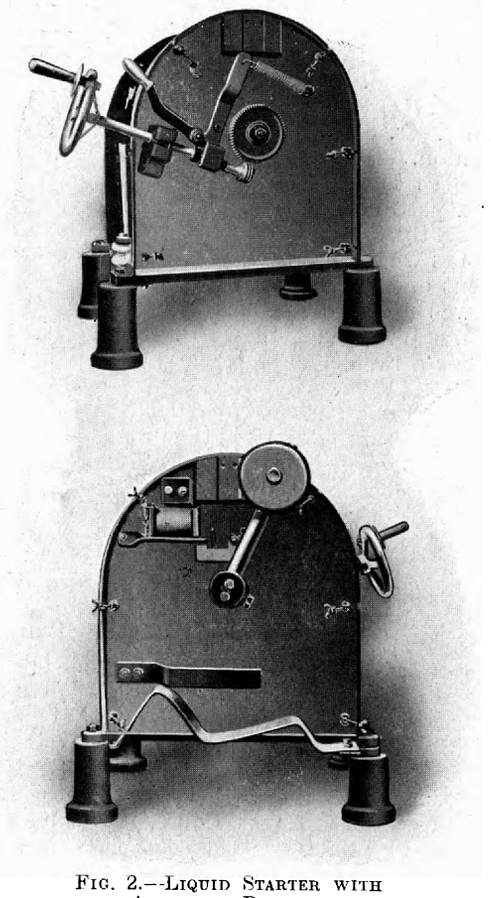


FIG. 2.—LIQUID STARTER WITH AUTOMATIC RELEASE.

matically withdrawn from the liquid on failure of current or overload. It is made in sizes from 25 to 500 h.p. Fig. 2 shows the construction. The upper figure shows the operating handle which lowers the plates into the liquid through worm gear, and raises the counter-weight seen in the lower figure. This counter-weight engages in a catch, which is released when the no-voltage or overload coil operates. The weight then falls on to the buffer springs seen at the bottom, and raises the plates out of the liquid.

The Association of Mining Electrical Engineers.—The first meeting of the Warwickshire and South Staffordshire Branch will be held on September 30th, at the Imperial Hotel, Birmingham. Mr. A. Hall will give an inaugural address. A meeting of the Yorkshire Branch will be held at the Royal Victoria Hotel, Sheffield, on Saturday at 5 p.m.

Gas Fires in Schools.—According to the *Elektrotechnische Zeitschrift*, the Berlin municipal Schools Committee (Schuldeputation) have decided to do away with all gas fires in the schools under their control on account of the frequent complaints from teachers and others of the dryness of the air and the ill effects of this upon the organs of speech. The technical officials reported that their investigations into the matter led them to conclude that gas heating is quite unsuitable for schools.

Kandergrund Power Station.—According to the *Elektrotechnische Zeitschrift*, this water-power station, the property of the Bernische Kraftwerke A.G., was opened in June last. At present only one of three pipe lines is constructed, and this supplies two 4,000 kw. turbine sets, which generate three-phase current at 16,000 volts, 40 cycles, for general power purposes. The remaining turbine sets will be installed shortly. These will generate single-phase current for the Loetschberg Tunnel railway. The turbines are of the Pelton-wheel type by Piccard, Pictet & Cie., of Geneva, and the generators were supplied by Brown, Boveri & Cie., of Baden.

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INAUGURAL DINNER OF THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION

THE British Electrical and Allied Manufacturers' Association have decided that the dinner to celebrate the re-organising of this Association will be held at the Hotel Cecil on Thursday, October 12th, 1911, when it is hoped that there will be a strong muster of members of firms exhibiting and their friends at the Electrical Exhibition. Advantage will, no doubt, be taken on the occasion to make some pronouncement as to the future policy of the Association. Further details will be published later. Early application should be made for tickets by letter addressed to Mr. F. B. O. Hawes, Olympia, Kensington, W., or 36 and 38 Kingsway, W.C.

Tickets may also be obtained from the following firms:—*London*:—Berry, Skinner & Co. (78 Upper Thames Street, E.C.), the General Electric Co., Ltd. (71 Queen Victoria Street, E.C.), and Nalder Bros. & Thompson, Ltd. (34 Queen Street, Cheapside). *Birmingham*:—Chamberlain & Hookham, Ltd. (Solar Works, New Bartholomew Street), and the Electric & Ordnance Accessories Co., Ltd. (Cheston Road, Aston). *Bradford*:—The Phœnix Dynamo Mfg. Co. (Thornbury Works). *Edinburgh*:—Bruce Peebles & Co., Ltd. *Gateshead-on-Tyne*:—The Sunbeam Lamp Co., Ltd. (Park Road). *Glasgow*:—Mavor & Coulson, Ltd. (47 Broad Street, Mile End). *Manchester*:—Electromotors, Ltd. (Openshaw), Ferranti, Ltd. (Hollingwood), and the Lancashire Dynamo & Motor Co., Ltd. (Trafford Park). Tickets may also be obtained from the offices of ELECTRICAL ENGINEERING (203 Temple Chambers, Temple Avenue, E.C.), or from the ELECTRICAL ENGINEERING Stand (No. 152) at the Olympia Exhibition.

ELECTRIC TRACTION NOTES

We are informed that the Croydon Corporation have decided to increase the maximum rates of pay for motor men from 7d. to 7½d., and for conductors from 6½d. to 7d. per hour. The rates of pay of labourers and car-cleaners are also to be raised, the total increases involving about £1,633 per annum.

The Nuremberg-Fürther tramways are substituting bow collectors for the existing roller collectors, which give much trouble by jumping frequently off the trolley wire. The system has many sharp curves.

A quarterly dividend at the rate of 12 per cent. per annum has been declared upon the ordinary shares of the Winnipeg Electric Railway Co.

Sir Edgar Speyer, Bart., presided at the half-yearly meeting of the Underground Electric Railways Co. last week. He said that whilst the Company showed good progress, the dividends paid are by no means a fair or adequate return upon the large amounts invested. When the transfer of the Lots Road Power House to the Joint Committee, as authorised by Parliament, is carried out, a surplus of about £630,000 will be realised in excess of the book value of the power house.

A 2 per cent. dividend is recommended upon the ordinary shares of the Dundee Broughty Ferry and District Tramways Co. for the year to July 31st, carrying forward £388.

Negotiations between the West Hartlepool Corporation and the Hartlepool Electric Tramways Co., in regard to the running of tramways there, have reached a somewhat critical stage. The Corporation have acquired two of the Company's routes, which they propose to re-lease upon certain terms which the Company have characterised as absurd from a business point of view. Among the terms of the proposed lease are that the Company shall pay 5 per cent. on the total capital expenditure of the Corporation in respect of the lines, that they shall establish a sinking fund representing 3 per cent. per annum on the capital, and pay £150 per route mile per annum for the maintenance of the tramways, in addition to a rental.

A proposal for the extension of the Bradford tramways to Bingley is under consideration. The Bolton Borough Engineer is preparing estimates of a proposed extension of the tramways.

It is stated that the Russian Minister of Ways and Communications is preparing plans for the electrification of the railways around St. Petersburg.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The General Post Office are about to erect a wireless station at the Engineering Department's building at St. Martin's-le-Grand. The aerial has already been installed on the roof, and consists of bare copper wires supported between two masts 50 ft. high and 240 ft. apart. This will be connected with the remaining apparatus, which, we understand, will be installed in the Department's laboratory in two or three months' time. It will be mainly for experimental work in connection with new stations to be erected in the future, as well as those existing, and also with a view to keeping the Post Office wireless equipment up to date by testing, under practical conditions, the many new devices which are continually being put forward by inventors.

Mr. A. W. Sharman, the inventor of the Helsby wireless telegraph and telephone systems (ELECTRICAL ENGINEERING, Vol. VI., p. 343, May 26th, 1910), has been carrying out some interesting experiments in Pegwell Bay, Ramsgate, in marine wireless telephony. Messages have been sent between a shore station and a boat, and between two boats, up to a distance, it is said, of three miles.

It is stated that the British patents of the Bellini and Tosi Directive wireless telegraph system are being acquired by the Helsby Wireless Telegraph Co., Ltd.

A dispute between the Postmaster-General and the Southwark Borough Council in regard to whether certain telegraph wires, which it was proposed to place in the borough, should be overhead or underground, came before Mr. Hopkins, the stipendiary magistrate having powers within the district, on Monday. In order to connect up some fire-alarm posts with the fire station, the Postmaster-General desired to erect overhead wires in Hillington Street, Aldred Road, Kennington Park Gardens, St. Agnes Place, Cook's Road, and Heiron Street, but the consent of the Council was refused. The Solicitor for the Post Office stated that the cost of the wires if placed overhead would be £90, whilst an expenditure of £339 would be entailed if they were placed underground. There would be fifteen poles, and the wires were intended to be connected with some overhead wires already sanctioned by the neighbouring Lambeth Council. It was pointed out for the Southwark Council that there were no overhead wires on public property in the borough, and that the Council had always objected to overhead wires.

On the 20th inst. the cable between Medan and Sabang was in working order again, followed on the 21st inst. by the re-entry of the cable between Zanzibar and Mombasa on the active list. The cable between Gibraltar and Tangier, however, failed on 22nd inst., and communications seem to be following the example of those during the Morocco troubles, and giving out at a time when their use is most urgently needed.—The 23rd inst. saw the re-establishment of the submarine cable link between Santhiago and Bathurst, and on the succeeding day the Gibraltar-Tangier cable was restored.—Telegraphic conditions to Casablanca are now again normal, while there is still delay in messages to Mogador.—There is delay in telegrams to points north of Sitka owing to the lines to Alaska being down.—The inland lines of Hayti have been put into order again.—It is a long time since we have had so many items to report, but, as is well known, events never come singly, and one cable going down gives the signal to others.

Iron and Steel Institute.—The autumn meeting of the Iron and Steel Institute, which was to be held in Turin next week, has had to be abandoned owing to a variety of circumstances. Arrangements have, therefore, been made for the meeting to be held at the Institute of Civil Engineers, Great George Street, Westminster, on October 5th, at 10.30 a.m. If necessary, the meeting will be resumed in the afternoon. The only paper of direct electrical interest is by Cav. Ing. Remo Catani (Rome), "On the Application of Electric Energy to the Manufacture of Iron and Steel in Italy."

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Sept. 21, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

20,441/10. **Wireless Telegraphy.** MARCONI WIRELESS TELEGRAPHY Co. and J. H. ROUND. To reduce the effects of powerful atmospheric discharges, a variable conductor and a receiver in the form of a Fleming valve, both of the unidirectional type, are connected in opposition and in parallel as shunts to the receiving circuit. The variable conductor only operates when acted upon by powerful oscillations, so that when the circuits are in tune signals can be received as long as they are not strong enough to affect the conductor; but, on a discharge taking place, the two valves become equally operative, and, being in opposition, no sound is produced. The filaments of the valves are rendered incandescent by current from two batteries, one in each circuit, adjusted by resistances. Potentiometers are also provided for varying the voltage across the valves, so that the sensitiveness of the variable conductor can be adjusted. Two figures.

25,683/10. **Induction Motors.** BRITISH THOMSON-HOUSTON Co. and J. MARTIN. To increase the range of speed variation, the stator is provided with a 3-phase winding, which can be connected for two or four poles. The rotor is fitted with a 6-phase winding, and can operate as a single winding for one number of poles, or as two distinct 3-phase windings for double the number of poles. The speed of the motor is controlled by a 6-phase star resistance connected to the slip rings. Two figures.

25,756/10. **Switch.** M. D. SCOTT. This invention relates to a device to prevent sparking in the case of a solenoid switch for opening one circuit and closing another. The moving contacts, in the form of rollers, are mounted, in one form, on arms pivoted to turn about the end of the solenoid spindle, and are acted upon by a helical spring. The stationary contacts, on which the rollers press, are placed close together on each side of the spindle, so that as the contact rollers move from one to the other they momentarily bridge the gap between the contacts and close both circuits. Three figures.

3,730/11. **Single Line Telephone System.** C. H. ELLISON and W. J. THORROWGOOD. In a battery ringing system in which several stations are connected in series, the relays of the calling bells are shunted by condensers. The calling switches are inserted between the line and the station batteries, which are connected between the line and earth. By this arrangement, while the stations are in series for telephonic currents, part of the line is cut out from the ringing circuit, namely, that between the battery connection of the calling station and the end of the line away from the station which is being called. One figure.

600/11. **Periodicity Transformers.** BROWN, BOVERI, ET CIE. In one method of transferring power at one frequency from a primary set of mains to another set of mains at a different frequency, two induction motors with slip rings are used, coupled to the same shaft. A stationary winding connected to two sets of brushes is also provided either as a separate machine or on the same shaft as the induction motors. The stator of one of the latter is connected between the primary mains and its rotor to one set of these brushes, while the stator of the second motor and the other set of brushes are connected to the secondary mains, the rotor being short-circuited. The power supplied by one machine is transmitted to the mains at half the frequency, partly through the slip rings and partly by the machine acting as generator, the machines having the same number of poles and running at the same speed. The energy can be varied by altering the excitation of the winding. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: SIEMENS BROS. DYNAMO WORKS and BRADLEY [Twin projectors or searchlights] 23,636/10.

Cables and Wires: NIELD [Contact clips for] 21,408/10.

Electric Ignition: BALTRUSCH, 23,030/10.

Electrometallurgy and Electrochemistry: LEVOZ [Production of steel] 20,594/10; SERPEK [Revolving furnaces] 29,715/10; HELBERGER [Furnaces] 419/11.

Heating and Cooking: ELECTRIC & ORDNANCE ACCESSORIES Co. [Ovens] 21,468/10; POWNALL [Heaters] 6,374/11.

Incandescent Lamps: WEBER, 1,210/11; HOUSKEEPER [Filaments] 17,480/11; KNIGHT [Filament supports] 17,482/11.

Storage Batteries: DRAKE, WADDELL, and D. P. BATTERY Co. [Plate packing] 25,516/10.

Switchgear, Fuses, and Fittings: PERRY [Starting rheostats] 20,565/10; COPLAND [Lamp holders] 25,897/10; BARNES [Lamp holder] 26,232/10; MÜLLER [Safety fuses] 27,259/10; WILLIAMS and GILLIES [Electric-light attachments] 225/11; COLLINS and COLLINS [Thermal switch mechanism] 1,900/11; TYLER and FREEMAN [Means for supporting lamps] 21,574/10.

Traction: PIACANI, PACINI, and CAPELLANO [Point-shifting mechanism] 24,524/10; JENSEN *(Witte and Litland)* [Signalling between moving trains] 2,982/11; ALBANESE [Construction of conduit and track of tramway] 3,022/11.

Miscellaneous: SMITH [Portable battery lamps] 20,378/10; HENRI, HELBRONNER and VON RECKLINGHAUSEN [Treating liquids with ultra-violet rays] 20,436/10; MEEK [Magnetic separators] 21,045/10; KUTINER [Insulating metallic coils with layers of oxides] 23,675/10; CROSSLAND and CROSSLAND [Control of coal-cutting machines] 25,426/10; CREMER [Magnetically-locked miners' lamp] 1,665/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: GES. FÜR MASCHINEN-U-METALL INDUSTRIE, 19,002/11 and 19,435/11.

Motors and Dynamos: BRUN [Reversible rotary motor] 15,579/11.

Electric Ignition: ROBERT BOSCH, 13,705/11.

Incandescent Lamps: BLOCH, 17,412/11.

Switchgear: FELTEN and GUILLEAUME CARLSWERKE [Excess current switches], 19,392/11.

Telephony: VOJEN [Receiver of radiating-field type] 17,027/11; ENGLISH, BOUKOFSKY, and LICHTENSTEIN [Antiseptic mouthpieces] 18,785/11; SIEMENS & HALSKE AKT.-GES. [Automatic exchange circuits] 19,185/11, and [Circuit arrangements for automatic systems] 19,186-7/11 and 19,230-1/11.

Amendment

25,651/09. **Turbines.** C. A. PARSONS. As a result of the extended investigation under section 8, the above-mentioned specification has been amended by way of disclaimer. It relates to gearing for turbines suitable for marine propulsion, and consists of differently-speeded turbines driving a common shaft. The main ahead and astern turbines are arranged either direct on the propeller shafts or by single or double reduction gear, while the cruising turbines are similarly geared to the propeller shaft.

Expiring and Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Names in round brackets indicate communicators of inventions from abroad.

Arc Lamps: B. A. QUINT, 12,902/07.

Dynamos and Motors: H. R. RIVERS-MOORE [Commutators] 12,860/07; A. E. WOODHOUSE [Carbon brush-holder] 13,021/07; H. N. HICKLEY [Carbon brush-holder] 13,259/07.

Incandescent Lamps: W. L. WISE *(G. O. Squier)*, 13,207/06; T. W. LOWDEN [Exhausting] 13,152/07.

Switchgear and Fittings: M. RALLING and J. H. COLLINGS [Combined switch and cut-out] 13,082/02; E. A. CAROLAN *(General Electric Co., U.S.A.)* [Magnetic brakes] 12,954/03; ALLGEMEINE ELEKTRICITÄTS-GES. [Switch] 12,855/06; C. REES [Electroliers] 13,300/07; T. S. PERKINS and R. P. JACKSON [Motor control] 8,196/05; J. SAHULKA [Motor-control system] 13,140/07; W. ARTHUR [Motor-control system] 13,206/07; ALLGEMEINE ELEKTRICITÄTS-GES. [Motor controller] 13,265/07.

Telephony, Telegraphy, and Signalling: H. JANKELOWITZ [Antiseptic mouth and ear pieces] 12,761/07; L. NEWITT [Order telegraphs] 12,907/07; W. D. WATKINS and J. W. BOLSTER [Signalling] 13,175/07; SIEMENS BROS. & Co. *(Siemens & Halske Akt.-Ges.)* [Signalling system] 13,349/07; F. R. WEBB [Telephone insulator] 13,044/07; E. L. E. and E. L. C. VACHERON [Signalling] 13,284/06; BRITISH THOMSON-HOUSTON Co. *(Allgemeine Elektricitäts-Ges.)* [Signalling] 13,195/07.

Traction: W. GRIFFITHS and B. H. BEDELL [Surface contact system] 12,684/02; W. COPE [Conduit system] 12,683/03; J. A. WHYTE [Signals] 11,840/05; BRITISH THOMSON-HOUSTON Co. *(General Electric Co., U.S.A.)* [Brake mechanism] 12,973/07.

Miscellaneous: W. H. K. BOWLEY [Flexible metallic tubing] 12,706/03; C. W. HUNT [Hoisting apparatus] 12,780-1-2/03; BRITISH THOMSON-HOUSTON Co. *(General Electric Co., U.S.A.)* [Vapour electric apparatus] 11,971/05; J. SCHWEND [Cutting-machines] 12,813/07; R. P. IRVING [Power hammers] 12,913/07; M. HELLMANN [Apparatus worked in synchronism] 12,969/07; J. H. GIBSON and R. R. BEVIS [Dynamometers] 13,096/07; C. MAY [Fire alarms] 13,327/07; A. and C. E. THOMPSON [Thermostats] 12,941/07.

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WHAT ARE THE DUTIES OF AN ELECTRICAL INSPECTOR?

A CONSUMER on the Borough Council's mains has applied to the local magistrate for the appointment of an electrical inspector under the terms of the Council's Electric Lighting Provisional Order. In the course of the application it was stated that the St. Pancras Council commenced electric supply before the London County Council had general powers in the matter of appointing electrical inspectors. The Borough Council's Provisional Order provides that application must be made to a stipendiary, neither the Board of Trade nor the L.C.C. having any jurisdiction. Mr. Bros reserved his decision.

We believe that the application, which was made on behalf of the consumer through his solicitor, was made without any previous consultation with the St. Pancras Borough Council's electricity department, and, in fact, that the name of the consumer is not even known to the department. It is apparently a protest against the department's regulations as to the size of break of the fuses used on consumers' premises. Owing to these regulations not having been fully complied with, it has been found necessary in one or two cases to refuse to connect up with the supply mains until the necessary alterations had been made.

Electrical inspectors have been appointed by the Board of Trade in the case of many electrical supply undertakings, but we know of no case in which the inspector has been called in to settle a dispute with regard to the details of wiring in a consumer's premises.

STREET LIGHTING IN MANCHESTER

WE recently referred to the installation of street electric lighting in Manchester, and an official inspection by the members of the Electricity Committee took place last week. The experiment is being carried out in Portland Street, Albert Square, and Piccadilly. In Albert Square, says the *Manchester Guardian*, sixteen 6-ampere Gilbert enclosed arc lamps have been replaced by a similar number of 10-ampere "Metro-Flam" arcs made by Messrs. Johnson and Phillips. The height of the new flame arcs is 22 ft. 6 in. from the ground level, against the 17 ft. of the existing arcs. The candle-power of the new "Metro-Flams" is 2,500, against 850 for the Gilberts. In Portland Street central lighting has been adopted as far as possible by means of arc lamps suspended from duplicate cross-span wires attached to rosettes fixed on the fronts or corners of the buildings. Where this course has not proved feasible, side poles with long arms are fixed so as to bring the lamp central with the street. Provision is made for the raising or lowering of the lamps. There are 16 lamps in all, but at the important crossing of Princess Street and Portland Street two are erected on an extension of the existing tramway standards at opposite street corners. The candle-power of the lamps is 3,000. It is proposed to have tests made by an expert, independent of the Electric Supply Department.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ALUMINIUM.—An interesting pamphlet from the British Aluminium Co., Ltd. (109 Queen Victoria Street, E.C.), deals generally with the uses of aluminium in the electrical industry. The progress that has been made in its use for transmission lines is recorded, views of actual lines are reproduced, and interesting details are given as to methods of jointing and erection, with illustrations of twisted sleeve and other joints, and methods of attachment to insulators. Useful tables and constants relating to the calculation of aluminium conductors, and comparing generally the properties of aluminium and copper, are included. Illustrations are also given of bar and strip switchboard connections, fuse strips, special joints for insulated cables, and a host of useful information on these subjects is given. Aluminium trolley heads, bow collector strips, and coils for lighting, magnets, and railway motor field coils.

HEATING AND COOKING APPARATUS.—Messrs. Perry and Grinell, Ltd. (182 Leopold Street, Birmingham) have sent us a leaflet giving particulars of some very moderate priced copper and tin electric kettles, with easily renewable heating elements.

SWITCH.—A leaflet from Tetley & Co. (Falcon Electrical Works, Salford) gives the dimensions and prices of a new switch for 600 volts, with a carbon break and enclosed fuses.

ELECTRIC COOKERS.—The Westminster Tool and Electric Co. (Suffolk House, Laurence Pountney Hill, Cannon Street, E.C.), have sent us an account of their electric cooking appliances. The heating element is specially constructed to withstand very high temperatures. The oven is lagged to prevent the radiation of heat. The top plate is of polished steel fitted with two boiling plates, arranged for two heats, and a grill for a single heat. In a larger size a third boiling plate is provided with three heats. A temperature of over 600° F. can be continuously maintained on the boiling plates.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

RADIATORS.—The Dowsing Radiant Heat Co., Ltd. (105 Great Portland Street, London, W.), have issued a new list of radiators. A few new designs have been added with the usual gilt lacquered frame, coppered interior, and reflector, four lamps, and two switches. A new tubular four-light type has also been included, together with a cheap combined radiator (Dowsing Huntley System), and two new convectors. The firm is also giving its attention to electric irons and cookers. These are made for any voltage, from 25 to 250. The cooker is in the form of a hot plate, and is supplied with two switches.

WATER-SOFTENING APPARATUS.—A booklet from Robert Boby, Ltd. (212 Upper Thames Street, E.C.) describes the "Neckar" water-softening and boiler-mud extracting apparatus, which combines purification of water by filtration, with softening by admixture with a reagent, and the automatic removal from the boiler of the deposit which is produced during the evaporation of the softened water.

TELEPHONES.—A new illustrated price list of telephones has been issued by G. Braulik (8 Lambeth Hill, Queen Victoria Street, London, E.C.). It includes receivers, transmitters, switchboards, magneto-extension bells, accessories, and every type of telephone, whilst diagrams of connections appear at the end.

BALL BEARINGS.—A new circular dealing with the application of ball bearings to electrical machinery is to hand from the Hoffman Manufacturing Co., Ltd. (Albion House, 59-61 New Oxford Street, London). In the illustrations given, a double thrust washer is shown in position to hold the shaft endways. The bearings are fitted with a Stauffer lubricator, so that grease can be put in now and again, to keep the ball races free from rust.

INDUCTION MOTORS.—These are described in a catalogue, which has been sent to us by C. Harding Churton & Co. (Atlas Works, Leeds). They are wound for either single, two, or three-phase currents. The rotors of the short-circuited type have the copper bars connected at the ends by metal rings, which are cast-welded direct to the bars, so that soldered or riveted joints are avoided.

LOCAL NOTES

Acton: *Electricity Undertaking.*—In connection with the acquisition of the Council's electricity undertaking, the Metropolitan Electric Supply Co. have opened a showroom and offices in High Street, where there is a good show of electric light fittings, lamps, heating and cooking apparatus, and motors. The company offer to wire premises on the hire-purchase system, and also to enter into agreements for the hire and purchase of motors. Electrical apparatus such as hot plates, kettles, flat-irons, &c., are being sent out for one month on approval.

Bury: *The New Electricity Works.*—At the last meeting of the Corporation, Mr. S. J. Watson, Borough Electrical Engineer, reported that the new Chamber Hall Power Station had been at work since Friday, August 25th. Since then a regular supply had been maintained from 8 a.m. to 6 p.m., Saturdays and Sundays excepted, the output being about 800 k.w.

Caversham: *Street Lighting.*—A very successful system of street electric lighting has been carried out in Caversham by the Reading Electric Supply Co.

Edinburgh: *Heriot-Watt College.*—The new electrical engineering laboratories at the Heriot-Watt College are now practically completed. They have been altered and refitted at a cost of about £2,000.

Glasgow: *The Olympia Exhibition.*—The Electricity Com-

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mittee recently discussed a proposal to send delegates to the Olympia Electrical Exhibition. The suggestion was defeated by the casting vote of the Chairman, but the Corporation have decided to refer the matter back to the Committee for reconsideration.

Halifax: *Tramway Management.*—The Tramways and Electricity Committee have decided to separate the management of the electricity and tramways undertakings. Consequently, Mr. W. M. Rogerson has been requested to relinquish his appointment as tramway manager in order that he may confine his attention solely to the electricity undertaking. A resolution was passed thanking Mr. Rogerson for the ability he has displayed during the four years he has held the position of tramways manager. The Committee hold the view that the prospective development of the electricity undertaking demands the whole time of a skilled engineer. The tramway management is to be placed in the hands of Mr. J. D. Caird, the traffic superintendent, and Mr. J. W. Galloway, the tramways engineer.

Heckmondwike: *Electricity Supply.*—The Yorkshire Electric Power Co. have laid a scheme of electric supply before the Council. This provides for the company supplying electricity in bulk to obviate the Council putting down additional generating plant.

London: *Stoke Newington: Electric Light.*—The chief library of the Stoke Newington Council has been wired for electric light at a cost of £210. The installation has been presented as a Coronation gift by the Mayor, and the opening ceremony took place on Thursday.

Norwich: *Tramway Purchase.*—The report of the Special Committee appointed to discuss the proposed purchase of the Norwich Electric Tramways undertaking is against the proposition, and the company have been definitely informed that the Corporation do not desire to proceed further with the matter.

Portsmouth: *Electricity Assessment.*—The Electric Light Committee having protested against the proposed assessment of the electricity works at £9,785, the Assessment Committee, in order to avoid any dispute between two Committees of the Corporation, have agreed to fix the assessment at £7,785.

Stirling: *Electricity Charges.*—The Council have approved of the recommendation by the Electrical Engineer for a reduction in the lighting charge of from 4½d. per unit to 4d. per unit.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Belfast.—Tenders are invited by October 9th for a 2,000 ampere switchboard apparatus, field regulating rheostat, and change-over switch. (See advertisement on another page.)

Chester.—Mr. S. E. Britton, the Council's Electrical Engineer, has prepared a scheme for the utilisation of the waters of the River Dee for generating electricity. Mr. A. C. Hurtzig, an hydraulic engineer whom the Council have consulted, has expressed his approval of Mr. Britton's scheme, and the details are to be laid before the River Dee Board.

Epsom.—The Council have decided to appoint an expert at a fee of £25 to advise as to the installation of a Diesel or other engine in the power station.

Grimsby.—Tenders are invited for paper lead-covered cables, fuse boxes, and cast lead service boxes. (See an advertisement on another page.)

Hayti.—The *Board of Trade Journal*, quoting from the *Bulletin Commercial* (Brussels), states that the Port-au-Prince authorities have granted a concession for the erection of an electric power station for supply to electric railways, five miles long, and tramways eleven miles long.

Panama.—A concession has been granted for the installation of an electric lighting plant for private and public purposes in the town of David. The name of the concessionaire is on file at the Commercial Intelligence branch of the Board of Trade, 73 Basinghall Street, E.C.

South Africa.—The *Board of Trade Journal* reports that the Pretoria Town Council have decided to extend the municipal tramway system at an estimated expenditure of £48,000.

A scheme for the rearrangement of the street arc lighting has been prepared in consequence of the unsatisfactory condition of the present installation. It is stated that the continual occurrence of faults is due to the rubber-insulated, lead-covered cables which are laid direct in the ground being damaged by subsidences in the streets. For the last few years, says the *Transvaal Leader*, there has been an average of four faults per week, whilst in wet weather they have amounted to as many as six per day. Two schemes have been suggested to the Electric Light Committee, one being for the laying of entirely new mains for the present arc lighting system, and the other to discard the arc lamp altogether, and lay new cables for lighting the town with metal filament lamps. The cost of the second scheme is put at £8,400, and that of the first at £4,800, but whilst the annual cost of maintaining the present arc lamp system, excluding capital charges, is £10,300, the annual cost of the metallic filament lamp scheme would be £9,080; thus the extra capital expenditure will be more than wiped out in three years by this saving.

OSRAM·LAMPS

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Chatham.—Additions at the Medway Union Workhouse Infirmary. Architect, G. E. Bond, 384 High Street, Rochester.

Manchester.—Elementary school at Failsworth. Architect, H. Littler, 16 Ribblesdale Place, Preston.

Merthyr Tydfil.—Sanitorium for Guardians.

Paisley.—Church at North Croft. Architect, T. G. Applecrombie, Paisley.

Rugby.—Extensions at municipal baths.

Southampton.—Plans for the new Hartley College have been approved.

Swansea.—Warehouse and offices in Cambrian Place for Messrs. Thornett & Chivers, wholesale grocers. Architects, Messrs. C. S. Thomas, Meager & Jones.

Torquay.—New Pavilion.

Woolwich.—New Police Court.

MISCELLANEOUS

Algeria.—The Municipal Authorities at Bona invite tenders for the supply and installation of electric pumping plant, capable of lifting 55 litres of water per minute. Further particulars from Monsieur le Directeur du Service des Eaux, Hotel de Ville, Bona, and tenders by October 15th.

Australia.—Tenders are invited by November 8th by the Deputy Postmaster-General, Brisbane, for telephone switchboards and parts, and instruments. Tender forms at 72 Victoria Street, or 73 Basinghall Street, London, E.C.

Canada.—Some electric pumps will shortly be required by the Hamilton Town Council.

London: *Hackney.*—The Council invite tenders by October 17th for 100,000 pairs of white open type arc lamp carbons. Particulars from Borough Electrical Engineer.

Southend.—Nine additional feeder pillars are to be purchased at an estimated cost of £114.

TENDERS RECEIVED AND ACCEPTED

Cleethorpes.—The tenders of the Western Electric Power Co., Ltd., for cable, and Messrs. Ferranti, for meters, have been accepted.

Skipton.—The tender of the Wilson Wolf Engineering Co. has been accepted for electric fans, wiring, and motors for the Town Hall.

Popular Lectures.—Two special popular lectures will be given by Mr. Frederic H. Taylor, Assoc.M.Inst.E.E., Assoc.M.Inst.M.E., on "Recent Developments in Electric Lighting and other applications of Electricity" on October 4th and 6th next commencing at 8 p.m. each evening. Tickets may be had on application to the Secretary at the Willesden Polytechnic, Priory Park Road, Kilburn, N.W.

Ironmongers and Municipal Trading.—A circular is being sent out to its members by the Ironmongers' Federated Association, urging the importance of combating the growing practice of municipal traders where it trespasses on the rights of the private trader. It is pointed out that much can be done in this direction by voting in the November municipal elections only for those candidates who will oppose such trading being carried to unfair limits.

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APPOINTMENTS AND PERSONAL NOTES

Mr. C. W. Hill, who recently resigned the general managership of the Bournemouth Corporation Tramways, has been presented by the staff with a leather writing case, whilst Mrs. Hill has been presented with two framed water-colours.

The Borough Electrical Engineer of a large Midland town has vacancy for pupils. (See an advertisement on another page.)

Messrs. Gilbert Lodge & Co., of Sydney, Australia, have been appointed Australian agents for the British Electrical Engineering Co. Mr. G. D. Moffatt, who is going to Australia, will be attached to the offices of Messrs. Lodge, at Norwich Chambers, Hunter Street, Sydney, as the Brush Co.'s engineer.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £56 15s. to £57 5s. (last week £57 5s. to £57 15s.).

Change of Telephone Number.—Messrs. Feld Bros. & Co., Ltd., have changed their telephone number to 1,051 London Wall (two lines).

Telegraphic Address.—Messrs. Marryat & Place (28 Hatton Garden) have registered the telegraphic address of "Marryat, London," and propose to drop the old telegraphic address, "Annealable, London."

Graetzin Metal-filament Lamps.—Messrs. Krufka & Jacoby (11 Queen Victoria Street, E.C.) inform us that considerable success has attended the introduction by them of the above lamp, for which they are sole agents in this country. This they attribute largely to the way in which the strong filament withstands vibration. They particularly call our attention to these lamps in "Euphos" glass bulbs, which obstruct the ultra-violet rays as a protection to the eyesight.

Johnson & Phillip, Ltd.—This firm request us to announce that, owing to representations made by some of their contractor friends, they have decided not to tender for, or accept orders for, ordinary wiring work. Should work of this nature be included in contracts for complete plant and cable installations, they propose to sublet the wiring portion.

Submersible Motors.—At the Electrical Exhibition, Olympia, at the stand (Nos. 317 & 318 in the gallery) of Submersible Motors, Ltd., 23 St. Swithin's Lane, and the J. L. Manufacturing Co.'s Works, Southall, a motor is shown under water driving a pump delivering 30,000 gallons of water per hour. The space was reserved late, and, as no entry appeared in the exhibition catalogue, we have been asked to insert the above announcement.

Liquidation.—The Reno Electric Stairways and Conveyors, Ltd., is to be wound up voluntarily. The liquidator, Mr. M. Lancaster, has been authorised to sell the undertaking to Reno, Ltd. A meeting of creditors will be held at the offices of Messrs. Thorne, Lancaster, Farey & Co., 1 Basinghall Street, E.C., on October 9th, at 11 a.m.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Yorkshire Electric Power Co.—Mr. A. J. Lupton presided at the half-yearly meeting in Leeds last week. He pointed to the general increase in the sale of energy to all classes of consumers, and to the growing importance of the Distribution Co., which now takes supply for no less than nine districts, for which they hold provisional orders. Since the issue of the report he regretted that there had been a serious breakdown in the generating plant at Thornhill, which would entail considerable expense. Temporary plant had been installed. The Chairman also referred to the difficulty with the Batley Corporation, who had refused to allow the company to lay a main through their district for the purpose of supplying other districts beyond. An application was made to the Board of Trade, and a decision was given in the company's favour.

Cleveland and Durham Electric Power Co.—The report for the year to June 30th shows a gross profit of £20,974, against £12,942 in the previous year. After providing for debenture and other interest, a net profit of £8,343 is carried forward. The connections to the company's mains now aggregate 40,464 h.p., an increase of 4,177 h.p. during the year. In addition, 12,500 h.p. have been contracted for, but not yet connected. The report contains a statement showing how the reduction of capital sanctioned by the High Courts last December has been applied to writing down assets.

United Electric Car Co.—Mr. George Richardson, presiding at the annual meeting of this company last week, expressed the directors' regret at the small net profit for the past year, viz., £4,420. Nevertheless, they considered it a satisfactory one in view of the stagnation in the car building trade. He considered the company was in an exceedingly strong position, and the prospects were better than for some years past, the order book being in a satisfactory condition.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203–6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Gas Engines." By Herman Haeder. 317 pages, 9½ in. by 7¼ in. 23 figures. (London: Crosby, Lockwood & Son.) 18s. net; abroad, 18s. 5d.

"Proceedings of the Incorporated Municipal Electrical Association, 1911." 240 pages, 8½ in. by 5½ in. 9 figures. (London: Wyman & Sons, Ltd.) 5s. net; abroad, 5s. 3d.

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WIRING CONTRACTORS. See page iv.

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Supplement to "Electrical Engineering" of Oct. 5, 1911.

THE ELECTRICAL EXHIBITION OF 1911

PART III.

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ART and MONEY

are rarely associated in those whose business it is to earn the one by the aid of the other, yet the artistic in the electric light fixture business is usually associated with much money. Most people (and nearly all electrical contractors) appear to labour under the impression that it is almost impossible to produce an artistic electric light fitting without considerable cost. The result is that when he has a client who requires a really inexpensive fitting and must have it, the electrical contractor's imagination can rise no higher than a three-light "spider" fitting. There appears to be no solid reason for it beyond a certain lack of initiative on the part of many of the best known fittings makers, whose limits appear to be the highly artistic at a relatively high price, appealing to the few. From the electrical contractor's point of view the trouble is a serious one, resulting in loss of profit and sometimes of a customer. He knows the demand that exists for a presentable range of artistic fittings at a comparative low figure which will appeal to the middle-class buyer and the man of moderate means, yet none the less discriminating taste.

The attitude of the fittings maker has hitherto been lethargic. A new factor has recently arisen, *viz.*, the development of a Fittings Department by Simplex Conduits, Limited, who, owing to their unique experience, are well able to appreciate the contractor's requirements and the filling thereof.

Commencing as recently as June last with the purchase of the fittings business of Jesson Birkett & Co., Ltd. (who were themselves in the forefront of decorative metal workers), this experience is rapidly bearing fruit. The splendid equipment of the Simplex Company's works at Garrison Lane, Birmingham, has resulted in the scope of the business hitherto carried on by Jesson Birket & Co. The combinations of these forces added to the fact that the services of Mr. T. Birkett (previously managing director of the firm now incorporated in the Simplex Company's business) enables this lately formed department to render considerable service to the electrical contractor in his business as it may exist now, and in the development of a fixture trade in the future.

The first step has been to produce those designs which he requires most and which are in most demand, namely, low-priced *artistic* fittings. There can be no better way for the engineer interested in this matter than to pay a visit to Stands Nos. 148 & 163 at Olympia, where the Simplex Company have a very representative display of electric fittings.

Those who are unable to do so are recommended at least to secure a copy of the new catalogue, which is a most exhaustive and complete publication.

Enough has been said to indicate the lines upon which the Simplex Conduits, Limited, are dealing with this business of the manufacture and supply of electric fittings, but the expression has been used, "the development of a fittings business in the future" in reference to the contractor's business.

These gentlemen are all very well aware that, although there is much good business to be done in the way of cheap fittings which they have no difficulty in getting, this is by no means the most profitable. It is the larger work, which for the sake of discussion may be termed "architectural," that is the real backbone and without which no fittings business can ever be really remunerative.

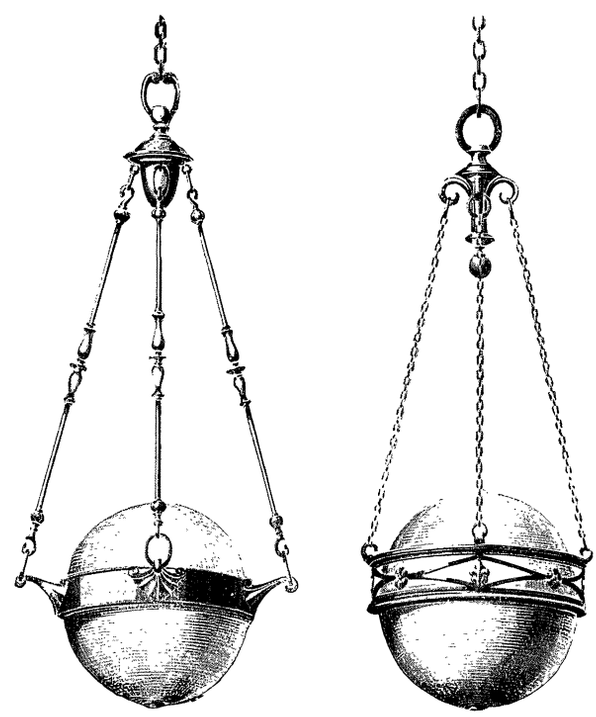
Up to the present the average contractor has little or none of this. Obviously he cannot have the facilities for tackling a big job requiring technical and expert knowledge all by himself. He is to a large extent dependent on the manufacturer. With one or two exceptions fittings makers are not electrical manufacturers also; they know nothing of the contractor, probably care less, and certainly would not think of going out of their way to protect his interest.

Simplex Conduits, Limited, intend to alter all this and to work their fittings business through the contractor, and back him in every possible way. Most contractors will have painful recollections of at least one occasion when they have been "short circuited" on a fittings order by the actual manufacturer. Many have not attempted to develop a large business as a result of these disappointments. With a firm with a reputation like that of Simplex Conduits, Limited, contractors may feel safe that their interests will be not only protected but well looked after.

By the way, it should be mentioned that the Company are specialising on fixtures suitable for holophane glassware, and publish a very handy little catalogue on the subject.

Every electrical engineer would do well to think over this subject, and when visiting the Electrical Exhibition, with a view to discussing the matter further, call at

STANDS Nos. 148 and 163.



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THE ELECTRICAL EXHIBITION OF 1911

(THIRD NOTICE.)

THE Electrical Exhibition at Olympia will have been open for a fortnight on Saturday next. It will only remain open until October 21st, and there must be several thousands of the men connected with the electrical industry who have still to visit it, and tens of thousands of the general public. Up to the present the attendance of both classes of visitors has been poor. We fear that the Executive Committee and the organisers have, in a way, fallen between two stools; the Exhibition is being run not quite as a trade exhibition and not quite as a popular one. In the case of a purely trade exhibition large quantities of free tickets are issued to exhibitors, with the result that practically everybody interested in the trade in question receives one. At Olympia the exhibitors have to pay a substantial sum for tickets, and the distribution is therefore not sufficiently lavish. In other respects, however, the Exhibition is a trade exhibition pure and simple. No attraction but the exhibits themselves is offered to the public, although it would not have been difficult to have devised some form of entertainment involving some applications of electricity, which would have had the effect of attracting persons not directly connected with the electrical trades except as customers. It is, however, now too late to make radical alterations in the arrangements, and we would therefore urge once more the desirability of a large emission of free tickets through the medium of the exhibitors themselves and the supply authorities of London.

While we are confident that the Exhibition would have been more successful at the start had such more or less artificial methods been employed to bring the public to it and to form the subject of the necessary initial advertisements, yet there is no doubt that the visitor who comes to the Exhibition—no matter of what class he may be—will find plenty to interest him. The efforts of the individual standholders and their competent staffs of attendants cannot be underrated. Almost without exception the representatives at the stand have a complete and detailed knowledge of every one of their firm's manufactures, and no one need leave the Exhibition without having his hunger for knowledge entirely satisfied.

EXHIBITION TELEPHONE DIRECTORY

LAST week we published a list of the telephone numbers of the Exhibitors at Olympia who are connected with the telephone exchange there. A number of Exhibitors, however, have their stands connected with the National Telephone Co.'s Kensington Exchange, and we give these below.

Name of Firms.	*Telephone Number (Kensington).*
Abbey Electric Co.	3166
Bastian Electric Heating Syndicate, Ltd.	3029
Berry, Skinner & Co.	3246
Brook, Hirst & Co., Ltd.	3374
Brush Electrical Engineering Co., Ltd.	3393
Exhibition Organising Manager	721
Elliott Bros.	3024
Escaré & Denelle, Ltd.	3392
General Electric Co., Ltd.	4224
F. B. O. Hawes [Executive Committee]	3413
London Electric Supply Companies	3245
Reyrolle & Co., Ltd.	3466

In addition there are several public call offices in the building.

The Exhibition Executive Committee.—Mr. J. Huddlestone, of Messrs. Siemens Bros. and Co., Ltd., has joined the Executive Committee of the Exhibition.

SOME OF THE EXHIBITS

Drake & Gorham,

66 Victoria Street, S.W. (Stand Nos. 61 & 62.)

Metal Filament Lamps.—Messrs. Drake & Gorham's stand is in a prominent position near the entrance. A considerable variety of apparatus is exhibited, and one or two effective demonstrations show the advances made by latest methods. Thus on one side of the stand we have groups of six 25-c.p. carbon and metal filament lamps respectively, connected up to separate meters, and a glance at the relative speeds of the revolving discs is most convincing of the relative economy of the latter. On the other side two cases of coloured ribbons, one illuminated by an Osram lamp in a holophane reflector, and the other by a carbon lamp with ordinary shade, demonstrate the greater suitability of the former for colour matching. The firm have always kept well abreast of the newest developments of metal filament lamps, of which they always hold very large stocks, and they show the latest sizes of both Tantalum and Osram lamps.

Electric Heating and Cooking Apparatus.—An excellent show is made on one side of the stand of high-class heating and cooking appliances, marking both in the design of the vessels themselves as well as in the electrical details the great advances which have taken place since the last exhibition. All this apparatus employs a standard interchangeable tubular insertion heater. Another example of electric heating is shown in the Price system for heating greenhouses, garages, etc, in which the heater is made up of large diameter tubes containing coils of nichrome wire on asbestos formers. A good display is also made of the well-known Quartzalite heaters (see Electrical Engineering, Vol. V., page 631), for which the company are agents and have supplied for use in the Royal cabins of the s.s. *Medina* on the way to the Durbar.

Switchgear, Fittings and other exhibits.—Attention should also be specially called to the display of switchgear made at the company's own works, and including a well-arranged and compact 50-volt country house lighting board with ingenious interlocked charge and discharge switches. Large switches and regulators are also shown, as well as tubular fuses, of Messrs. Drake and Gorham's own manufacture. The display of fittings is varied and extensive, including decorative fittings after the styles of various periods, special fittings for holophane glassware and exterior fittings for large metal filament lamps. Examples of the Butt arc lamp are shown, as well as many general accessories. The Frisby current gauge (described in Electrical Engineering, June 29th, page 369) may be inspected, and examples of the Drake and Gorham magnetic clutch, which we have described in connection with former exhibitions, are shown.

John Barker & Co., Ltd.,

High Street, Kensington, W. (Stand No. 280.)

The Electric Home.—Messrs. John Barker & Co. have erected, decorated, furnished, and fitted up a complete house at one end of the gallery, arranged to show the many ways in which electricity can assist in domestic comfort and economy, and forming the most attractive and complete exhibit of its kind we have seen at any exhibition. Taking the rooms seriatim, we first enter the hall warmed by an electric imitation log fire, the air freshened by a self-contained electric table-fountain, with concealed motor pump, and lighted principally by a fine cut glass bowl fitting in the ceiling. Electric cigar-lighters are also provided. The whole of the lighting is by 50-volt metal filament lamps. The drawing-room to the left of the entrance, decorated in what is known as the Colonial Adams style, is a fine example of concealed lighting, with the lamps hidden in a special cornice. A certain amount of direct illumination is also obtainable from four cut glass pendants and a few standard lamps about the room. An electric radiator stands in the "fireplace," and a further luxury is a wedge-shaped electric foot-warmer. As in most of the other rooms, a small ozonair plant purifies the atmosphere, and it may be mentioned here that all the rooms are connected by an intercommunication telephone

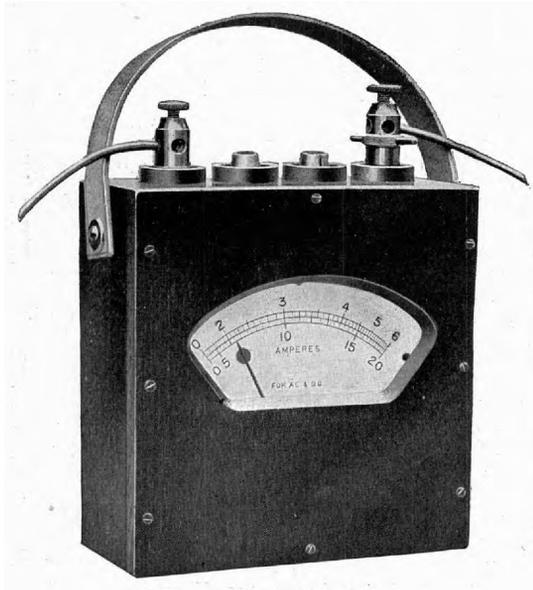
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system. There is also an electric piano in the drawing-room. Beyond this is the bedroom, the special features of which, in addition to its dainty scheme of decoration, are electric bed-warmers, including a new pattern in which a thermal switch cuts off the current when the desired temperature is reached, hair-dryers consisting of tiny motor-driven fans delivering electrically heated air, curling-iron heaters as well as curling-irons themselves containing heating elements, and an electrically driven sewing machine with the motor controlled by a foot-switch giving four speeds. In the bath-room we have a new circulation heater in the form of a cylinder 30 in. long, capable of raising the temperature of 20 gallons of water from 60° F. to 100° F. in fifteen minutes. This is provided with switches allowing as much as 9 k.w. to flow, or reducing this in nine stages to about 1 k.w. On the other side of the room is a large electric light bath, or soliarium, and demonstrations are also given here of electrical vibratory massage with apparatus supplied by the International Vibro-Massage Co. A considerable variety of appliances are shown, and we are informed that they form the only apparatus of this nature that is entirely British made. Coming now to the rooms on the right of the entrance, we have the handsome Georgian dining-room, where particular attention should be paid to the fine chandelier over the table, the electrically lighted table centre, and the display of plate-warmers, grillers, coffee-pots, kettles, toasters, and other heating devices on the sideboard. Perhaps the most interesting room however, to many visitors, will be the kitchen, where electric cooking demonstrations are given at frequent intervals by a lady expert. The equipment is rather larger than would be required for a house of this size, and the principal item is a complete outfit, or range, of which Messrs. John Barker & Co. are making a speciality. This comprises a large oven with neat white-enamelled exterior, capable of taking the largest joints, with the heat controllable in three steps, a plate-warmer, and on the top three hot-plates, suitable for heating a variety of different utensils, each also arranged for three degrees of heat. There is also a smaller oven of a different make, and a good show is made of independently heated saucepans, stewpans, &c., and a very convenient immersion heater in the form of a flat disc with a long handle, which can heat water in a pail or any other vessel. The room is excellently lighted by inverted semi-indirect fittings on the ceiling, and in the centre a porthole fan draws out the heated air. The new pattern of bell indicator fitted up in the kitchen should also be mentioned. In the adjoining scullery is a Therol water heater, for heating large quantities of water slowly with a small expenditure of energy. From here we cross the intervening space between the house proper and the laundry and power-house building, passing on our way exhibits of a new vacuum cleaner, with several points to recommend it, including ball-jointed nozzles, giving great freedom of angular position to the tube held in the hand, and a worm-geared knife-cleaner, which is self-adjusting to any thickness of knife, and is driven by a ¾-h.p. motor. The laundry has been fitted up by the Park Royal Laundry (90 Avenue Road, Acton, W.), and working demonstrations are shown of electric laundry ironing with special irons, all provided with regulating rheostats and flexible leads coming from overhead. Very fine examples of the work turned out are shown, such as we are assured could not be obtained by ordinary methods. An electric fan keeps the room cool. Current for lighting, &c., is obtained from the generating set in the adjoining power-house, which consists of a 2¼-k.w. 50–75-volt continuous current dynamo, running at 830 r.p.m., and coupled to a 4-h.p. paraffin engine, although on account of exhibition restrictions the set is at present being driven by a motor off the main supply. A small rotary pump, such as can be used for country-house water supply, driven by a ½-h.p. motor and capable of raising 10 gallons per minute against a head of 30 ft., is also shown in the same room. The accumulator room adjoins and contains a battery of 27 cells capable of running 125 16-c.p. lamps for 27 hours on one charge. A complete battery control switchboard in the engine-room completes this neatly arranged equipment.

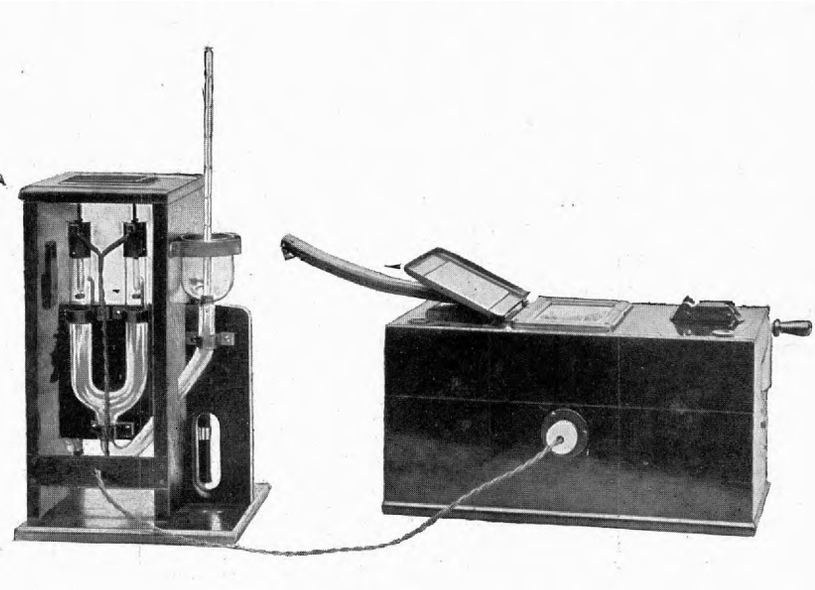
Eversheds & Vignoles, Ltd.,

Acton Lane Works, Chiswick, London, W. (Stand No. 168.)

Speed Indicator.—This is one of the firm's latest manufactures. The shaft whose speed is to be indicated drives a small D.-C. generator, across the terminals of which a moving coil voltmeter is connected calibrated in revolutions per minute. The generator is fitted in a water-tight cast iron case, and special attention has been given to the design of the commutator, brush gear, and bearings. The commutator is made with an air core, and no insulation is provided between the segments, which are held in position by two slotted fibre rings surrounded by a steel ring. Rubber pads are placed behind the carbon brushes, and a spring is also attached to take up the vertical thrust and render the whole flexible. The bearings are made large and long for continual running.



3-Range Portable Ammeter.
(Eversheds & Vignoles.)



Dionic Water Tester and Generator.

Dionic Water Tester.—This instrument, which we illustrate above, is for testing water. In the illustration it will be seen to consist of a glass U-tube, which takes the water to be tested and carries electrodes in the form of short, hollow platinum cylinders. Current at 100 volts is passed through the water by means of a constant speed generator, with which is combined an ohmmeter, similar to the firm's megger, and a direct deflection is obtained, giving the conductivity in reciprocal megohms, known as units. The instrument is extremely sensitive, a trace of salt, which could not be detected chemically, greatly altering the conductivity. A fuller description was published in Electrical Engineering, November 17th, 1910 (Vol. VI., p. 735). A higher range has now been made, and readings up to 200,000 units can be taken.

Ammeters and Voltmeters.—Two types of these are shown, including a combined portable moving coil set for measuring continuous currents. The voltmeter can be made to read up to any range or multiple of ranges by means of a sliding switch. The ammeter and voltmeter are quite independent, so that power, as well as resistance on the drop of potential method, can be measured. It is contained in a teak case, and is very light, the 100-ampere range weighing about 5 lbs., while the 1,000 ampere range weighs 25 lbs.

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ELECTROMOTORS LTD.

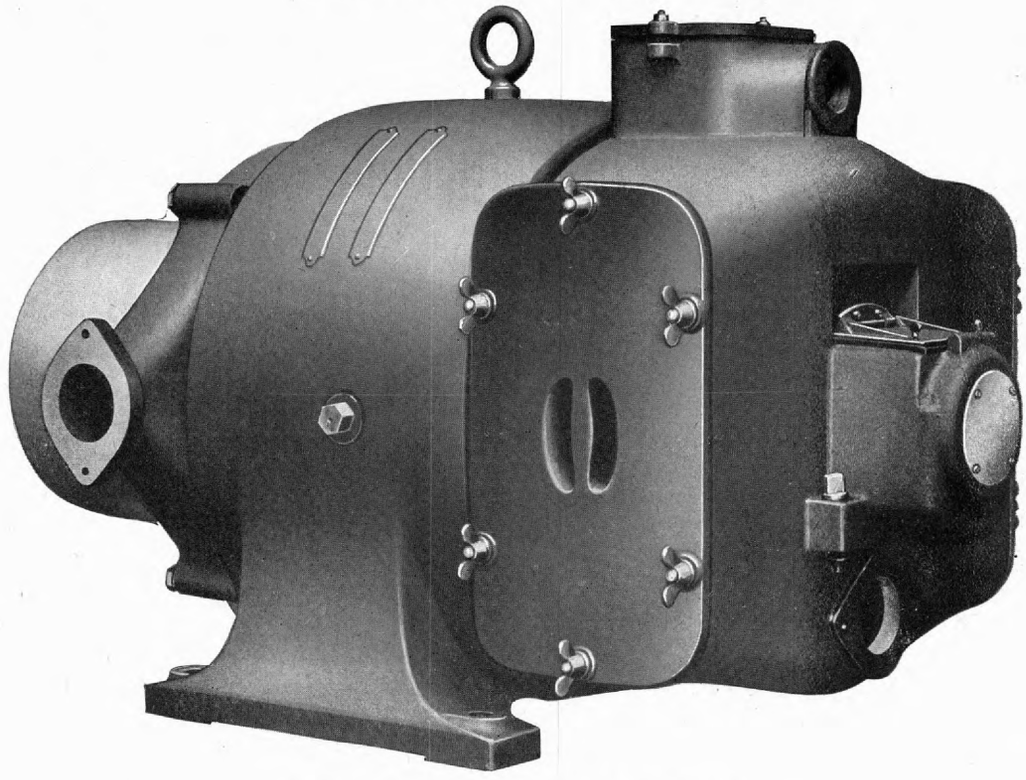
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For artistic, efficient and economical illumination

WESTINGHOUSE

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A three-range portable moving iron ammeter, which we show here, is also exhibited. It measures direct or alternating currents over a large range, from 1 to 100 amperes, without the use of a transformer. The range is changed by means of a travelling terminal, which can be very quickly unscrewed and transformed for whichever range is required. The following ranges are made: 5, 15 and 50; 6, 25 and 60; and 10, 30 and 100 amperes.

Leakage Recorder.—This is a development of an instrument for measuring the insulation resistance of D.-C. two-wire networks. The connections of the instrument are successively changed by means of a clockwork mechanism. Two resistances in series are bridged across the 'bus-bars, and the instrument is first connected between the central point and earth. Next the resistance connected to the positive bar is switched out so that the instrument is between the negative bar and earth, and the reading is inversely proportional to the insulation resistance of the positive main. Next the corresponding connection is made on the other main. These operations are performed successively, and the readings automatically recorded on a chart. A table is provided for obtaining the insulation resistances from the readings. The pen is of the Murday Patent type, carried on knife edges in a stirrup, and works on top and at right angles to the motion of the paper.

Electric Soldering Iron.—This is another novelty which is being exhibited, known as the Thermobit. A special wire is wound on a steatite cylinder fitted both inside and outside with copper, which projects beyond to take the bit, which is screwed on. These are made for voltages up to 250.

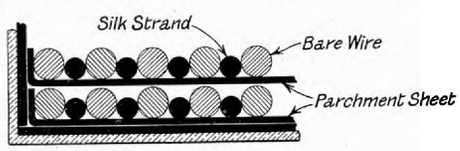
Other Exhibits.—The Ducter, for measuring very low resistances, was fully described in our issue of March 23rd, 1911, p. 149, the well-known megger for measuring insulation resistance, and the bridge-megger for either copper or insulation resistance, are also on view. The stand is decorated with pictures showing the work of the naval section, including the orders telegraphs recently installed on the *Olympic*.

Oliver Arc Lamp, Ltd., & The Varley Magnet Co.,

CAMBRIDGE PLACE, BURRAGE ROAD, WOOLWICH.
(STAND NOS. 58 & 65.)

Arc Lamps.—The Oliver magazine flame arc lamp is too well known to require detailed description. Several sizes are shown in operation at this stand, and visitors can examine the construction in detail. A slight alteration in design has been made in replacing the mercury switch by a carbon make and break, which now reduces the period of extinction between each pair of carbons coming into action to nine seconds.

Coil Winding.—The coil winding of the Varley Magnet Co., which is a subsidiary company to the Oliver Arc Lamp Co., although largely used, might with advantage be even more extensively adopted for almost all classes of coils for electrical work. Instead of winding the coil with insulated wire, bare wire is employed, and a silk strand is wound on to the coil parallel to it at the same time. The method will be clearly understood by an inspection of the illustration. Each layer of bare wire is insulated from the one below it by a sheet of insulating material, which is inserted by the machine on the completion of each layer of wire as the feed reverses to start the next layer. The winding is done throughout by automatic machines, and the company supplies coils, wound in this way, of any size and for all purposes.



The Light Alloy Co.,

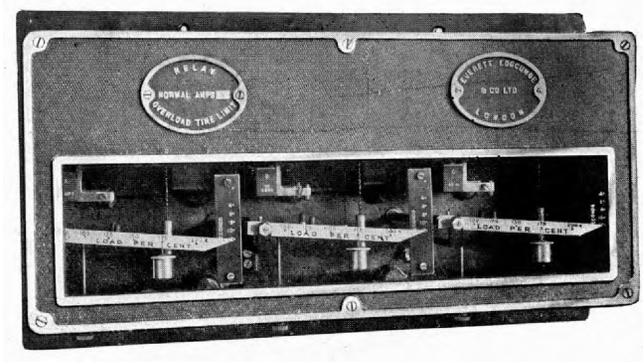
7 QUEEN VICTORIA STREET, E.C. (STAND NOS. 58 & 65.)

This is another subsidiary company to the Oliver Arc Lamp Co., Ltd. The light alloy is called "Vanalium"; it is an alloy of aluminium, and only 2 to 3 per cent. heavier than the pure metal. It is claimed to be absolutely non-corrodible, and is not liable to disintegration as are some other less stable aluminium alloys. Cast vanalium has a tensile strength of over 11 tons per square inch, and a yield point of 8 tons per square inch with 6 per cent. elongation. Rolled vanalium has double, and drawn vanalium treble the tensile strength of the cast metal. We understand that the metal flows well when casting, and that its behaviour when being machined, drilled, tapped and filed is much the same as brass. Its use is particularly suggested for ships' fittings on account of its showing no corrosion when in contact with sea water, and it obviously has a host of other applications.

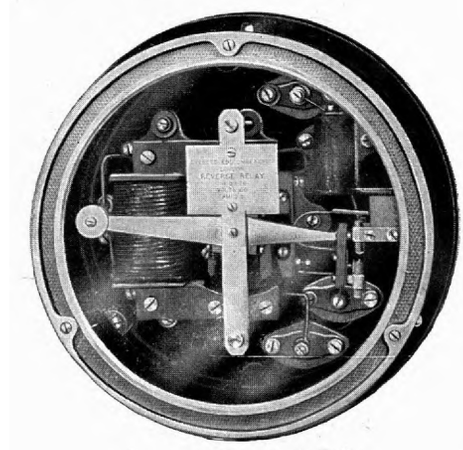
Everett & Edgcumbe & Co., Ltd.,

HENDON, LONDON, N.W. (STAND NO. 66.)

A.-C. Relays.—This firm is exhibiting two special types of A.-C. relays, which we illustrate in the accompanying figures. The induction over-load type with inverse time limits is so arranged that both the current and time settings are adjustable over a wide range, and the latter can be relied upon to keep their proportional settings at all overloads so that perfect discrimination is ensured. The reverse current relay, which is specified for the L.C.C. tramways, is another interesting device. In this a pressure winding is provided, the only function of which is to determine the direction of flow of the current, and not (as in almost all other reverse current relays) the magnitude of the overload required to trip the breaker which it controls. The makers contend that a reverse *power* relay is not what is required, and that a reverse relay should act or not according to the magnitude of the *current* flowing. Owing to the fact that on the occurrence of a bad short the pressure may fall very seriously, it is essential with a reverse power relay to make it extremely sensitive and set it excessively fine. For example, if such a relay is required to trip at full load current when the pressure falls to 10 per cent. of its normal value (a by no means unlikely occurrence), it must be set to trip with less than 10 per cent. of the full load current at normal voltage. Messrs. Everett, Edgcumbe & Co.'s reverse relays can be set for 50 per cent. of the full load current, and will be practically independent of the pressure.



Triple Pole Overload Time Limit Relay.



Reverse Current Relay.

"Graphic" Instruments.—Amongst the "Graphic" (recording) instruments which we recently described in our issue of August 31st, 1911, p. 486, a new type is shown, in which the pen is replaced by a special syphon device, which gives an inexhaustible supply of ink.

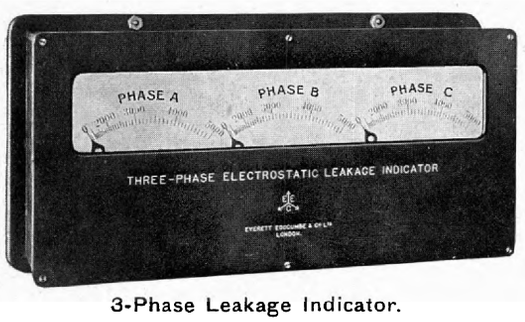
Rotary Synchroniser.—An improved pattern is now made by this firm. Instead of slip-rings and flexible connections, the windings are fixed, the only rotating part being a soft iron needle attached to the pointer. It is just as sensitive as the old pattern, and makes one revolution, while the original type made only half a revolution.

Watertight Ammeters.—A numerous selection of ammeters

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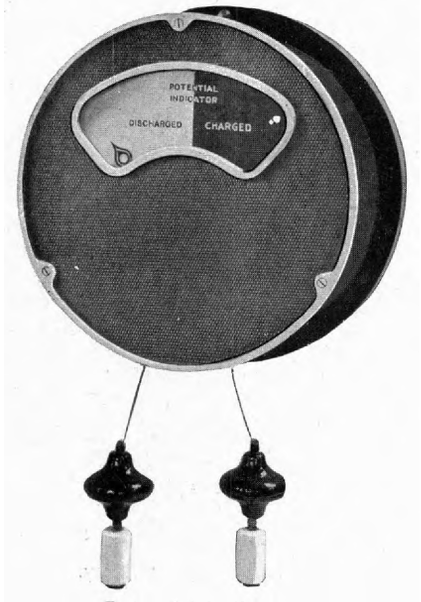
and voltmeters are shown, including a watertight ammeter. Glands are screwed into the terminals, and the coils are enclosed in the square compartment at the bottom, so that if the glass, which is inlaid with wire, is broken, water or moisture cannot get to the coils. We understand that these are extensively used on British battleships.

Leakage Indicator.—This should prove of great interest, especially to mining engineers. The accompanying figure shows a three-phase electrostatic high-tension combined instru-



3-Phase Leakage Indicator.

ment. Each phase is connected between the line and earth, and normally should read the same. If a fault occurs on the system, the phase in which it occurs will be seen to register less, while the others will give a higher reading. Another type of indicator is shown below; its function is to



Potential Indicator.

tell whether the bus-bars are alive or not. One half of the dial is red and marked charged, and the other half is white and stamped discharged. Connection to the indicator is made through two special condensers, so that it is not in actual connection with the high-tension circuit.

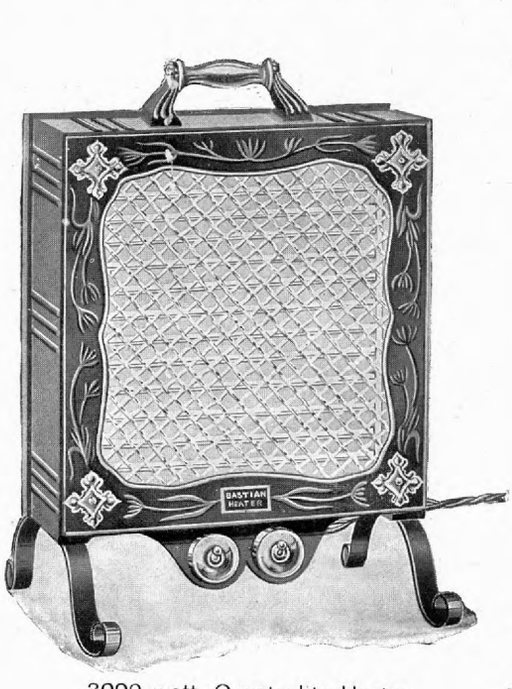
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Other Exhibits.—A further novelty to be seen on this stand is a combined stop-watch and speed-counter. The watch is started as soon as the spindle is pressed against the revolving shaft. Other exhibits include a series of tachometers and tachographs which give a record of the speed variation. A neat little high-speed tachometer for separators and spinning machines is made on the governor principle. The "Luxometer" for measuring both interior and exterior illumination was fully described in Electrical Engineering, Sept. 21st, page 523.

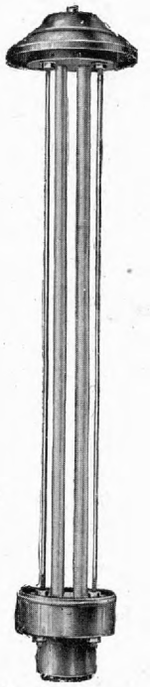
The Bastian Electric Heating Syndicate, Ltd.,

91-93 Palmerston House, E.C. (Stand Nos. 173 & 190.)

Electric Heaters.—Several types of the now well-known Quartzalite heater, in which the heating element is composed of groups of thin tubes containing wire spirals of a special alloy, the whole being proportioned to glow at a bright red heat when current is passing. The smaller rat-trap pattern of small heater is familiar to all our readers, but some new larger heaters on the stand are new, including the one illustrated here in nickel-plated frame, which, although quite

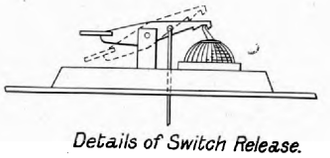


3000 watt. Quartzalite Heater with 4 Heats.

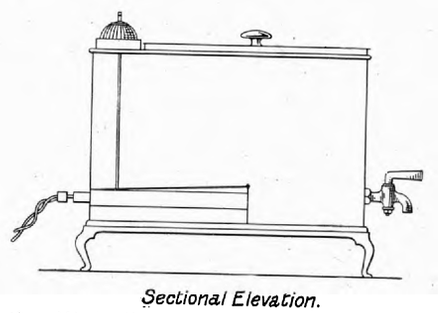


Replacement Unit.

compact, is made up to 3 kw. The same system, with rows of these quartz tubes, is applied to several other forms, and the special element also illustrated has been designed for replacing the lamps in an ordinary radiator to convert it into a Quartzalite heater. We have on previous occasions called attention to substitution elements of this nature, but the



Details of Switch Release.



Sectional Elevation.

Bastian Water Heater with Automatic Switch.

pattern shown is a great improvement on the previous designs. For hot plates, water heaters, and other apparatus, a row of quartz units is made up into a flat slab to serve as an "inser-

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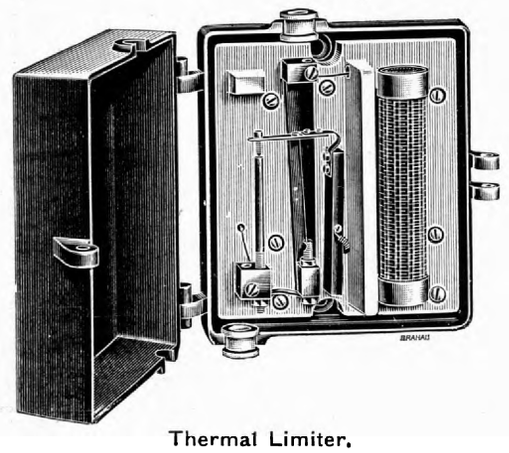
tion" heater, which can be used at will for a variety of different utensils. The older patterns of these carried a switch on a projection of the frame, but this is now replaced by neat pin contacts, which fit into the well protected contacts of a socket carried on the flexible lead. Flat-irons containing quartz heating elements are represented on the stand. Stands consisting of cast feet and copper slides for rendering insertion units available as electric stoves or hot plates for a variety of other purposes are also shown. For some of the large types of water heater, designed to heat water slowly with a small expenditure of current, are provided with an ingenious arrangement for switching off the current when the water boils. The working will be understood from the diagrammatic sketch reproduced. Above the chamber containing the insertion heater is a light hinged metal flap, upon which bears the end of a rod connected to a catch lever holding the switch in the "on" position. The bubbling of the water when boiling commences causes the flap to rise and to release the switch. The firm have also a most interesting new development in progress with the apparatus, for which they are experimenting. This is a heat storage system for use in conjunction with windmill plant. The windmill drives a small generator with no regulating gear at a varying speed depending on the force of the wind, and the whole of its output is absorbed in resistances, which heat a form of heat accumulator, consisting of a metal mass arranged with very large surface, but enclosed in a heat-insulated chamber. When heat is required for any purpose, air is rapidly drawn through the vessel, and passing over the large surface of the hot metal readily withdraws the heat and conveys it to where it is required. We look forward with great interest to details being available of the way in which the evident difficulties of the scheme have been surmounted.

Although the firm are exhibiting the heaters, &c., of their manufacture on their own stand, the apparatus can only be obtained through their wholesale selling agents, among whom are the British Westinghouse Co., Drake & Gorham, the Electrical Co., Electrical Installations, Ltd., Gillespie & Beales, Johnson & Phillips, and the Sunbeam Lamp Co.

Nalder Bros. and Thompson, Ltd.,

34 Queen Street, E.C. (Stand No. 87.)

Thermal Limiter.—This will interest central station men who supply consumers on the contract demand system. As will be seen in the illustration, it has two iron bars with a steel wire attached to a spring contact. When the demand is exceeded, the extra current causes the wire to expand and to open a contact at the end of the spring. This puts a resistance, seen on the right of the figure, into the circuit, thus dimming the lamps, and at the same time cooling the wire so that it



Thermal Limiter.

closes the circuit, and the lamps return to their normal brilliancy. The effect is to produce a continual flickering of the lights, which ceases directly the additional lamp is switched off. A condenser is provided across the gap to prevent sparking. The whole apparatus is mounted on a china base and enclosed in a cast-iron case.

Circuit-breakers.—A new and cheap design in this line is shown. This contains the usual magnetic blow out, and has a free handle, so that it cannot be reset until the fault on the line is cleared. They are small and take up very little space.

Accumulator Switch.—A cheaper form of the firm's well-known automatic battery charging switch is exhibited, in which the solenoid coil is replaced by a U-shaped magnet.

Ammeters and Voltmeters.—A numerous selection of these appear on the stands, including a dynamometer type for measuring both alternating and direct currents.

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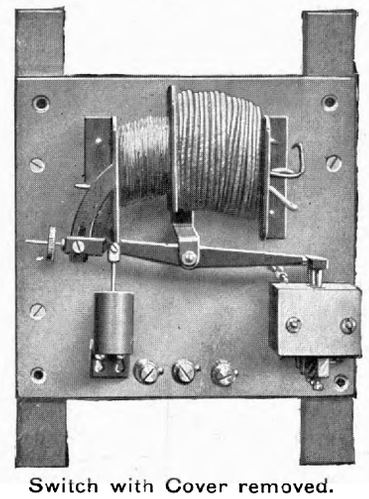
Telephones: London Wall 4940 (Three lines), Central 3506.

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Nalder Bros. & Co. and Muirhead & Co.,

Elmers End, Kent. (Stand No. 86.)

Automatic Transformer Switch.—This is a new pattern of automatic transformer switch for use in connection with 25 or 50-volt installations connected to 200–220-volt mains through auto-transformers. When no lights are on, the main circuit of the auto-transformer is open at the mercury cup (see diagram). As soon as one lamp is switched on, a circuit is established through the coil marked starting coil, and the "auxiliary" coil and "main" coil in series, and the core seen in the two illustrations is sucked into the coil, making contacts 1 and 2. This connects the auto-transformer to the mains at contact 1, and also short-circuits the starting coil at contacts 1 and 2. When a few more lamps are in circuit, bringing the current up to 2·2 amperes, the core has been sucked in further, and contact 3 is made, short-circuiting the "auxiliary" coil and leaving the main or retaining coil only in circuit. The object of successively short-circuiting the first two coils is to diminish the voltage drop. On the lamps being all switched off, the arm falls by gravity and the auto-transformer is out of circuit.



Switch with Cover removed.

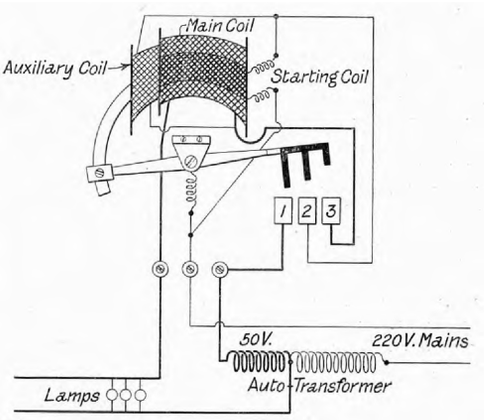
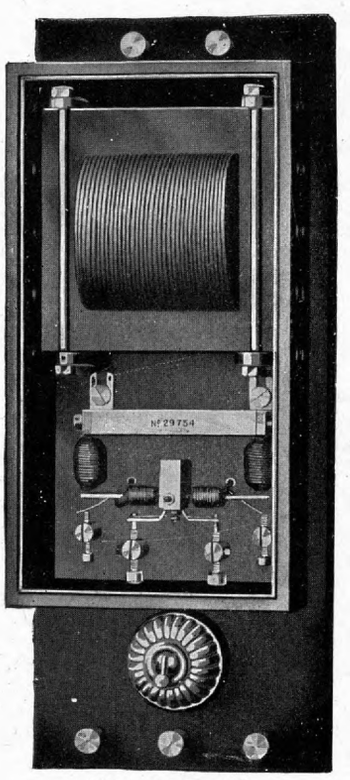


Diagram of Automatic Transformer Switch.



View of Rectifier.

Rectifier.—This is shown working. As will be seen from the accompanying figure, it consists of a transformer provided with two secondaries and a neutral point, which forms one pole of the direct-current circuit. The secondaries are connected up to the D.-C. circuit alternately and synchronously at each half phase by means of the armature shown in the centre. This vibrates between two coils connected to the A.-C. supply, so that a uni-directional current is supplied to the circuits fed by the secondaries.

Other Exhibits.—These include a portable form of testing set for copper and insulation resistance, capacity and fault testing, a potentiometer with two dials, the studs of which are made of the same material as the coils, the telethermometer described in Electrical Engineering, February 2nd, 1911, p. 59, and the Raphael fault localising bridge.

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Union Cable Co., Ltd.,

Eagle Wharf Road, N. (Stand Nos. 181 & 182.)

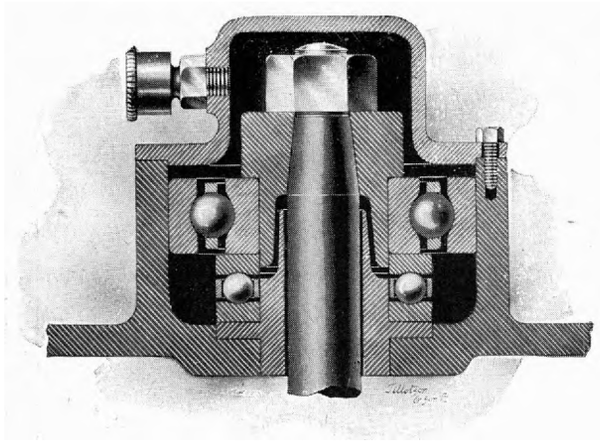
Cables.—Samples of every class of cable supplied by this company are shown—paper-insulated, lead-covered, V.I.R., V.B., light and power cables, telephone cables, flexible, bell-wire, &c. Among the more interesting samples is one of a large cable which has just been supplied to Dundee. It has three conductors, 0·75, 0·75, and 0·2 sq. in. section, with three 7/18 pilot wires, paper-insulated, lead-covered, steel tape, armoured and served with jute and compounded. The diameter of each main core over the paper insulation is 1·23 in., and under the lead 2·82 in. The lead is 0·16 in. thick. Over the lead is a serving of jute, and then the double armouring consisting of steel tapes $2\frac{1}{4}$ in. wide and 0·6 in. thick. The complete diameter over the final serving of jute is 3·8 in. Another is a 7/14 concentric cable for 30,000 volts pressure. The radial thickness of paper insulation between conductors is $\frac{1}{2}$ in.; the outer conductor is also heavily insulated and the cable is lead-covered. Specimens of joint boxes and cable heads are also exhibited. The company is building a large works at Dagenham Dock, and an elevation of the building is shown, together with photographs showing the progress of the building during erection. Ten acres of ground have been taken, and the works will cover nearly 2 acres.

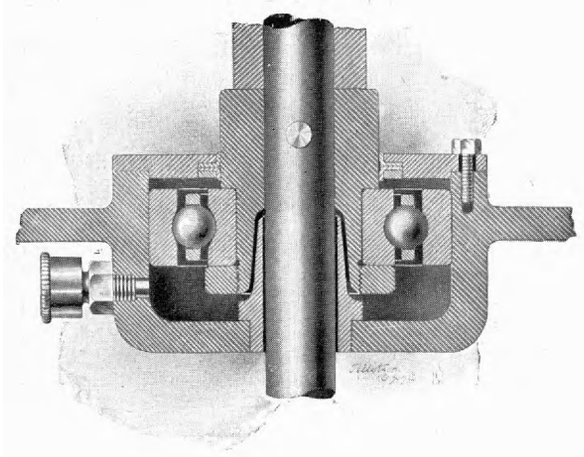
The Jandus Arc Lamp & Electric Co., Ltd.,

Hartham Road, Holloway, N. (Stand Nos. 105 & 110.)

Arc Lamps.—The visitor, after he has inspected the lamps in action and the lamps arranged to show the working mechanism in the recesses at the corners of the stand, will find within a delightful haven of rest in an artistic panelled room with most comfortable armchairs. It is, however, the lamps and not the armchairs that it is our present pleasure

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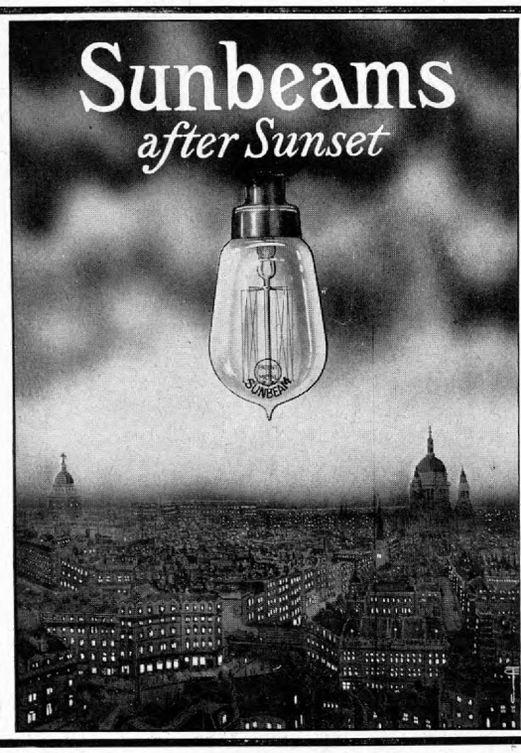
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Stand No. 149/162.

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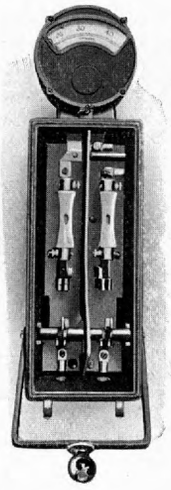
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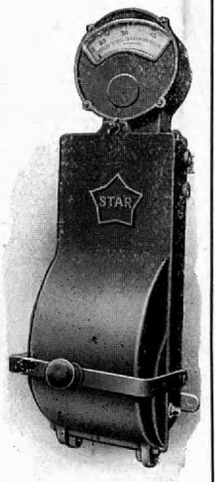


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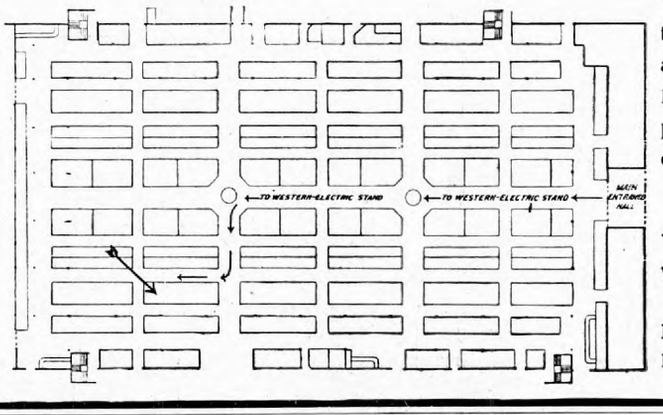
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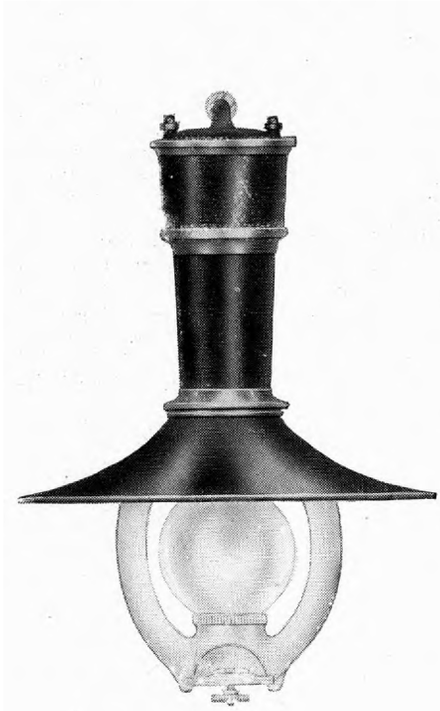
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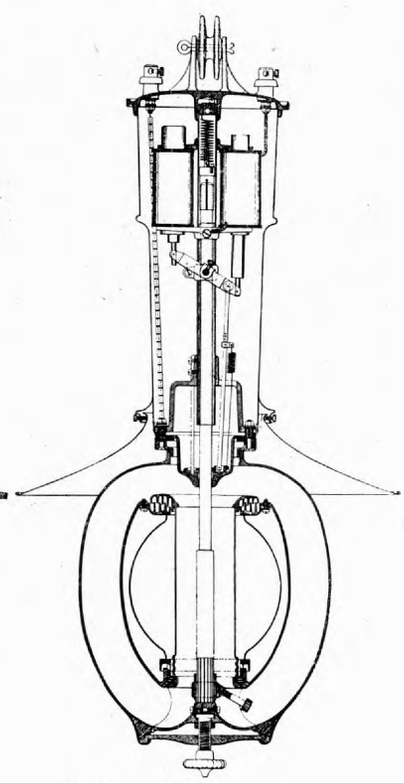
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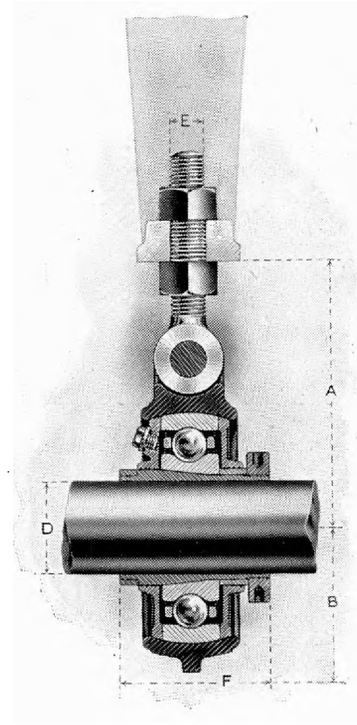
to introduce to our readers. The Jandus lamp is virtually an enclosed, specially ventilated, regenerative vertical carbon flame lamp, and burns chemically treated carbons in an air-tight enclosure. The lower framework of the lamp consists essentially of two metal tubes which carry the inner cylindrical globe and the outer spherical globe, and conveys the heated gases rising through the cylinder from the arc back again to the base of the cylinder, reascending through the arc and intensifying it. The circulation of fumes is constantly going on, and thus the chemicals are used over and over again, and the carbons consume at a very slow rate, given 70 to 120 hours for a single pair of carbons. The efficiency reaches nearly 8 c.p. per watt, and with a current as low as 5 amperes 4,000 c.p. is given off at 15 degrees below the horizontal, of a rich golden colour excellent for penetrating fog; the mechanism as seen in the illustration is very simple, and a particularly useful size is the small 250-watt lamp, giving a maximum of 2,000 c.p. Further details of the Jandus lamp have appeared in ELECTRICAL ENGINEERING, Vol. V., September 30th, 1909, page 852, and Vol. VI.., November 10th, 1910, page 710. The lamps exhibited include A.C. as well as D.C. lamps, and of the latter the standard 550 and 350-watt sizes are shown, as well as the special small lamp for shop-window lighting, etc., and a special Admiralty pattern in water-tight and fume-proof case. It should be mentioned that these lamps are made entirely in London, and that over 10,000 are in use in various parts of the world.



Jandus Lamp.



Section of Jandus Lamp.



Hoffmann Ball-bearing Self-centring Line Shaft Hanger.

The Hoffmann Manufacturing Co., Ltd.,

CHELMSFORD. (STAND NOS. 149/162.)

Ball-bearings.—The Hoffmann ball-bearing is well known, but visitors will not fail to be struck with the demonstration of the small amount of friction, especially at starting under heavy loads, that these bearings have as compared with ordinary plain bearings. In one case a thrust bearing is loaded by a spring up to three tons, but a spring balance demonstrates that only a pull of some 7 lbs. at about 6 in. radius is required to start. In another case two little trucks carrying 56 lb. weights, with ball and plain bearings respectively, are placed on a tilting table, which has to attain a gradient of 1 in 55 before the plain bearing truck will start running down, whereas the ball-bearing truck starts off with only 1 in 350. In another example, journal bearings loaded with half a ton are provided with cranks that the visitor can feel the relative friction for himself. A further model demonstrates the flexibility of the Hoffmann self-aligning shaft bearing, and a ball-bearing crane hook loaded with 5 cwt. is also a striking example. A new roller bearing for heavy machinery, largely used by the British Westinghouse Co. for rotary converters, etc., similar in general features to the Hoffmann ball-bearing, is shown for the first time. This can be used when required in conjunction with ball thrust bearings. Standard ball-bearing countershafts for small machine tools with self-locking belt striking gear are also shown, and the uses of ball-bearings are further exemplified by complete examples of line shafting, train-lighting dynamos, and a selection of motors by the following makers :—Lancashire Dynamo Co., Phœnix Manufacturing Co., J. L. Manufacturing Co., and Compton & Co. A ball-bearing Kieth fan is also shown.

Pinchin, Johnson and Co., Ltd.,

MINERVA HOUSE, BEVIS MARKS, E.C. (STAND NOS. 155 & 158.)

Paint, Insulating Varnishes and Compounds, Vacuum Impregnator.—This stand is one of the best-finished in the exhibition. The firm have employed their own "Satinette" enamel for the columns and entablature of the stand, and the beautiful surface of this is its own recommendation to those who know the difficulties under which stands at exhibitions have to be erected and finished. To electrical engineers, however, the insulating varnishes and compounds and the vacuum impregnating apparatus for dynamo, motor, and transformer coils will be the most interesting. We believe that 80 per cent. of the large dynamo and motor-builders already use Pinchin & Johnson varnishes and compounds, and a good proportion of the remaining 20 per cent. will doubtless give these materials a trial if they visit this stand. In the impregnating apparatus to which we have referred, a combined vacuum and pressure pump is employed. A 28-in. vacuum is created in the vessel in which the coils are placed, and while this is being produced the compound is being heated by a steam jacket and agitated by a stirrer worked through a belt from the pump shaft. When the desired vacuum is reached, the compound is let into the vacuum chamber and pressure is applied, so that thorough penetration of the compound is assured.

Johnson & Phillips, Ltd.,

VICTORIA WORKS, CHARLTON S.O., KENT. (STAND NOS. 123 & 136.)

Arc Lamps.—The "Metroflam" lamps exhibited on this stand are flame arcs of the magazine pattern, which run about 80 hours at each trim. They carry fourteen pairs of carbons, and by an arrangement of double magazines, dark intervals as the carbons charge are avoided. Cheap carbons are used, and they are burnt down to about two inches long. The working parts of the D.-C. lamp comprise differential

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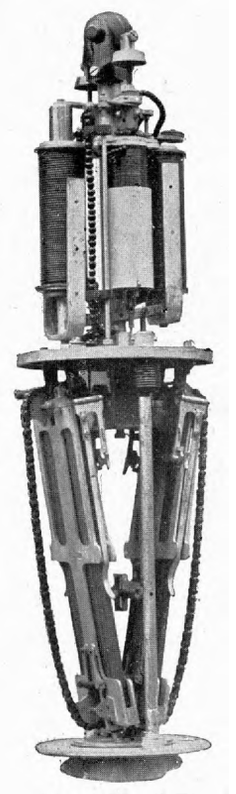
The above books, together with a wider selection from Messrs. Constable's List, may be seen on Stall No. 152 at the Electrical Exhibition, Olympia. Please also ask for full detailed List.

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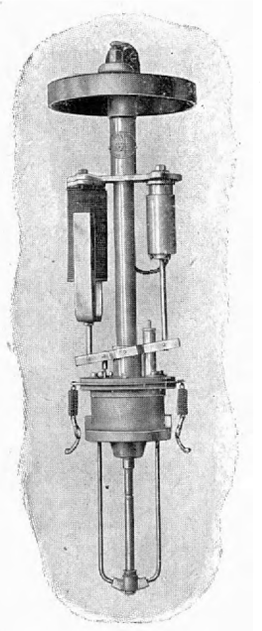
solenoids for striking and regulating the arc and a shunt coil system for feeding down the carbons, pair by pair, as they are consumed. The A.-C. lamp is built on the same lines, but an induction motor feed is employed. In the series burning lamps the auto cut-out and substitutional resistance are usually mounted within the lamp cover. A special light-diffusing globe is employed with the lamps. As mentioned in our last issue, these lamps are being used for the new street lighting in Albert Square and Portland Street, Manchester.

The "Orb," a simple single enclosed flame lamp, is also exhibited. It is of the shuntless type, a single series coil with a floating core being provided for striking and regulating the arc. A simple non-slipping clutch is fitted, together with a synchronous regulator to prevent lamps burning in series to get "out of balance," so that the light emitted from all the lamps in a group is always of uniform intensity. Both lamps have been designed by Mr. J. Brockie.

Searchlight.—A marine type searchlight forms the most prominent exhibit on this stand. The projector lantern is a light steel drum, and its primary equipment consists of a 24-inch diameter silvered glass parabolic mirror and a combined automatic and hand-feed horizontal lamp arranged for working with a current of 80 amperes. The lamp is provided with a pair of main coils for striking the arc, and an independent coil for feeding the carbons, together actuating through a ratchet gear a divided right and left hand screwed spindle and traversing nuts, which engage with the carbon carriers. The automatic gear is thrown out of action for retrimming, or when operating the lamp by hand. A blow magnet is fitted for centering the arc to obtain steady burning, and a well-shaped crater. A removable shoulder lever is fitted for rapidly tilting and turning, a focussing gear for the lamp, supporting brackets for a sighting telescope, and a spirit level for enabling the operator to keep the beam of light steady when the vessel is rolling. A spot of light from the lamp illuminates the spirit level tube, so that the bubble is always visible. The lamp is shown in operation, and is supplied with current by a motor-generator running on the stand.



"Metroflam" Flame Lamp.



"Orb" Shuntless Single Enclosed Arc Lamp.

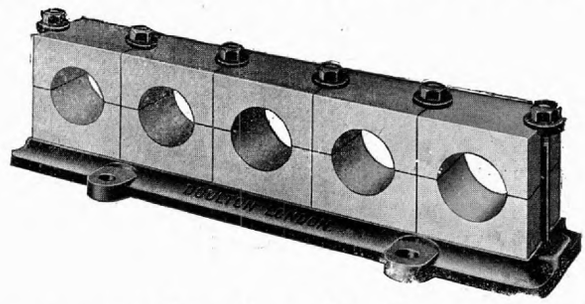
Switchboards.—A 10,000-volt mechanical remote control panel, a 3,000-volt panel designed to Home Office requirements, and a standard traction board are exhibited. Two of the switchboards in the sub-station which supplies current to the exhibition are also of this firm's manufacture.

Cables.—A very large selection of samples of cable of almost every pattern are shown. Among those we particularly noticed was a very flexible copper-braided cable for warships.

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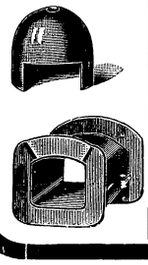
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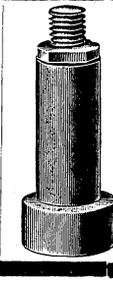
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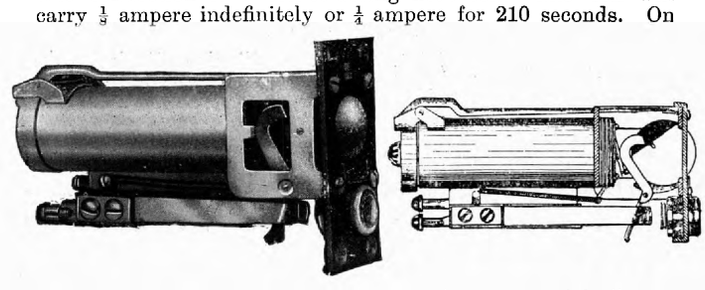
This is a vulcanised rubber cable, the armouring of which is a copper or phosphor-bronze braid, in which each strand of the braid is itself a braid formed of a number of fine wires. The result is an armoured cable of extreme flexibility.

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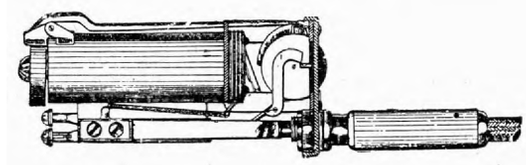
Instruments.—The tendency towards increased neatness in design is very evident on this stand. Well finished matt black japanned metal cases are now largely used instead of wood. In the company's "interphones" for interior intercommunication working, a new flush pattern has been introduced which projects only one inch from the wall instead of the $3\frac{1}{4}$ inches of the ordinary interphone instrument. The back part of the case serves as a distributing box and is sunk in the wall. An inexpensive, strong metal C.B. wall set of neat appearance also attracted our attention, and a particularly compact metal "hotel" telephone set, in which the switch-hook projects at right angles to the base. A new pattern of receiver is also shown, in which the outer case is of metal instead of being of vulcanite; this, we understand, is now being used on P.O. exchange systems. Among other instruments, the company show a "farmer's" telephone, capable of being used 30 or 40 in series on lines 20 to 25 miles long. A five-bar magneto generator is employed, and for the longest lines a 2,500-ohm ringer. In the largest sizes a condenser is employed in the receiver circuit.

Switchboards and Exchange Material.—Several switchboards are shown. On one of these a new "eyeball" combined indicator and jack is fitted. The "eyeball" is a red sphere, which appears above the jack, and is automatically restored on inserting the plug. The construction and action are seen from the three illustrations in the next column. A point in connection with this indicator is the ease with which the coil can be removed for repair; it is only necessary to loosen one screw, and no connections need be unsoldered. Another switchboard is designed on the "unit" system, to facilitate extension by simply adding a unit more or less, as in a "sectional bookcase." The "unit" system is also employed in a pattern of lightning protector for private branch exchanges, which is very practically arranged. A device in this connection is a self-soldering heat coil. The coil will carry $\frac{1}{5}$ ampere indefinitely or $\frac{1}{4}$ ampere for 210 seconds. On the current exceeding the latter limit, sufficiently long to melt the fusible metal in the heat coil, a small star wheel whose shaft was held by the solder is enabled to turn one tooth under the action of a flat contact spring; this is released, breaking the line circuit, upon which the solder cools and the spring can be restored without using a new heat coil.

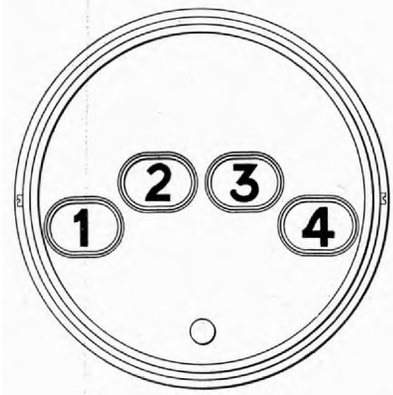


Combined Indicator and Jack. General view.

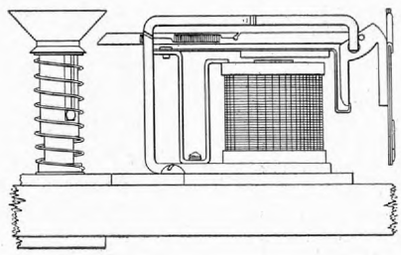
Combined Indicator and Jack (Signal Operated).



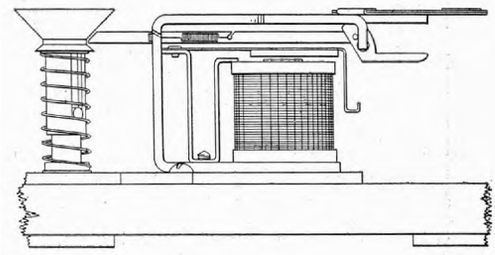
Combined Indicator and Jack (Signal replaced by Insertion of Plug).



Plan of 4-way Bell Indicator. 1/3 scale.



Elevation of Bell Indicator Movement (indicator down). 2/3 scale.



Elevation of Bell Indicator Movement (indicator operated). 2/3 scale.

A New Bell Indicator.—An interesting departure from the stereotyped pattern of bell indicator is illustrated above. We show a four-line instrument; for five lines and upwards the indicator movements are disposed in a circle. From the drawings of the indicator, which illustrates the construction very clearly, it will be seen that when the armature is attracted, the number disc springs upwards. All the discs are replaced simultaneously by depressing the button in the centre. The case is of japanned metal, and the indicator appears to be an ideal form for lifts and for hotel, office, and domestic bell installations generally.



Flush Pattern Interphone.

A. Reyrolle & Co., Ltd.,

HEBBURN-ON-TYNE. (STAND NO. 147.)

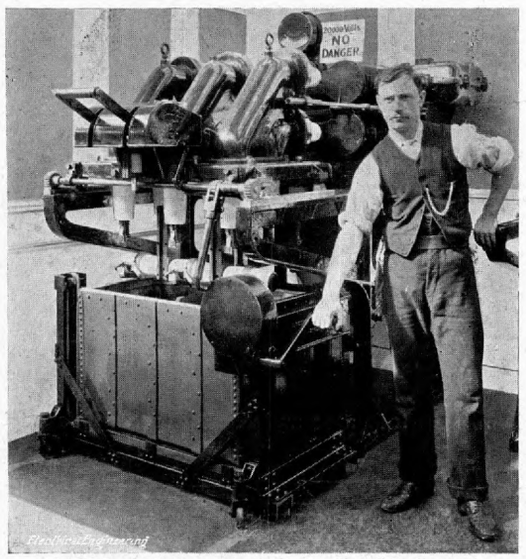
Ironclad E.H.T. Switchgear.—The most imposing exhibit on Messrs. Reyrolle's stand is a complete 20,000-volt 6,000-h.p. ironclad switch unit of a pattern of which 75 are now being supplied to the north-east coast power companies for sub-stations. This gear is generally similar to the ironclad gear for lower voltages and powers (see ELECTRICAL ENGINEERING, Vol. IV., page 24), but has some improvements in detail. The racking out arrangements for the switch carriage are better adapted for the greater weight, and there are more complete interlocking arrangements by which, for example, the switch cannot be closed till the carriage is quite home, nor can the carriage be either pushed home or withdrawn unless the switch is off. A bell signal indicates when the trip has acted, and further improvements are to be found in the gear, by which the oil tank can be lowered on to a truck.

Flame-proof Switchgear.—In the centre of the stand a switchbox has been arranged, so that it can be filled with a mixture of gas and air, and the mixture exploded to show how broad, rough-machined flanges, although not gas-tight, entirely prevent the passage of flame. The experiment is most convincing, and should be seen by all mining engineers. The principle of constructing flame-proof joints by wide flanges without packing is applied to all their mining switchgear down to the smallest lighting switches, and examples of drum type motor starters, complete underground switch

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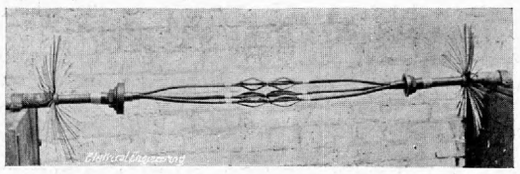
pillars, and other apparatus made in this way, can be seen on the stand. An example is also shown of the Fisher gate and box with automatic protection.

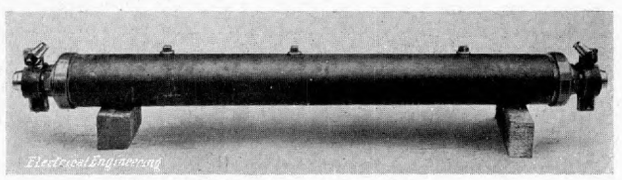
The Vernier Cable-joint.—Interest will also attach to the expansion cable-joint devised by Mr. C. Vernier, of the



20,000 Volt Ironclad Reyrolle Oil Switch.

Newcastle-upon-Tyne Electric Supply Co., to permit of an endwise telescoping of each conductor to the extent of six inches to avoid trouble due to expansion. The construction is seen in the accompanying illustrations. The cable ends are cut to leave a gap of three inches, and a piece of brass tubing having flexible braids secured to it axially is slipped over the ends, and the ends of the braids are in turn secured to the cable. The cable ends are thus constrained to move

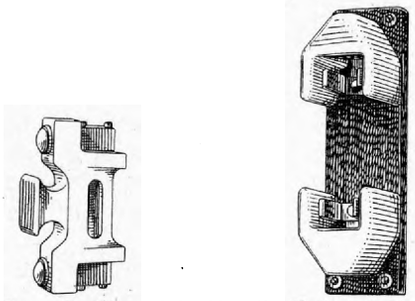




The Vernier Expansion Cable-Joint.

in a straight line, and the flexible braids ensure continuity of circuit. The whole joint may be enclosed either in a lead box or in a wrought iron pipe with special ends and glands for taking the lead covering and armouring.

Other Exhibits.—An effective demonstration is made of the properties of the current-growing resistances with nega-

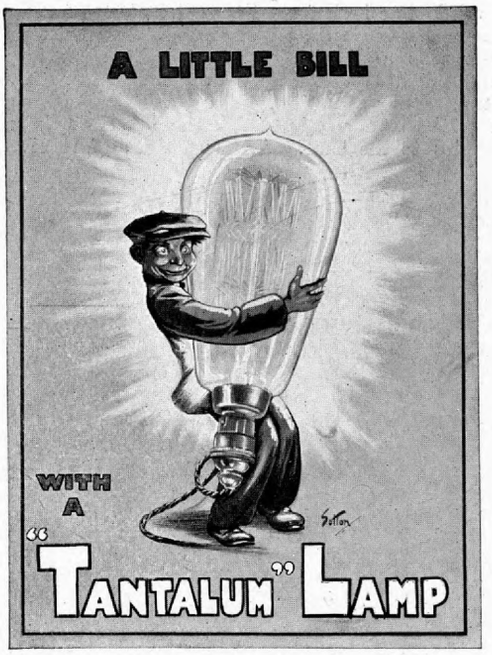


Reyrolle Porcelain Handle Tubular Fuse.

tive temperature coefficient which Messrs. Reyrolle employ in their starters. The increase of the current can be watched on an ammeter until it reaches a value where a circuit-breaker comes into action. Apparatus for the Merz-Price protective system is well represented, and among other apparatus may be mentioned an extensive series of designs of protected wall plugs with earthing contacts, suitable for connecting to almost every class of cable. Attention should also be drawn to the new form of porcelain handle tubular fuse illustrated here, which has been designed in view of the Home Office recommendations, and particularly well shielded with porcelain both as regards the fuse carrier and the contacts on the board.

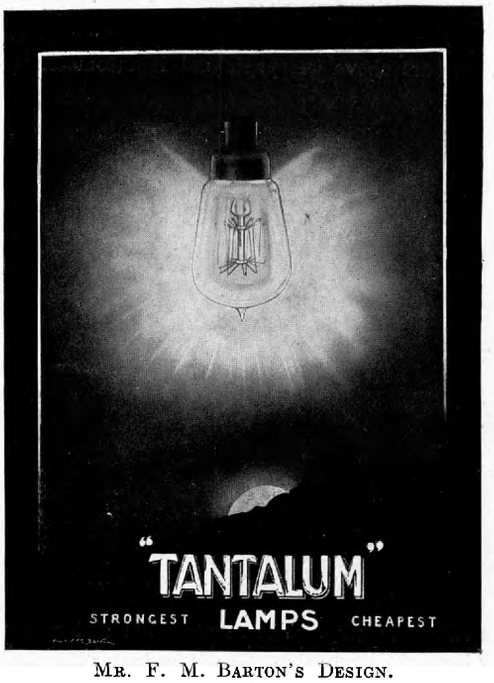
TANTALUM SHOWCARDS

ON page 535 of our issue of last week we announced the result of the Siemens tantalum showcard competition. We are now able to reproduce the two successful designs, for



Mr. L. Sutton Wood's Design.

which prizes have been awarded to Messrs. L. Sutton Wood and F. M. Barton respectively. Mr. Barton's design is being attractively printed in several colours, and makes it appeal on artistic grounds, while the prevailing note of Mr. Sutton



Mr. F. M. Barton's Design.

Wood's is humorous. The "little bill" showcard should become very popular with contractors, and will also soon be ready for issue. The ideas of the saving in money, the brilliancy of illumination, and the detail of the construction of the tantalum lamp are happily combined.

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ELECTRICAL ENGINEERING

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SUMMARY

The third of our series of special supplements dealing with the Electrical Exhibition now being held at Olympia is given with this issue. An addition to our exhibition telephone directory of last week is included, with the numbers of those exhibitors whose stands are connected up direct to the National Telephone Co.'s Kensington exchange. A large number of stands are very fully described, including Messrs. John Barker & Co.'s electric home. The stands of several prominent instrument makers are dealt with at length, and some novelties are described, including a thermal limit-switch and an automatic transformer switch. Illustrated particulars are given of several forms of arc lamp, and a new combined telephone indicator and jack, as well as a new bell indicator, are among the novelties noticed. An account is also given of Messrs. A. Reyrolle & Co.'s exhibit of mining and other switchgear, including their striking experimental demonstrations of the flame tight qualities of the method of enclosure they adopt.

Our monthly supplement on Electrical Engineering in Mines is also given with this issue. Two illustrated articles on colliery generating plants and electrical equipment are included, and a new electric miners' lamp is described.

At the Annual Conference of the Municipal Tramways Association last week, at Glasgow, Papers were read on tramway finance, and there were interesting discussions on a Paper by Messrs. R. G. and J. G. Cunliffe on tramcar motors, and on a collection of reports on tramway track construction and maintenance. (Page 545.)

An account of the resolutions passed by the International Electrotechnical Commission at Turin last month is given. Practically no further progress has been made in the important matter of international conventions for rating electrical machinery. (Page 546.)

A new form of small radial drill is described in a short illustrated article. (Page 546.)

A lengthy report has been issued by the Joint Committee of the Incorporated Municipal Electrical Association upon the question of charging for tramway energy supplied from combined power stations. It is recommended that the cost should be based upon the actual cost of production, and in order to arrive at this, an allocation of the "standing costs" and "running costs" is suggested. The whole question is discussed in great detail. (Page 547.)

In our "Electric Traction Notes" we state that a leading British Railway Company has given instructions for the preparation of designs for a 500-kw. Diesel-electric locomotive. The North-Eastern Railway Co. have sent their chief mechanical engineer and consulting electrical engineer to investigate the methods of handling goods traffic in the United States. We refer to a proposition for the adoption of trolley omnibuses in Ilford. (Page 548.)

Under "Telephony and Telegraphy" attention is called to some of the telephone exhibits at Olympia and a note is given expressing the opinion of a German doctor on the causes of ear trouble to telephone operators. It is stated that automatic exchange working is to be adopted in Vienna. (Page 548.)

The patent specifications published by the Patent Office last week, related among other things to electric ovens, locking lampholders, incandescent lamps and a conduit tramway system. The lamp patents were two

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in number; one describes a process for welding metal filaments to the leading-in wires, in which sulphide metal compounds are used, the other is for the use of 2-phase current in the manufacture of the filaments. In a new construction of underground conduit tramway track, the conduit, and the girders supported by brackets for taking the rails are made of reinforced concrete, the whole being formed integrally. (Page 549.)

The Barrow Corporation have decided to substitute electricity for gas in a number of important streets.—The water-power scheme proposed at Chester is estimated to cost £12,500.—The Stoke Newington Council have decided to take over from the North Metropolitan Electric Power Supply Co. the management of the local electricity undertaking.—There was a net profit of £3,118 on the Bermondsey electricity accounts last year, and £1,300 at Oldham. (Page 551.)

An electric lighting scheme is under consideration at Bampton, and an agreement has been signed for the erection of electric supply works at Honiton. A Local Government Board inquiry was held at Carlisle concerning a loan of £9,755 last week, and at Belfast for a loan of £40,000. New mains are to be laid at Merthyr Tydvil, and electric lighting schemes are proposed in Bulgaria and Russia. We give the full list of accepted tenders for the new power scheme at Stoke-on-Trent. (Page 551.)

At the annual meeting of Messrs. Dick, Kerr & Co., last week, reference was made to the Company's new lamp factory, which is nearly completed. In order to avoid experimental work, the Company have availed themselves of the experience of a Continental firm. The directors of the County of Durham Electrical Power Co. have decided not to declare an interim dividend on the preference shares. (Page 552.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, October 5th.
Iron and Steel Institute.
10.30 a.m. Autumn meeting at Institution of Civil Engineers, 25 Great George Street, Westminster. Among the Papers to be read is "On the Application of Electric Energy to the Manufacture of Iron and Steel in Italy," by Cav. Ing. Remo Catani.

THURSDAY, October 12th.
British Electrical and Allied Manufacturers' Association.
2.30 p.m. Council Meeting at Olympia.
7 for 7.30 p.m. Annual Dinner at Hotel Cecil.

FRIDAY, October 13th.
Junior Institution of Engineers.
6.30 p.m. Visit to "Model Engineer" small-power engineering and scientific exhibition at Royal Horticultural Hall, Westminster, S.W.

The Fire at the Empire Palace Theatre, Edinburgh.—We have received from the British Fire Prevention Committee a detailed report of the fire at the Empire Palace Theatre, Edinburgh, on May 9th, when ten lives were lost, including that of "Lafayette." An illustrated account is given of the fire and its effects, and extracts are given of the evidence given at the public inquiry. It seems to have been established that the fire originated in an ornamental lantern containing seven 8-c.p. lamps, with windows covered by a composition known as "gelatine." The lantern was supplied by flexible cable, which according to the evidence was in good condition. It is surmised that a short circuit took place inside the lantern, due to faulty connections, but the suggestion is made by Mr. F. Newington (City Electrical Engineer, Edinburgh) that the so-called "gelatine" may really have been a form of celluloid which could easily take fire.

Electrolytic Refining of Zinc.—H.M. Commercial Attaché at Yokohama reports that a method for the electrolytic refining of zinc has been invented by Mr. Chitaru Yoshida, proprietor of the Kano Copper Mine, Iwashior Province, Japan. Hitherto zinc ore has been exported and the refined metal imported. The right of working the process in Japan has been leased to the Mitsui Bussan Kaisha.



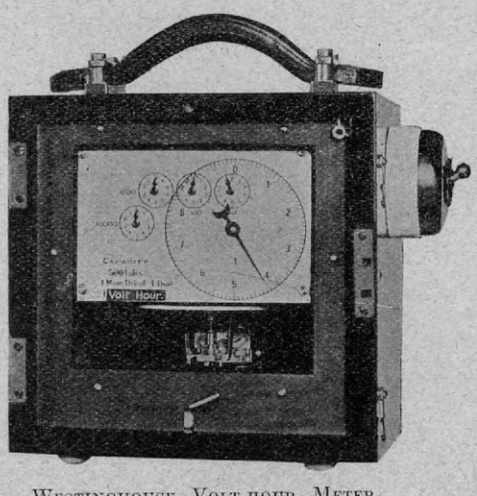
CURATE:—And what can you tell me about the ARK?
SUNDAY SCHOLAR:—It takes about 10 amps. and 50 volts, Sir. . . . Used to be trimmed every day, now only once a week, and if it gets any worse father says he'll have to come round to you for a job.

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ANNUAL CONFERENCE OF THE MUNICIPAL TRAMWAYS ASSOCIATION AT GLASGOW

THE tenth annual conference of the Municipal Tramways Association commenced at Glasgow on Wednesday of last week under the presidency of Mr. J. Dalrymple (General Manager Glasgow Corporation Tramways). In his presidential address he made a strong plea for careful detail work and control of expenditure on track and rolling stock maintenance by the tramway manager himself, and outlined various spheres of activity in which their association was busy. A Paper was afterwards read by Councillor W. Nelson on the "Common Good" of the city of Glasgow. A Paper was read in the afternoon by Councillor J. H. Rodgers (Chairman, Newcastle Corporation Tramways Committee) on Tramway Finances and Policy, in which he criticised rather severely the financial position of many of the municipal tramway systems in this country, pointing out that out of the total of 88 only 30 could be called financially sound. He attached great importance to the building up of adequate reserve and renewals funds, especially for track maintenance, where the period of loan was much longer than the life of the rails, and stated that no fewer than 26 municipal tramway undertakings had no such fund at all. He suggested taking the average life of the rails at fifteen years and setting aside £200 per mile of single track per annum. He deprecated the reckless lowering of fares that was taking place, and added a few words on the labour question.

The first Paper at the Thursday meeting was one by R. G. and J. G. Cunliffe on Tramcar Meters. These authors,



WESTINGHOUSE VOLT-HOUR METER.

who are both assistants in the Manchester tramway system, showed curves recording actual observations, which demonstrated how the cost of maintenance was related to the energy losses, and discussed the advantage of absolute over relative determinations and the working of different types of meter available, describing incidentally a long series of observations on the Manchester system, and leading finally to the following conclusions :—

The ampere-hour meter can, with proper supervision, be made to operate with an accuracy of within 1 per cent., and that its uncorrected values may be employed for the purpose of placing motormen and cars in their correct order of merit, whilst, when corrected for variation of average voltage by the volt-hour meter, its readings give the true energy consumption. If percentage differences between the results of various men are required the corrected values must be used. The watt-hour meter, owing to its greater complexity, more fragile construction, susceptibility to lightning discharges, and greater inaccuracy, is not so desirable or valuable an instrument as is the corrected ampere-hour meter. The time-meter, although very accurate in its measurement of time, cannot be trusted to measure energy within 10 per cent., and, if used at all, should only be employed in conjunction with the energy meter for purposes of investigation, in which connection it is very valuable. The volt-hour meter is indispensable for many purposes, and ought to be employed on all tramway undertakings for the purpose of measuring average voltages. On small undertakings, with light traffic, approximately equal savings may be effected in the driving and in the detection of faulty equipments, but, as the congestion increases, the state of the equipments becomes of increasing importance, more especially as regards the feeding and distributing system where the losses are a fraction of the total energy consumption, and do not merely affect the consumption of individual cars.

The volt-hour meter referred to is an instrument which has been developed by the British Westinghouse Co. in accordance with Messrs. Cunliffe's suggestions. It is in principle a direct-current motor in its simplest form, designed so that the speed of the armature is proportional to the voltage, and is arranged to read in volt-hours; thus at the end of one hour the average voltage of the circuit during that hour is indicated directly on the dial. It can be calibrated so as to record with a high degree of accuracy, and subsequent checking and recalibration is a simple matter. The keeping of a constant check on the average voltage at various points is of considerable importance. Where the voltage becomes low, through long feeders, long trolley lines, or heavy loading, serious losses of energy are incurred in transmission and in the car equipment. Low voltage also means reduced speed, and to keep to schedule time a driver may be compelled to use energy in driving where otherwise he would be able to coast. A knowledge of the average voltage is essential with systems using ampere-hour meters on cars, as conclusions drawn from readings taken in amperes only may be misleading. Up to the present time instruments recording with a pen upon a paper chart have been used to determine average voltages, but errors result from friction between the pen and the paper, and the effect of stopping, starting, and vibration upon the pen.

The new meter, which is illustrated here, has neither pen nor paper, and therefore is free from the drawbacks indicated, and can be used in a stationary position or upon a car.

The discussion on this Paper was opened by Mr. Goodyer (General Manager, Croydon Corporation Tramways), who referred to saving on his own system of £5,000 in one year, due to the use of meters; there were considerable savings in repairs owing to the more careful driving which meters encouraged; but in Berlin £21,000 had been saved in cost of energy alone. Mr. Clough referred to the savings at Bury, but did not like the author's separate ampere-hour and volt-hour meters. Mr. Pilcher, of Aberdeen, thought that economical driving could be obtained without meters, but Mr. Baker, of Birmingham, said that meters made the men much more careful in detecting faults on their cars. Mr. Hamilton was inclined to think that the saving in current was at the expense of good time-keeping. Mr. Spencer (Bradford) held that meters made drivers less willing to help each other when cars were disabled, but at Cardiff Mr. Ellis was very satisfied with the good effected.

Reports on methods of tramway track construction and maintenance, embodying remarks on abstracts of replies to queries addressed to the tramway managers of the county, were also read on the Thursday morning by Mr. J. Grierson (Permanent Way Engineer, Glasgow Corporation Tramways), H. Mattinson (Permanent Way Engineer, Manchester Corporation Tramways), and R. B. Holt (Permanent Way Engineer, Leeds City Tramways). These contained a large amount of detailed information regarding prevailing practice in permanent way work, and recorded rather conflicting opinions on the part of different authorities.

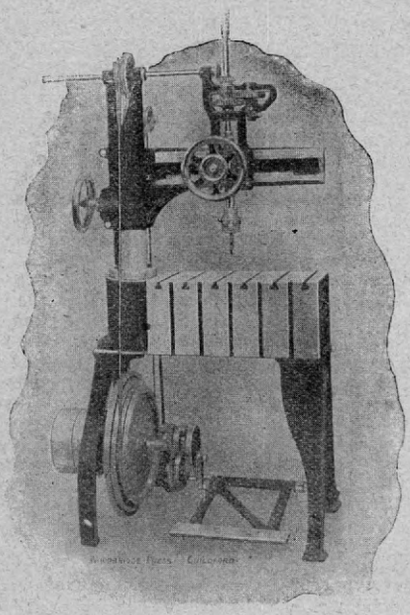
In the discussion Mr. McElroy (Manchester) called attention to the difference of opinion regarding Thermit joints, but in Manchester they had made 7,000 such joints in five years with only 0·3 per cent. breakages. In this case the joints were made by the Thermit Welding Co.'s own men. Mr. Acland (Chesterfield) did not see why tramway-track conditions should vary in different towns any more than railway conditions. He objected to the British Standard rail section. Mr. Simpson (Preston), Mr. Knowles (Sheffield), and the President also joined in the discussion.

At the annual meeting on Thursday afternoon, the following office-bearers were elected for the next session :—*President*—Mr. H. E. Blain (Tramways Manager, West Ham); *Vice-President*—Mr. A. R. Fearnley (Tramways Manager, Sheffield); *Secretary and Treasurer*—Mr. C. J. Spencer (Tramways Manager, Bradford); *Members of Committee*—Messrs. Flint (Leicester), Rogers (Newcastle), Whyte (West Ham), Goodyer (Croydon), Hamilton (Leeds), Clough (Bury), Fisher (Dundee), and Aldworth (Nottingham). The conference is to be held next year at West Ham.

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A NEW DESIGN OF RADIAL DRILL

AMONG the recently introduced patterns of machine tools made at Churchill Works, Guildford, by Messrs. Drummond Bros., is a drilling machine of moderate size for motor repairers or other light work. The drill is arranged to be driven either by foot or power, and has all the advantages of larger radial drills in the way of rigidity, quick setting into position, &c. One inch holes can be drilled at about six minutes per inch by foot power without previously putting a smaller drill through, and for small work considerable speeds are attainable. The small exertion required is largely due to the simple form of drive with a light high speed belt, this drive going direct to the bevel wheels, which have ball thrusts, and the back gearing between them and the spindle for heavy work, the key wheel giving a long leverage over the spindle, and in the anti-friction roller drive to the flywheel with direct simple connection to the treadle, and the rigidity, stability and weight of the standards and bed.



Drummond Light Radial Drill.

The general construction of the machine, with its convenient box bed for holding the work, is seen in the accompanying figure, and it is interesting to note that the mechanical transport section of the Army Service Corps has ordered eleven of these machines for their motor wagons, which are being fitted out as movable workshops.

INTERNATIONAL CONVENTIONS

THE International Electrotechnical Commission is making very slow progress. Although it may be hoped that some really useful results of their labours will be reported before the next meeting in two years' time, the resolutions arrived at at the meeting in Turin last month did not go very far. Useful work still remains to be done in connection with the framing of conventions for the rating of electrical machinery, but the only resolution passed was to confirm resolutions unofficially arrived at in Brussels last year as follows :—

1. The output of electrical generators is defined as the electrical power at the terminals.
2. The output of electrical motors is defined as the mechanical power at the shafts.
3. Both the mechanical and the electrical power are to be expressed in international watts or kw.

A Sub-Committee has been formed to carry on further this question of the international rating of electrical machinery and apparatus.

The amended list of terms and definitions drawn up in English and French was provisionally adopted. This will come up for revision and expansion at the next meeting in 1913.

The following resolutions as to symbols were provisionally adopted :—

1. Instantaneous values of electrical quantities which vary with the time are to be represented by small letters.
2. Virtual or constant values of electrical quantities to be represented by capital letters.
3. Maximum values of periodic electrical quantities to be represented by capital letters, followed by the subscript m.
4. Magnetic quantities, constant or variable, to be represented either by capital script, Gothic, heavy-faced or any special type.
5. Maximum values of magnetic quantities to be represented either by capital script, Gothic, heavy-faced or any special type followed by the subscript m.
6. The following quantities to be represented by the following letters :—

Electromotive force = E, e.
Electric quantity = Q, q.
Inductance (coefficient of self-induction) = L.
Magnetic force = **H**.
Magnetic flux density = **B**.
Length = L, l.
Mass = M, m.
Time = T, t.

The letters I, E, and R were adopted to represent current, electromotive force, and resistance respectively in the simple algebraic expression of Ohm's law.

The term "reactive power" was adopted to designate the quantity VI sin ϕ.

In the graphical representation of alternating electric and magnetic quantities, it was decided that the advance in phase should be represented in the counter-clockwise direction.

A Sub-Committee was formed consisting of one member each from Belgium, France, Germany, Great Britain, Holland, Spain, Italy, Switzerland, and the United States to continue the study of international symbols.

The next meeting will be held in Berlin in 1913 under the presidency of Professor E. Budde, but unofficial meetings may be held in the meantime. An invitation from the American Institution of Electrical Engineers was accepted to hold an official meeting in San Francisco in 1915.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

METAL FILAMENT LAMPS.—A very neatly arranged catalogue has been issued by Pope's Electric Lamp Co., Ltd. (Hythe Road, Willesden, London, N.W.). A numerous selection of lamps are illustrated on art paper, showing the bulbs full size. These can be had in various shapes. A new pattern torch flame bulb for tubular lamps, and a ribbed conical shaped bulb, for preventing glare effect, are two of the most striking of the fancy types. Besides these, many spherical and ordinary forms are included, all of which are British made, and can be had for the usual voltages and candle powers.

ALUMINIUM.—A leaflet from The British Aluminium Co., Ltd. (109 Queen Victoria Street, London, E.C.), illustrates aluminium panels, ceilings, and mouldings for railways and tramways.

FANS, MOTORS, AND DYNAMOS.—A leaflet from L'Air Electrique (38 Rue de la Folie-Regnault, Paris), gives a numerous illustrated selection of fans of all types, small dynamos, motors, and converters, as well as an electric polisher and centrifugal ventilator.

CARBON LAMPS.—A leaflet from the Sunbeam Lamp Co., Ltd. (Park Road, Gateshead), gives particulars of the carbon filament lamps manufactured by the company, calling special attention to traction lamps, flame, and other fancy lamps, radiator lamps, and turn-down lamps with live filaments.

MERCURY VAPOUR LAMPS.—The Westinghouse, Cooper, Hewitt Co., Ltd. (151-2 Great Saffron Hill, London, E.C.), has sent us another leaflet discussing these lamps in connection with engineering, in which an attempt is made, with the help of illustrations, to show that the light given out is better than daylight. The wide range of applications to which they are being put is shown by a long list of customers, which is also before us.

MERCURY VAPOUR RECTIFIER.—The same firm also send a pamphlet relating to this rectifier, which is for use chiefly with projection arcs and in connection with cinematograph work. It starts up automatically directly the carbons make contact.

CONDUIT WIRING.—A pamphlet has been sent to us by the Sun Electrical Co., Ltd. (118-120 Charing Cross Road, W.C.), describing their Kalkos system of conduit wiring without condensation. The conduit consists of specially drawn brass tubes tinned inside and out, joined with slip sockets, and soldered. This gives a continuous metallic circuit of very low resistance, which can be used as an earth for twin wire systems, as a return for concentric systems, or as a neutral conductor for a three-wire system. The material used is a very good conductor of heat, and soon adjusts its inside temperature to that of the atmosphere, thus avoiding condensation.

CONDUIT BOX.—The same firm also send details of the Kalkos iron box, the special feature of which is its adjustment ring. This can be rotated forwards and backwards to attain the desired level at the front of the box. For extreme cases an extension ring is available. All boxes, being divided by the adjustment ring, form two compartments. The Kalkos switch used throughout was described in Electrical Engineering, January 12th, 1911, p. 16.

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"Electrical Engineering"
October 5, 1911.

ELECTRICAL ENGINEERING

IN

MINES

ELECTRICAL EQUIPMENT OF THE CRAIGHEAD AND BOTHWELL CASTLE COLLIERIES

THESE collieries, situated near Glasgow, are owned by Messrs. William Baird & Company, who were one of the first firms in Scotland to use electricity for underground mining work. It is the purpose of this article, however, to deal with the power equipment rather than with the motors below ground.

The power house is at present situated at the Bothwell Castle Colliery, and a portion of the output is transmitted at 2,200 volts to Craighead Colliery, a distance of about a mile away, and may, at a later date, be transmitted to other collieries in the same way. The power unit at present comprises a mixed-pressure, straight-flow turbine of the Westinghouse impulse type, direct coupled to a 300-k.w. 500–550-volt, three-phase, 50-cycle turbo-alternator and exciter. The turbine takes exhaust steam from two engines, one driving a fan and the other a haulage. The amount of steam thus available is 115–180-k.w., and when this supply is insufficient to carry the load, live steam is taken from the boilers at 60 lbs. per square inch pressure, through a reducing valve. The condensing plant, which has an average duty of 12,000 lbs. of steam per hour, is of the Westinghouse Leblanc multiple jet type, and is capable of maintaining a vacuum of between 27½ and 28 inches of mercury at full load, the air circulating pumps being driven by a squirrel-cage motor rated at 47 b.h.p. at 720 r.p.m. This motor, which, with the condenser, is situated in the basement, is controlled from the engine room by a mining type control pillar comprising oil switch, oil immersed controller, and ammeter; the water and vacuum gauges are also mounted on this pillar, the whole forming a remarkably complete and accessible control system.

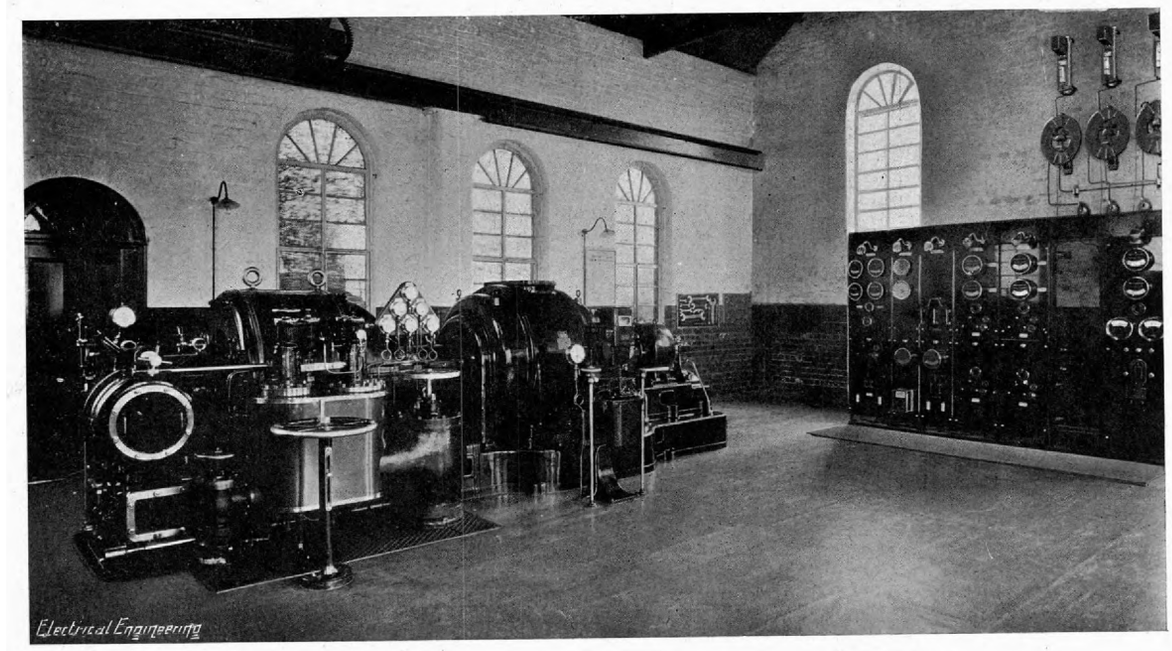
The current generated is used at terminal pressure at Bothwell Castle, on motors both above and below ground, but is transformed to 2,200 volts for transmission to Craighead. The line is designed for a later working at a pressure of 6,600 volts, but as all the electrical machinery has not yet been erected, the lower voltage is quite sufficient for the small amount of power at present being transmitted.

A six-panel black enamelled slate switchboard controls the generator and outgoing feeders, and comprises one high tension and five low tension panels equipped with the necessary switches and instruments. There are also three low-tension feeder panels for station supply, surface, and underground feed.

Current is taken from the high-tension 'bus-bars and led underground by a three-core, paper insulated, lead covered cable to a point clear of the Bothwell Castle Works, and thence by an overhead aluminium line, supported at intervals of about 50 yards on wooden poles to Craighead, where it is stepped down to 500 volts for use.

This line is led across country over road, and woods, finally crosses the River Clyde, at a point where it is 210 feet wide. The line was tested at 11,000 volts to meet the B.O.T. requirements, and was found perfectly satisfactory in every way. It is composed of three aluminium cables, each consisting of three No. 10 S.W.G. strands having no joint from end to end, fastened to brown porcelain insulators, tested to 22,000 volts by aluminium clips. At the Clyde, steel guard wires are fixed underneath the lines for the double purpose of taking the pull, and preventing the lines from falling in the event of a break. A high-tension telephone line connects the two mines, and is mounted on the same poles as the power lines.

Although it has been stated that the pressure is stepped down to 500 volts for use at Craighead, it should be mentioned that high-tension current will be used direct for large motors, and will also be used for transmission to other collieries where the supply will be a direct high-tension one to the motors. At Bothwell, Nos. 1 and 2 pits, 500-volt A.-C. only is used. At present there are five motors in use at the former and seven at the latter, all of the squirrel-cage

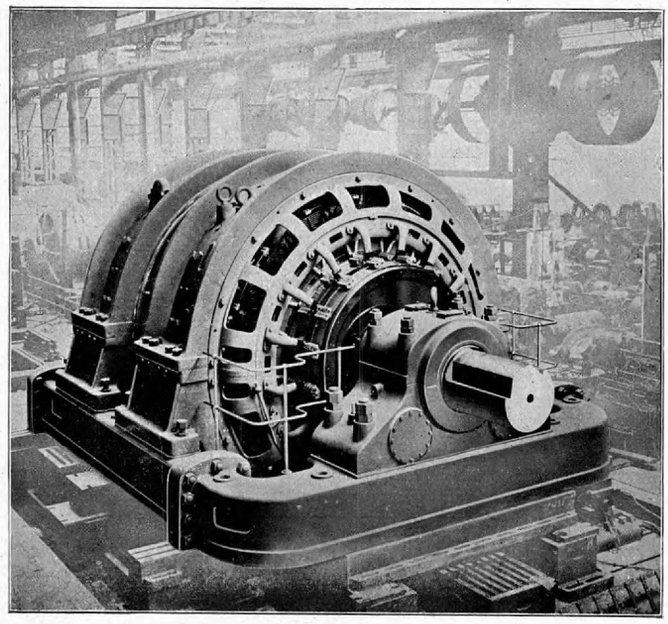


INTERIOR OF ENGINE ROOM, SHOWING TURBO-GENERATOR AND SWITCHBOARD.

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SIEMENS

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type. One of these is a 7-h.p. motor used for driving a winding equipment for hauling men up a 25-ft. blind pit. At the Bothwell Castle and Craighead pit some very neat haulages are in use, motive power being furnished by two speed squirrel-cage motors operated by oil immersed con-

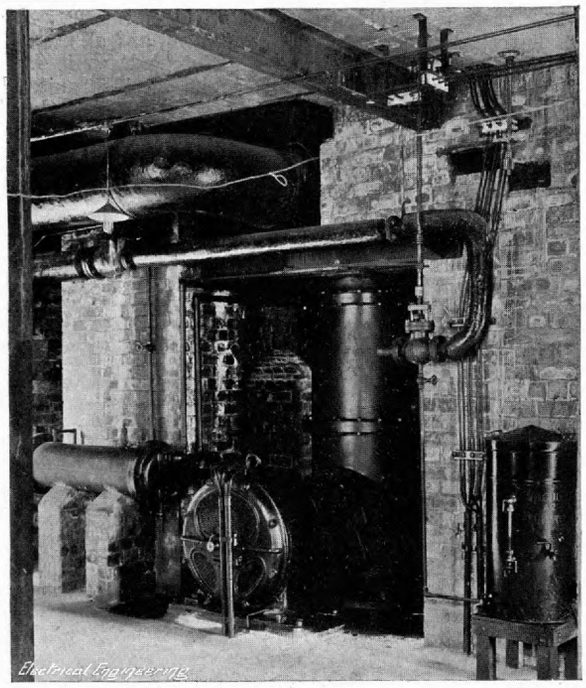


FIG. 2.—CONDENSING PLANT.

trollers and mining type oil switches. The drive is by worm gear, and the motors, which are rated at 10/5 h.p., run at a speed of 970–480 r.p.m. This variation is effected by a controller which makes the different connections of the stator winding so as to vary the number of poles, the minimum number of poles giving the maximum speed.

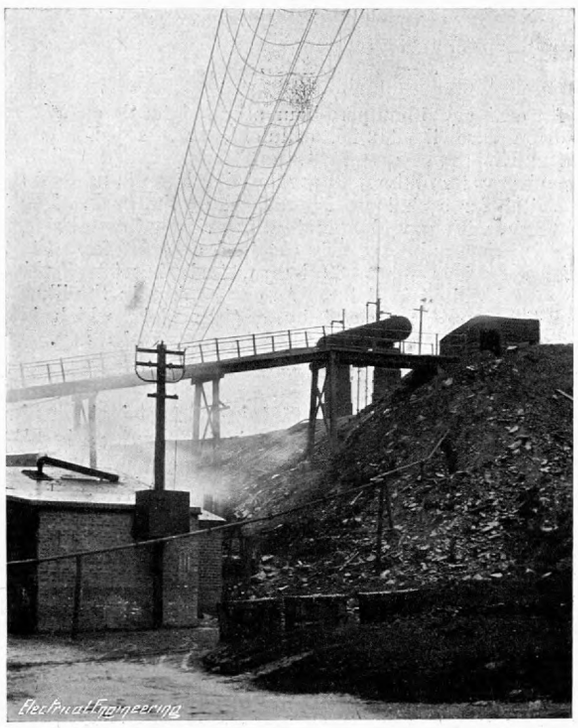


FIG. 3.—PART OF TRANSMISSION LINE, SHOWING CRADLE.

This plant reflects the greatest credit on Messrs. Stevenson & McGuffie, of Glasgow, the consulting engineers, on Messrs. William Baird, and on the British Westinghouse Electric & Manufacturing Company, Limited, who are responsible for the entire electrical equipment.

ELECTRICAL EQUIPMENT OF THE CLOCK FACE COLLIERY OF THE WIGAN COAL AND IRON CO.

THIS colliery, which was begun in 1905, started running about the end of 1906, and is situated about three miles from St. Helens.

Electricity is supplied to the two pits by two 400-k.w. Westinghouse straight-flow Parsons type turbines running on live steam at 110 lbs. pressure and 200° superheat, rod driving a Westinghouse 400-kw. three-phase 2,200-volt 50-cycle turbo-alternator. A Westinghouse Leblanc Condenser is installed capable of dealing with the whole of the steam from either of the turbines.

The switchgear controlling these units is mounted on a

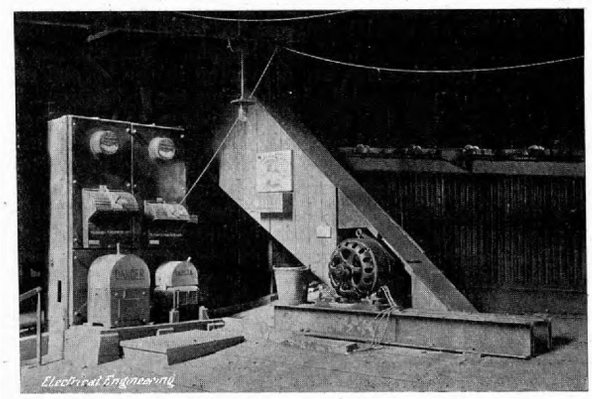


FIG. 1.—10-H.P. MOTOR DRIVING CREEPER FOR TUBS.

slate board containing two generators, two feeders, and some spare panels, separated at the back by slate partitions, and with the cubicles formed by these panels are enclosed by expanded metal doors. The bus-bars are carried overhead by porcelain insulators.

The supply is led to a 500-k.w. 2,200/500-volt three-phase 50-period transformer placed in the basement, and is taken out through the wall by two three-core bitumen cables, supported on wooden poles for about 40 yards, and thence by the wall of the winding engine-house to the pit-brow, where one cable

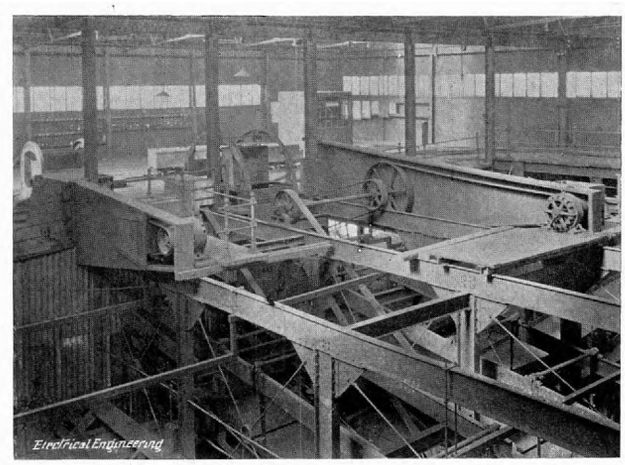


FIG. 2.—VIEW OF SCREENING PLANT DRIVEN BY TWO MOTORS.

goes underground, and the other to the screens. A 375-k.w. motor generator set is used for converting to direct current for surface lighting, the cables running on the same poles as those carrying the A.-C. cables. An engine-driven D.-C. generator is used for night lighting, and as an emergency stand-by, the engine being by Messrs. Marshall & Co., of Gainsborough.

The screening plant is built straight over the mine head some 29 feet above the ground level, and the pit cages are wound right up into it. The trucks are run from cage to tippler by gravity, and the coal automatically tips into the screens, conveyed on belts, and finally shot into trucks in one continuous operation by means of electrical power.

One 25-h.p. motor drives the tipplers and shakers, and a 50-h.p. motor is used for the picking belts, the lowering

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ends of which being operated from a counter shaft driven by the same motor. There are two 10-h.p. motors on empty tub creepers, and one driving a full tub creeper. There is also a 25-h.p. motor driving extension belts.

At the present time the colliery is being opened out, but when the underground developments are completed it is expected that the output of the plant will be at least 1,500 tons per day.

We are informed that the whole installation, the electrical part of which was supplied by the British Westinghouse Co., is working in a very efficient manner, and is kept in excellent condition.

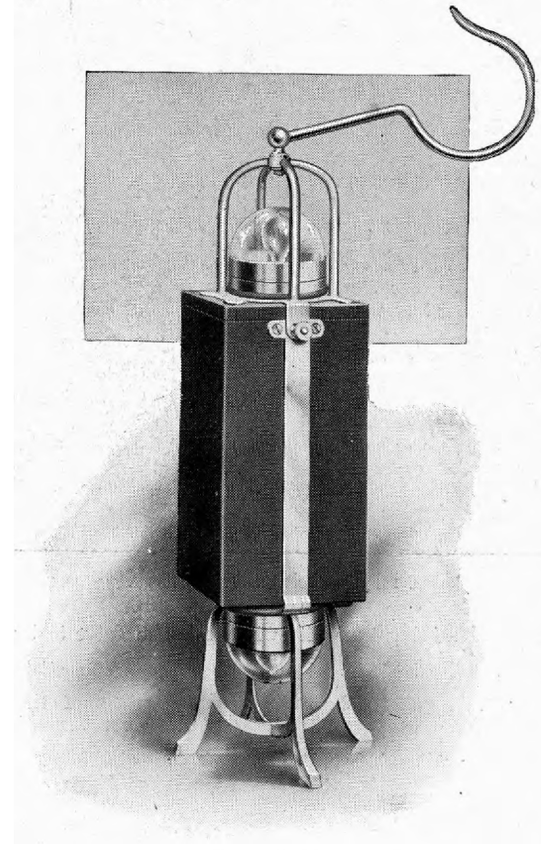
ELECTRICAL MINING PLANT AT THE OLYMPIA EXHIBITION

MINING electrical engineers will find a number of exhibits of special interest to them at the Electrical Exhibition, now being held at Olympia. Descriptions of all novelties in this direction are appearing in the special supplements which we are publishing during the exhibition, but it may be convenient to indicate here where some of the most interesting items may be found. No one interested in electricity in mines should omit a visit to the stand of A. Reyrolle & Co., where demonstrations are being given of the flame-proof qualities of their switch cases and a quantity of specially designed mining switchgear, including a gate end-box with the Fisher system of leakage protection, can be seen. Special mining switchgear should also be inspected on the stands of Siemens Brothers Dynamo Works, Ltd., the British Thomson-Houston Co., the Union Electric Co., and Allen West & Co. Cables and cable boxes for mining are shown by W. T. Henley's Telegraph Works Co. and Callendar's Cable & Construction Co., and among those exhibiting special flame-proof and other mining motors are Bruce Peebles & Co., Ltd., and the Phœnix Dynamo Manufacturing Co. On the stand of Everett, Edgcumbe & Co. are shown special water-tight mining instruments, and mining telephones, mine exploders, &c., are exhibited by the Sterling Telephone Co. Another interesting item is the Bowie safety lamp relighter of Spagnoletti, Ltd., on the stand of Pooley & Austin.

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MINERS' ELECTRIC LAMP

THE Electrical Power Storage Co., Ltd. (4 Great Winchester Street, London, E.C.), have put a new type of electric miners' lamp on the market, known as the Up-and-down lamp. Great attention is being given to electric lamps just now by the principal mining companies, who are adopting them extensively, so a few details will be of interest. Many types have been manufactured by this firm, and all are simple in construction. In the one we illustrate a lamp is fixed at each end, so that a bottom light can be obtained quite close to the ground, or higher up, according to the work in hand.



"Up and Down" Miners' Lamp.

An ordinary 10-ampere-hour accumulator is contained in a wooden case lined with celluloid, and supplies a 4-volt, 2·5 candle power metal filament lamp, which will burn on one charge for 27 hours, provided one lamp is used at a time. A switch for each lamp is provided on the back. The safety of these, with regard to arcing, is evident from the fact that the firm has quite recently obtained an order from the South Wales Colliery for 1,000 lamps, including 50 of this type. The total weight is 5½ lbs. As can be seen in the illustration, the lamps are protected by a glass globe which is easily detached. The whole is locked by means of a key.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during September.

September 7th.—Monthly supplement on "Electrical Engineering in Mines," opening with a critical article on the New Coal Mines Bill, commenting upon the amendment suggesting that the use of electricity should be discontinued where a minute proportion of inflammable gas is present in the air, and urging that in the new Home Office Rules the regulation prohibiting the use of electricity where there is the risk of explosion should be more definite. Some other articles summarise some of the most important mining patents during August, and describe a new controller and a new form of earth plate, suitable for mining work. A report is given of some police court prosecutions relating to infringements of the mining rules.

September 14th.—Report of a discussion before the British Association on steam, gas, and oil engines.

September 21st.—First special supplement on the Electrical Exhibition at Olympia. Description of an arc lamp lowering gear.

September 28th.—Description of a 110,000-volt transmission system. Particulars of some new liquid starters and controllers. Second special supplement on the Electrical Exhibition.

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EQUITABLE CHARGES FOR TRAMWAY SUPPLY

THE Joint-Committee appointed by the Incorporated Municipal Electrical Association and the Municipal Tramways Association to consider the question of the charge which should be made for electrical energy supplied for traction purposes from combined power stations, has now presented its report, which is given in full below. The report has been adopted by the Councils of both Associations.

The committee, which consisted of Messrs. J. Christie, S. L. Pearce, Thos. Roles, C. E. C. Shawfield, H. Talbot, S. J. Watson, and T. P. Wilmshurst, representing the I.M.E.A., and Messrs. H. E. Blain, J. Dalrymple, A. R. Fearnley, J. B. Hamilton, J. M. McElroy, and C. J. Spencer, representing the Municipal Tramways Association, have come to the conclusion that the following broad principles should be adopted as the basis for the charge for electrical energy supplied for traction purposes from combined stations, viz. :—

(1) That the charge should be based upon the actual cost of production.

(2) That in order to ascertain the actual cost of production it is necessary that the "standing costs" and the "running costs" should be properly separated, and the following allocation is suggested subject to the general observations subsequently made in this report, viz :—

	Standing Costs.	Running Costs.
Coal	25%	75%
Oil waste and water	25%	75%
Repairs :—		
(*a*) Building	100%	—
(*b*) Steam boilers, piping, &c. ...	75%	25%
(*c*) Engines and generating plant ...	50%	50%
Repairs of joint mains in case of high tension stations	100%	—
Wages at generating stations	50%	50%
,, ,, sub-stations	100%	—
Salaries of operating officials	100%	—
Rents, rates and taxes on joint assets (not including Income Tax)	100%	—
Management expenses (salaries of administrative officials)	50%	—
Interest in respect of all capital which is used in common for the various classes of supply	100%	—
Depreciation in respect of all assets used in common for the various classes of supply	100%	—

(3) That the tramways department's proportion of the standing costs should be the ratio which the maximum demand for traction purposes at the generating station bears to the total maximum demand on the generating station, such maximum being arrived at in the same manner in each case as hereinafter set forth.

(4) That the tramways department's proportion of the running costs should be the ratio which the total number of units delivered to feeders at the station for traction purposes bears to the total number of units delivered to feeders at the station for all purposes.

(5) That the traction maximum demand should be taken to be the mean of the figures representing : (1) The maximum traction demand at any time of the year, and (2) The average of the daily maximum traction demand (Sundays excepted) taken over a period of a month coincident with the maximum demand on the station.

The method of ascertaining the traction maximum shall be taken as the maximum observed load deducting therefrom 20 per cent.

(6) That in cases where storage batteries are in use the figure to be adopted as the traction maximum demand and used for allocating to the tramways department their proportion of the standing costs under the headings of :—

(*a*) Rents, rates and taxes, and
(*b*) Management expenses

should be the generating plant maximum plus the battery—and for the purpose of allocating the remaining standing costs—*i.e.*,

(*a*) Coal.
(*b*) Oil waste and water.
(*c*) Repairs.
(*d*) Wages at generating and sub-stations, and
(*e*) Salaries of operating staff.

the maximum demand to be adopted should be the maximum demand of the generating plant only.

That the two-hour rating of any storage battery should be deemed to be its kilowatt capacity, and that all repairs to the battery which could be used for the dual purpose of lighting and traction should be dealt with in the same manner as repairs to engines and generating plant. If, on the other hand, it is put in for purely traction purposes it should be dealt with under the heading of repairs to exclusive traction plant.

(7) That the total costs in respect of traction feeders and any other apparatus connected exclusively with traction distribution should be wholly allocated to the tramways department, such costs to include interest, depreciation, and repairs.

(8) That it is desirable as a matter of ordinary commercial prudence that there should be established in connection with electrical undertakings a suitable reserve fund for meeting any extraordinary expenditure in any year, and that the tramways department should bear their proper proportion of the annual sums to be set aside for establishing such reserve fund, but it should be an understanding that the tramways department should be a party to the fixing of the annual amounts to be so set aside.

(9) That the total actual cost of production of current for traction purposes may be summarised under the following heads, viz. :—

(*a*) Proportion of standing costs (ascertained as per Paragraphs 2 and 3).
(*b*) Proportion of running costs (as per Paragraphs 2 and 4).
(*c*) Total cost of traction feeders, &c. (as per Paragraph 7).
(*d*) Proportion of reserve fund (as per Paragraph 8).

(10) That the question as to what amount of profit (if any) should be paid to the electricity department by the tramways department is a matter which each municipality should settle for itself. The joint-committee have only endeavoured to lay down what they consider to be the correct method of ascertaining the actual cost of production, and upon which they suggest the charge should be based.

General Notes made by the Joint-Committee.

Coal allocation as between Standing and Running Costs.—The question as to the proper proportion of coal to be allocated to the standing costs received careful consideration by the joint-committee. From the evidence in their possession it would appear that the amount of coal which is consumed to make up for radiation losses differs somewhat in the various stations. The general information obtained showed that it averages from 4 lb. to 5 lb. per kilowatt of plant usefully employed per day. It is suggested by the joint-committee that each municipality should carefully go into this matter with a view to ascertaining, as far as possible, the actual figure for their particular station. If, however, it is not thought worth while in any particular case to go into this detail, it is suggested that the division suggested by the joint-committee should be adopted, viz. : 25 per cent. to standing costs, and 75 per cent. to running costs.

Oil Waste and Water.—The joint-committee after considering the allocation under this head suggests that it should follow the division proposed in the case of coal. They recognise that this may not be strictly accurate, but they think that the smallness of the figure does not justify a different allocation.

Repairs to Steam Boilers, Piping, &c.—The figures suggested as the allocation under this head are not less than 75 per cent. to standing costs, the balance going to running costs. The joint-committee suggest that the figures should be settled for each station having regard to local conditions.

Salaries of Operating Officials.—Under this head it is suggested that only the salaries of those officials should be included whose services are devoted to generation and transformation of electrical energy.

Management Expenses (Salaries of Administrative Officials).—Under this head the proposal is to include the salaries of the administrative staff as apart from the staff engaged at the generating station. It would include the salary of the chief engineer, the secretary, the accountant, and officers of that class. It will be observed that it is proposed to allocate half only of the management expenses to standing costs, the remaining half, having no connection with the traction supply, is eliminated from the calculations.

Interest and Depreciation.—The capital, it is suggested, should be that which is used *in common* for the various classes of supply, and should be ascertained by taking the total capital expenditure of the undertaking and deducting therefrom all items which are *not* used in common, e.g. :—

Traction feeders.
Lighting feeders and distributing networks and services.
Meters, &c.
Motors (for hire).
Any other plant not used for the *common* supply.

In calculating the depreciation charges it is suggested that the "lives" of the various portions of the assets should be fixed in accordance with the actual provision made by the electricity department.

Method to be adopted for accurately measuring the current supplied for traction purposes.—The joint-committee suggest that all direct current meters should be of the watt-hour type. When fixed in position where they are liable to be affected by stray magnetic fields they should be astatic, and of a type containing no iron or permanent magnets, and should not be

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affected by momentary overloads or short circuits. Where meters containing permanent magnets or iron are used it is advisable that they should be shielded as much as possible.

It is further desirable that all meters should be calibrated for the temperature of the surrounding medium in which they will be located. For loads up to 2,000 amperes the total current type is recommended, and above this output the shunted type —each with its own shunt.

Where polyphase currents have to be measured, "Dynamometer" or "Induction" type of meters may be used.

It is suggested that the two-wire wattmeter method should be employed as being the most satisfactory way of metering three-phase electrical energy.

The joint-committee recommend, having regard to the importance of reliable measurements being obtained, that in all generating stations three wattmeters should be arranged in series, one meter being the property of the tramways department.

In all important sub-stations they consider that two wattmeters will suffice, one of which would also be the property of the tramways department.

Provision should be made for reference to an independent authority in the event of any dispute arising as to the accuracy of any or all of the meters installed.

RESERVATIONS MADE BY THE JOINT-COMMITTEE.

Traction Maximum Demand.—The joint-committee in Paragraph 5 have suggested a method of ascertaining the traction maximum which they are of opinion could be equitably applied to the majority of tramway undertakings in the kingdom; they consider, however, that it might not be applicable in every case where the "peaks" are accentuated or where the ratio of sustained maximum demand to average maximum demand is of an abnormally high value due to (*a*) geographical, or (*b*) service conditions. As an instance of the former they cite the case of those towns having very severe gradients on their system, and as an instance of the latter, the case of those towns having to deal with football or other abnormal rush traffic.

Capital Charges.—The joint-committee have set forth in Paragraphs (2) and (3) and further amplified in the "General Notes" what they consider is the most practicable method of treating the question of the capital charges in the ascertainment of the costs of traction supply. They are aware, however, that circumstances may arise in connection with the development of electrical undertakings which might properly justify some departure from the method suggested.

They have had under their notice the case of stations where the principle of dealing with the capital charges on the "common plant" basis, or the "pooling system" as it may be termed, would not be in the best interests of either the electricity or the tramways undertakings. They therefore suggest the following as an alternative basis which might be applied in cases which come within this category, viz. :—

(*a*) That the tramways department's proportion of the charges for interest on capital expenditure in respect of generating and transforming plant and boilers should be based upon the cost per kilowatt for such plant at the time of its installation, the amount of such plant to be ascertained on the maximum demand principle already described, plus a reasonable allowance for reserve or spare plant to be determined in accordance with the local conditions.

(*b*) That the tramways department's proportion of the interest on the capital in respect of land and buildings should be based upon the proportion which the kilowatt capacity of the traction plant bears to the total kilowatt capacity installed.

(*c*) That the depreciation charges should be determined in accordance with the paragraph under the heading of "General Notes" contained in this report.

The joint-committee cannot make any recommendation as to which of the two methods outlined should be applied in any particular instance. Each case should be settled on its merits, having regard to the local conditions, and in the event of any dispute arising, the joint-committee suggest that provision should be made for referring the matter to an independent engineer for settlement.

The joint-committee desire to take this opportunity of acknowledging the special assistance which they have received in the work of drafting the report on this difficult matter from the sub-committee, consisting of Mr. S. L. Pearce (Manchester) and Mr. T. Roles (Bradford), representing the I.M.E.A.; and Mr. J. M. McElroy (Manchester) and Mr. C. J. Spencer (Bradford), representing the M.T.A. These gentlemen have devoted a considerable amount of time to the question, and it is largely owing to their efforts that your committee are able to report at this date.

Students' Section of the Institution of Electrical Engineers.—The Hon. Sec. of the section wishes us to call the attention of those members of the Students' Section who desire to read papers to the facts that it is necessary that notice of such intention be sent to him *immediately*, in order that the announcement may be embodied in the programme of the session. Notice should be sent to Mr. D. Betts, 3 Fordwych Road, London, N.W.

ELECTRIC TRACTION NOTES

We give elsewhere in this issue the full report of the Joint Committee appointed by the Incorporated Municipal Electrical Association and the Municipal Tramways Association to consider the charges for traction supply from combined power stations. Our views upon this important question were expressed briefly in connection with Mr. R. Hammond's award in the Paisley tramways arbitration (ELECTRICAL ENGINEERING, Vol. VI., December 1st, 1910, p. 766).

Speaking at a meeting of the Society of Engineers on Monday, Mr. W. P. Durtnall stated that he has received instructions from a leading British railway company, to prepare the designs of a 500-h.p. petrol-electric locomotive, in which a Diesel engine will be used. He also mentioned that although the North British Railway Co. had been experimenting with a locomotive in which there was a steam turbine, dynamo and motors, it was not likely that this class of engine would be taken into general use.

With a view to coming to a decision as to the adoption of electric locomotives for goods and mineral traffic, the North-Eastern Railway Co. have sent Mr. V. L. Raven, the Company's Chief Mechanical Engineer, and C. H. Merz, the Company's Consulting Electrical Engineer, to the United States to investigate the various methods adopted there for operating goods traffic by electrical power.

The Glasgow Corporation have put into service a tramcar of the type designed some time ago by Mr. T. Kavanagh, of Liverpool, and which was described in ELECTRICAL ENGINEERING, Vol. II., p. 575. This car has been designed to facilitate the rapid entry and leaving of passengers, an exit and entrance being afforded at both ends.

The West Hartlepool Corporation have passed the recommendation of the Tramways Committee that the whole of the lines of the Hartlepool Tramways Co. be purchased, and that powers be sought for this in addition to the construction of further lines. This decision has been arrived at after a report by Mr. J. B. Hamilton, of Leeds, and also owing to the failure of the negotiations between the Council and Company for the latter to take a lease of the lines which have been purchased by the former.

A scheme for the adoption of trolley omnibuses has been placed before the Ilford Council.

A Sub-Committee has been appointed by the Brighouse Council to consider the proposed tramway extension to Rastrick.

An interim dividend of 3% has been declared upon the ordinary shares of the Lisbon Electric Tramways Co.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Several stands at the Electrical Exhibition now being held at Olympia contain telephone apparatus, telephone cables, &c. Descriptions of these are appearing in our special supplements on the exhibition. In this week's supplement details are given of some novelties in this direction, introduced by the Western Electric Co., including a new combined indicator and jack.

An interesting contribution to the subject of the physiological effects of the continuous use of the telephone has been made by Dr. Förster, of Charlottenburg, in the *Berliner Klin. Wochenschrift*, a German medical journal. He describes experiments from which he concludes that the ear troubles developed by telephone operators are due, not to any electrical or electromagnetic action, but to the "cracking" noise or the continuous series of sharp noises at regular short intervals. He suggests that special attention should be given to this matter in the future development of the telephone, and recommends a form of telephone designed by Herr Bähr, of Charlottenburg, in which a diaphram of mica with an iron disc attached is used in place of an iron diaphram.

According to the *Elektrotechnische Zeitschrift*, a large electrical concern is endeavouring to arrange for public telephonic communication between Berlin and St. Petersburg. It is stated that the Russian Government favours the project.

The Austrian Ministry of Commerce has decided to introduce automatic telephone exchanges into the Vienna telephone system. Three exchanges are to be constructed shortly.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Sept. 28, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

21,468/10. **Electric Ovens.** The Electric & Ordnance Accessories Co., Ltd., and J. D. Morrison. The heating elements, which consist of a series of separate resistance units, are arranged on the opposite sides of the oven, and held in place by detachable clips fitted to bars arranged at the top and bottom. They are protected by hinged shields, which fold flat and cover them up. These are, however, perforated to allow the heat to radiate into the oven, and their outside surfaces are provided with ledges to take the shelves, which, in turn, keep the shields in position over the resistances. The latter are connected up in parallel with the supply, and independently controlled by four tumbler switches, or a single three-heat switch can be used, with which various combinations of resistances can be obtained. Ten figures.

21,574/10. **Light Reflectors.** R. G. Tyler and E. H. Freeman. A continuous trough-shaped reflector is made in two parts, one constituting one side and the bottom of the trough, and the other forming the remaining side. Each part is provided with a flange, adapted so that one flange can lie on and be secured with the other to the moulding or other fixture by screws, the flanges extending to one side of the trough. Lamps of a tubular shape are connected at intervals along the troughing between insulating bridge pieces, which are supplied with terminal screws and washers for securing the leading-in wires. Heat insulating material may be placed between the reflector and lamps, and the latter may be covered with glass secured by flanges at the edges of the reflector. The reflector is intended for use with low-voltage low-candle-power lamps, mounted in series to form groups connected in parallel. Six figures.

23,675/10. **Insulating Coils with Oxides.** E. W. Küttner. This is effected by exposing the coils throughout their entire mass to the action of oxygen, producing the oxidation in the presence of warm or hot steam. This is done in conjunction with an artificially produced fall of temperature.

25,516/10. **Storage Batteries.** B. M. Drake, J. Waddell, and The D.P. Battery Co., Ltd. In order that newly-charged battery plates shall retain their charge during transport or storage, they are put straight from the charging bath into cases, which are exhausted of air and hermetically sealed. Instead of exhausting the cases, they may be filled with an inert gas, such as carbonic acid.

25,897/10. **Lamp Holder.** C. D. Copland. A locking lamp-holder in which the barrel part of the holder is slit, and provided with a recess or hole to receive one of the pins of the lamp. The entrance of the hole is closed after the lamp has been inserted by screwing the shade ring on to the barrel. This causes the slit parts to come together, securing the lamp. Six figures.

1,210/11. **Incandescent Lamps.** C. H. Weber. A process for connecting filaments to the leading-in wires consists in soldering or welding with the aid of sulphide metal compounds such as sulphide of tungsten or molybdenum. These can be decomposed at a very low temperature, and the fusing operation can take place in the open air instead of in hydrogen.

3,022/11. **Conduit Tramway Construction.** G. S. Albanese. The conduit is formed of a continuous length of reinforced concrete or cement, to which is attached one or more continuous girders of the same material. The girders which take the track rails are secured at intervals by concrete brackets, so that the conduit, girders, and brackets are all integral. Seven figures.

17,480/11. **Incandescent Lamps.** W. G. Houskeeper. In preparing filaments for incandescent lamps, the continual heating and cooling that takes place when single-phase currents are used causes the material to break. In this invention a two-phase current is used, in which one phase current traverses one-half of the filament, while the current from the second phase simultaneously passes through the second half. Since the currents differ 90° in phase, one portion of the filament is hottest when the other is coolest, so that expansion and contraction of the parts take place together, and the length of the filament remains constant. An autotransformer and lamps are provided in each phase to regulate the current. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad. Summaries of some of the more important of these patents will appear in our next issue.

Dynamos, Motors, and Transformers: Auvert and Ferrand [Rotary transformers] 20,948/10; Gray (*Latour*) [Commutator motors] 26,119/10.

Heating and Cooking: Macdonogh [Detachable heater for cookers] 21,557/10.

Incandescent Lamps: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Supports for filaments] 30,323/10; Moller [Manufacture of] 1,162/11; Majert and Gladitz [Device for welding metal filaments] 12,104/11.

Meters: Strelow [Meters of Ferraris type] 21,240/10.

Storage Batteries: Taylor [Secondary battery discharge] 20,906/10; Inrig and Gavan Inrig, Ltd. [Secondary batteries] 28,755/10.

Switchgear, &c.: Venner and Griesbach [Automatic switch] 14,471/10; British Thomson-Houston Co. and Wedmore [Switch control devices] 20,882/10; Railing and Garrard [Switches] 26,009/10; Woodford [Safety device for motor controllers] 15,469/11.

Telephony, Telegraphy, and Signalling: Knudsen [Impulse transmission apparatus] 13,917/10; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Signalling systems] 18,868/10; Sácek [Wireless telegraphy apparatus] 21,311/10; Aktieselskabet Hovlands Radiotelegraf [Condensers] 12,976/11.

Traction: Mawson [Mounting conductors on railways] 20,917/10.

Miscellaneous: Helbronner and Von Recklinghausen [Sterilising apparatus] 23,078/10; Sabotka [Air condensers] 24,916/10; Arnold [Illuminating signs] 29,452/10; Lake (*United States Light and Heating Co.*) [Electric regulating arrangements] 9,363/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Motors and Dynamos: Lamme [Windings for] 18,132/11; Baum [Method for cooling] 19,760/11.

Telephony: Betulander [Speaking switches for automatic systems] 19,661/11.

Traction: Siemens Schuckertwerke Ges. [Mounting overhead wires for railways] 20,031/11.

Miscellaneous: Stuart [Underground electric despatch system] 18,998/11; Betulander [Connecting apparatus actuated from a distance] 19,553/11; Appoullot [Contact devices for clocks] 20,149/11.

The following amended Specification can now be obtained.

Sir Oliver Lodge [Wireless Telegraphy] 11,575/97.

Opposition to Grant of Patents

20,900/10. **Switches.** J. H. Tucker. Opposition has been entered to the grant of this patent. It relates to switches of the tumbler kind, in which means are provided for earthing the metal parts not intended to carry current, so that shocks are avoided. One of the fixing screws is replaced by a hollow terminal, which is in electrical connection with the handle, and carries an earthed wire.

Expiring and Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: British Thomson-Houston Co. (*C. E. Harthan, U.S.A.*) 13,012/98.

Dynamos and Motors: C. Ilgner [Motor-generator] 13,556/02; Electric Construction Co., W. Buchanan, and J. McMillan [Means for varying dynamo field current] 13,761/07.

Instruments: H. G. C. Fairweather (*H. M. Friendly, U.S.A.*) [Fault testing set] 13,563/07.

Switchgear and Fuses: E. Schattner [Cut-outs] 13,432/07; J. S. Highfield [Switches, cut-outs] 13,543/07.

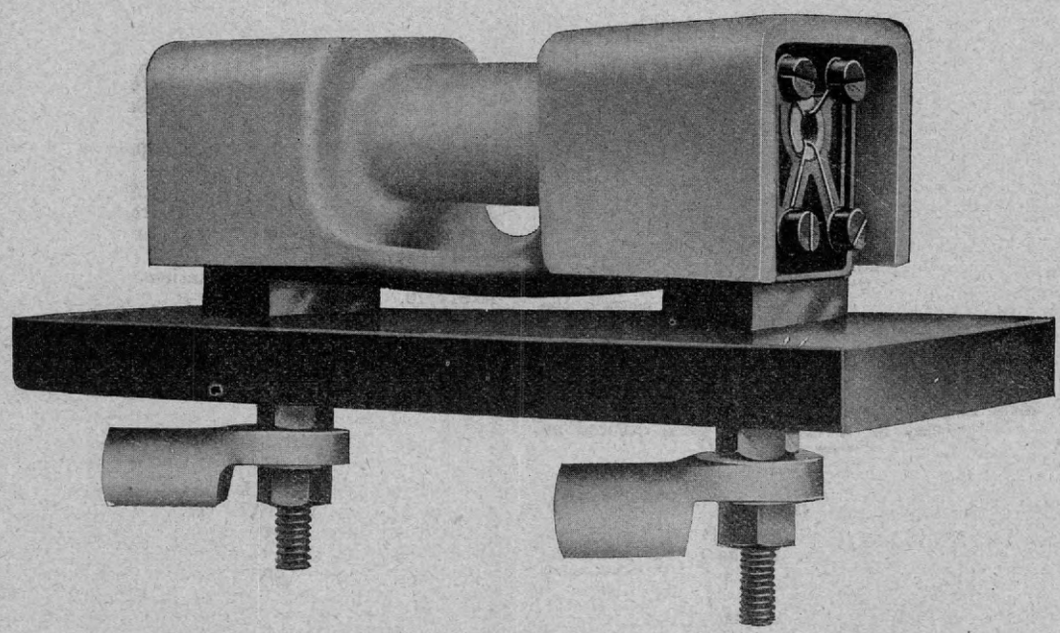
Telephony, Telegraphy, and Signalling: Evershed & Vignoles and S. Evershed [Order telegraphs] 12,279/99; J. Kitsee [Signalling] 12,424/05; R. B. North [Signalling] 13,594/06; G. Jahr [Electrostatic detector] 13,596/07; R. B. Jentzsch [Coin-freed telephones] 13,821/07.

Traction: H. H. Lake (*T. E. Murray and J. Van Vleck* [Automatic operation of mail trains] 13,438/02; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Rail bonds] 13,275/04; Allgemeine Elektricitäts-Ges. [Overhead system] 13,697/06.

Miscellaneous: C. E. Dolbear [Electrostatic separators] 12,210/01; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Vapour electric apparatus] 13,413/06; J. H. Schoneberger and G. W. Fraser [Electrolytic apparatus for protecting ships' bottoms] 13,674/07; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Variable reactance resistance] 13,739/07; A. O. Tate [Purifying water by electrolysis] 13,891/07.

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LOCAL NOTES

Barrow-in-Furness: *Street Lighting.*—The Corporation have to replace the existing gas lighting in Abbey Road and Roose Road by electric lighting, and metallic filament lamps suspended from span-wires fixed between the tram poles on either side of the road will be adopted. The total length of the road over which gas lighting is to be displaced is over two miles, and the number of electric lamps to be erected 162. This decision has been arrived at as a result of a prolonged test between the two illuminants, in which the superiority of electric lighting along roads planted on both sides with trees has been very marked.

Canada: *New Power Plant.*—The first two units of 7,600 h.p. each in the new power station of the Canadian Light & Power Co. at St. Timothy were put into operation last week. It is expected that a third unit will be in operation within three weeks.

Chester: *The Water Power Scheme.*—We are able to give a few further particulars of the scheme referred to in our last issue, for making use of the waters of the River Dee for generating electricity. The proposal is due to Mr. S. E. Britton, the Corporation's Electrical Engineer, and it is estimated that the flow of water at the old Dee Mills is about 25,000 cubic feet per minute. The cost of the scheme is put at £12,500. The Electric Light Committee have not considered Mr. Britton's report in detail, as they do not propose to proceed with the scheme until next spring.

Edinburgh: *Electric Light.*—The Electric Light Committee propose to apply to the Board of Trade for sanction to supply electricity to Craigcrook Castle, which is outside the present supply area.

Egham: *Electricity Works.*—The foundation stone of the new electric power station of the Egham and Staines Electricity Co., Ltd., was laid by the Lord Mayor of London on September 30th.

Johnstone (N.B.): *Electric Supply.*—The Council are considering the advisability of erecting electricity works.

London: *Bermondsey: Electricity Accounts.*—The accounts of the Council's electricity department for the year to March 31st. show a net profit of £3,118. The Chairman of the Finance Committee stated that as the electric light undertaking still owed the ratepayers £38,885, this would not be dealt with as a profit.

Hammersmith: Tramway Track.—The Works Committee's recommendation that the Board of Trade should be asked to appoint a referee to determine the difference between them and the London United Tramways Co., as to the necessity for reconstructing the tramway track in the borough, has been adopted by the Council. The Tramway Co. have refused to incur any large expenditure upon reconstruction, in view of the fact that the London County Council will shortly take over the lines.

Stoke Newington: Electricity Undertaking.—The Council have decided to give notice to the North Metropolitan Electric Power Supply Co. to terminate the agreement under which the Company now manages the Council's electricity undertaking. The Company at present bears all losses and takes all profits. Under the existing agreement there is a Schedule II. which the Council propose to take advantage of, by which the Company will supply the current in bulk and leave the Council to carry out the distribution themselves as a business venture.

New Zealand: *Auckland Power Scheme.*—Good progress is being made with the erection of the City Council's new electric power station, and it is expected that the first portion of the machinery will arrive at the end of the year.

Nuremburg (Germany): *Electricity Supply.*—According to the *Frankfürter Zeitung*, a company is to be formed to construct a large power station for the supply of Nuremburg and the neighbouring districts. The city of Nuremburg will hold 51 per cent. of the share capital, and the town of Fürth and the Elektrizitäts Akt.-Ges. (vorm. Schuckert & Co.) the remaining 49 per cent.

Oldham: *Electricity Accounts.*—The revenue of the electricity department for the year to March 25th, 1911, was £42,445, and the net profit, after meeting capital charges, £1,300. The number of consumers has increased during the year by 116. The Committee have made an arrangement with Sir Alexander Kennedy, the Consulting Electrical Engineer, that he shall in future only receive commission upon extensions designed and carried out under his supervision.

Retford: *Electricity Supply.*—A Special Committee has been formed to consider the advisability of applying for an electric light provisional order.

Scotland: *Fife Electric Power.*—A duplicate 2,000-h.p. Curtis turbine has been put into operation at the Townhill works of the Fife Electric Power Co.

Worthing: *Smoke Nuisance.*—Serious complaints have been made as to the emission of black smoke from the shaft of the Corporation Electricity Works. The Electrical Engineer, reporting upon the matter, states that six of the furnaces are fitted with smoke-consuming apparatus, and that under normal circumstances these work well. During the past summer, however, the seamen's strike so seriously affected the coal contractors, that coal had to be obtained from such sources as they could command. Further, in view of the general state of unrest in the coalfields, they had laid in a much larger stock of coal than they would otherwise have purchased, and this was not so suitable from the point of view of smoke as the coal usually supplied under the contract. The Engineer is now using another class of fuel, and does not anticipate any further trouble.

TENDERS INVITED AND PROSPECTIVE BUSINESS

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bampton.—Messrs. J. & W. Purvis, of Exeter and London, have placed an electric lighting scheme before the Council. There is no gas supply in the district, and it is suggested that a local electric light company should be formed.

Barrow-in-Furness.—Extensions of mains at an estimated cost of about £900 are being carried out in connection with the supply of power to Messrs. Burt, Boulton & Haywood's sawmills at Devonshire Dock, where motors aggregating about 165 h.p. are being installed.

Belfast.—A Local Government Board inquiry concerning a loan of £40,000 for the electricity department was held on Tuesday.

Bulgaria.—The Municipal Authorities of Plevna invite tenders for an electric lighting installation. Tenders will be received between the 4th and 17th of November.

Carlisle.—A Local Government Board inquiry was held last week concerning an application for sanction to borrow £9,755 in connection with the electricity works. This sum includes £1,755 for a new storage battery, and £5,000 for mains extensions. There was no opposition.

The Electricity Committee invite tenders for water-softening and purifying plant of 4,000 gallons per hour capacity, and low-tension main feeder switchboard.

Erith.—The tramway manager has been instructed to make inquiries as to speed indicators for the tramcars.

Honiton.—An agreement has been signed with Messrs. J. & W. Purvis, of Exeter and London, for the installation of an electric lighting plant in the borough.

Merthyr Tydfil.—The Merthyr Electric Traction & Lighting Co. propose to lay new main feeders to Treharris.

Russia.—The specification may be seen at the Board of Trade Intelligence Department, 73 Basinghall Street, London, of the proposed scheme of tramways and lighting for the town of Ssysran. Tenders may be sent until October 14th to Gorodskaya Uprava, Ssysran, Russia.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Exeter.—An expenditure of £15,500 is contemplated upon extensions to the sanatorium.

Leigh-on-Sea.—School for Essex Education Committee. P. Brockbank, 14 & 15 County Chambers, Southend.

Manchester.—Baths and washhouses. City Architect, Town Hall.

OSRAM·LAMPS

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Rathmines.—Library. Messrs. Batchelor & Hicks.
Torquay.—New school. Town Clerk.
West Ham.—Additions to nurses' home at Infirmary, Whipps Cross Road, Leytonstone. Architect, Mr. R. F. Sturdy, 45 Finsbury Pavement, London, E.C.
Wood Green.—New Council school. W. P. Harding, Town Hall.

MISCELLANEOUS

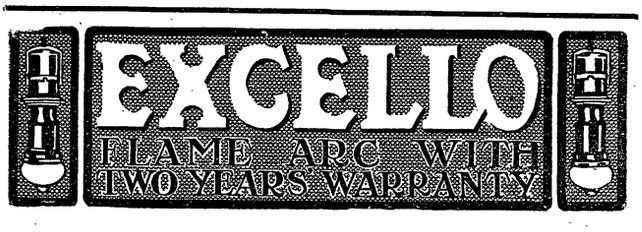
Bulgaria.—The Bulgarian Posts, Telegraphs and Telephones Department, Sofia, invite tenders for the supply of telephone and telegraph material. Copy of specification may be seen at 73, Basinghall Street, London, E.C.
Chelmsford.—The Council require a 3-h.p. electric motor and 3-h.p. gas engine for the cattle market. Particulars from Borough Surveyor, 16 London Road.
Dundee.—The Electricity Department invite tenders by Monday, October 9th, for overhead tramway construction in Clepington Road. Particulars from H. Richardson, Tramways Engineer. The Council also require 400 3-in. diameter circular two-way earthenware conduits, 3 ft. long. Particulars from Tramways Engineer.

TENDERS RECEIVED AND ACCEPTED

Brighton.—Messrs. Richardsons, Westgarth & Co., quoted £5,000, and the British Westinghouse Co. £4,980 for the reconstruction of No. 5 turbine. The offer of the latter has been accepted. The necessary motor-driven air-pump is to be supplied by Messrs. Richardsons, Westgarth & Co., at £635, and the electrically driven circulating pump by Messrs. Greenwood & Batley at £229. When this reconstruction is complete, it is anticipated that £1,000 a year will be saved in coal consumption.
Haslingden.—The tenders of Messrs. Ferranti, Ltd., for switchboard and accessories, and the British Westinghouse Co. for static tranformers, have been accepted.
New Zealand.—The tender of Messrs. G. Chambers & Son for Babcock & Wilcox boilers at the Auckland Power Station has been accepted at £21,844. The tender of Messrs. A. & T. Burt on behalf of Messrs. Siemens Bros. & Co. for generating plant (Bellis engines) at £34,484 has also been accepted.
Stoke-on-Trent.—All the contracts in connection with the new power scheme have now been accepted. Whereas the original estimates put the total cost at £60,000, the actual figure does not exceed £55,000. We give the list of accepted tenders below:—Turbo generators, Jas. Howden & Co., Ltd., £8,905; rotary converters, British Westinghouse Co., Ltd., £3,800; motor converters, Bruce Peebles & Co., Ltd., £2,250; motor generators, Siemens Brothers, Ltd., £2,385; mains and cables, Callenders Cable and Construction Co., Ltd., £13,093 10s. 10d.; switchgear, British Westinghouse Co., Ltd., £6,651; boilers, Stirling Boiler Co., Ltd., £5,040; cooling towers, Davenport Engine Co., Ltd., £1,053; steam pipes, &c., Aiton & Co., £1,128 12s.; coal bunkers, &c., New Conveyor Co., Ltd., £1,426; steam feed pump, G. & J. Weir, Ltd., £113; secondary battery, D.P. Battery Co., Ltd., £91; transformers, British Westinghouse Co., Ltd., £364; motor generator (D.C.), Bruce Peebles & Co., Ltd., £225; 15-ton crane, Herbert Morris & Bastert, Ltd., £229; electric feed pump, British Westinghouse Co., Ltd., £180.
Yarmouth.—The tender of Messrs. Bowers & Barr has been accepted by the Yarmouth Port and Haven Commission for an electric lighting installation on the South Pier.

APPOINTMENTS AND PERSONAL NOTES

The recommendation of the Brighton Electricity Committee that the salary of Mr. C. C. Fowler, Assistant Manager of the Department, should be increased from £350 to £400 per annum, has been rejected by the Council. It would appear that the majority of the Brighton Council have determined to set their face against any increase in the salaries of officials, at any rate for the present, and Mr. Fowler is not the only official who has suffered from this frame of mind of the Council.



MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £56 15s. to £57 5s. (last week the same).
Hope's "Bi-Metal" Fuse Wire.—To prevent misunderstanding, we are asked to point out that this new fuse wire is Mr. Vernon Hope's invention, and the patent is owned by Messrs. Parmiter, Hope & Sugden, of Hulme Electrical Works, Manchester. The fuse wire is manufactured by Simplex Conduits, Ltd., and sold by them, under license, at the same price as the patentees.
Western Electric Telephone Number.—The North Woolwich Works telephone number of the Western Electric Co., Ltd., is now 3840 East (10 lines) in place of 1400 East.
Lacquers for Steel.—The Frederick Crane Chemical Co. (22 & 23 Newhall Hill, Birmingham) are making a speciality of lacquers for preventing rusting of carpenters' and other tools without the necessity for greasing. These lacquers may be applied by dipping, brushing, or spraying, and for the last process the company make a special machine.
The G.E.C. Athletic Club.—The G.E.C. Athletic Club opened their football season on Saturday last on their new ground at Willesden with a stirring game between Head Office (Osram F.C.) and Queenhithe Branch (Magnet F.C.). Mr. H. Hirst, the Chairman of the Company, kicked off, and a hard-fought game resulted in a win for the "Osram" team by 3 goals to 2. The Secretary will be pleased to hear from any club connected with the industry with a view to fixing up matches for the coming season.
The Lazilite Co.—One of the late-comers to the Electrical Exhibition who are unfortunately not mentioned in the catalogue is the Lazilite Co., Southampton House, High Holborn, who have a stand (No. 316) in the gallery, where a new extensible fitting is being shown.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Dick, Kerr & Co.—At the annual meeting on Thursday, the report and accounts, given in our issue of September 21st, were adopted. Mr. John Kerr, who presided, said that the development of electrical power in iron works and the textile trades had shown some progress during the year, and the greatest interest had now been awakened in these outlets for the use of electricity. After commenting upon the keen competition between home manufacturers, which he said was increased by our Free Trade system, he referred to the company's efforts in the manufacture of steam turbines. Their efforts in this direction were made with satisfactory results. In view of the enormous demand for metal filament lamps, the directors had decided to add a lamp factory, and, in order to avoid the danger of experimental work, had availed themselves of the experience of a Continental company. The factory was now approaching completion, and it was the intention of the Board to push this branch with vigour. The prospects in the future were encouraging, and as soon as the Continental international difficulties were settled, a large amount of foreign work which was held in suspense could be proceeded with. In conclusion, he mentioned that in consequence of the lamented death of Mr. G. Flett, the Board had appointed Mr. Schultz assistant managing director. As the result of subscriptions by the staff and directors, a bed had been endowed in the London Hospital to commemorate the late Mr. Flett's memory.
Drake & Gorham.—The report for the year to June 30th shows a net profit of £7,184, to which is to be added £1,242 brought forward. A dividend at the rate of 4½ per cent. per annum is recommended, and after transferring £1,500 towards writing off part of the underwriting commission, the sum of £1,301 12s. is carried forward.
Cleveland & Durham Electric Power Co.—The report and accounts, given in our last issue, were adopted at the meeting of the company last week after some strong criticisms on the part of a shareholder. This gentleman stated that he failed to see any satisfactory feature in the company's business at all. The bulk supply of electricity to the Northern Counties Co., which had been a prominent feature in the last prospectus, had failed to produce any dividend, and, whilst the gross profits were most unsatisfactory, £5,000 more would be required next year for interest. He advocated a thorough investigation of the company's business by an independent expert. The report was carried with only this shareholder as a dissentient.
County of Durham Electrical Power Distribution Co.—A circular has been sent to the shareholders, pointing out that whilst the profits of the first six months of the current year are slightly better than those of the same period of last year, the directors, in view of the disturbed condition of the labour world and the possible dislocation of local trades which may follow therefrom, do not think it advisable to declare an interim dividend on the preference shares.

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"Electrical Engineering" Oct. 12. 1911.

THE ELECTRICAL EXHIBITION OF 1911

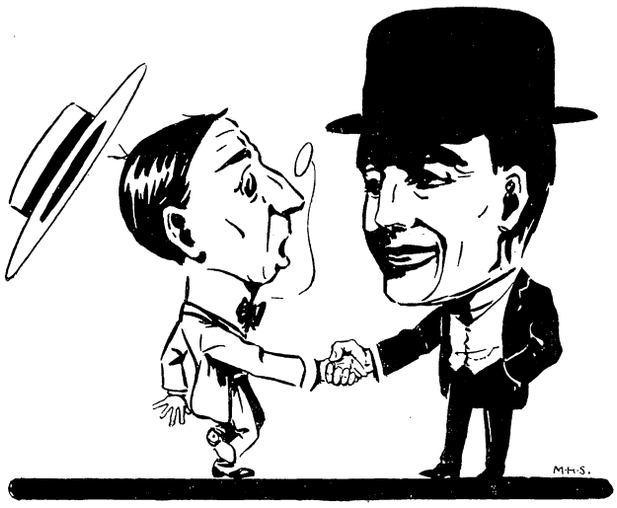
PART IV.

Published by

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203-206 TEMPLE CHAMBERS, LONDON, E.C.
AND ALSO ON SALE AT STAND NO. 152, ELECTRICAL EXHIBITION, OLYMPIA.

PRICE ONE PENNY.

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A GOOD GRIP

between the tube and the fitting is the one essential on all conduit systems which require to be erected electrically continuous. The solving of the problem of rendering a socket-joint conduit system electrically continuous depends on the efficiency of the grip. There have been dozens of different devices introduced at one time and another with a view to obtaining this grip and efficient electrical continuity, but, with the exception of the Simplex "Grip" Continuity System, they all fail (if it is possible to judge from the relative popularity enjoyed by them as compared with the Simplex "Grip" System), either owing to their being impractical or on the score of cost. The latter point, it must be remembered, is of the first importance. Any system of rendering the ordinary unscrewed conduit electrically continuous when erected, must not increase the cost of the system erected to any considerable extent when compared with an ordinary socket job. Further, all the fittings used must be standard type.

Prior to 1904, the date on which the Simplex "Grip" System was introduced, there was no satisfactory method on the market of rendering the unscrewed system electrically continuous; other devices have since been introduced, but in a large measure they have failed, and the Simplex "Grip" System is now looked upon as the best under all headings.

The Pin Contact System has been introduced to still further cheapen wiring costs, but at the same time providing an electrically continuous system. The method approximates still more closely to the simple "Socket" junction with a small addition, negligible in cost, in the form of a hardened steel pin or wedge. This is inserted in a slot in the fitting as shown in the accompanying diagram between the external surface of the conduit and the inside of the fitting, the small slot being provided in the latter to give the pin a larger contact surface. This junction forms an equally neat and efficient junction as the ordinary "socket," at practically the same cost for material and labour. The following advantages may be enumerated:—

1. Lowest costs *erected* of any system providing for electrical continuity.
2. No screwing tools required.
3. No twisting of the cables.
4. Standard conduits and fittings used throughout.
5. Permanent electrical continuity.

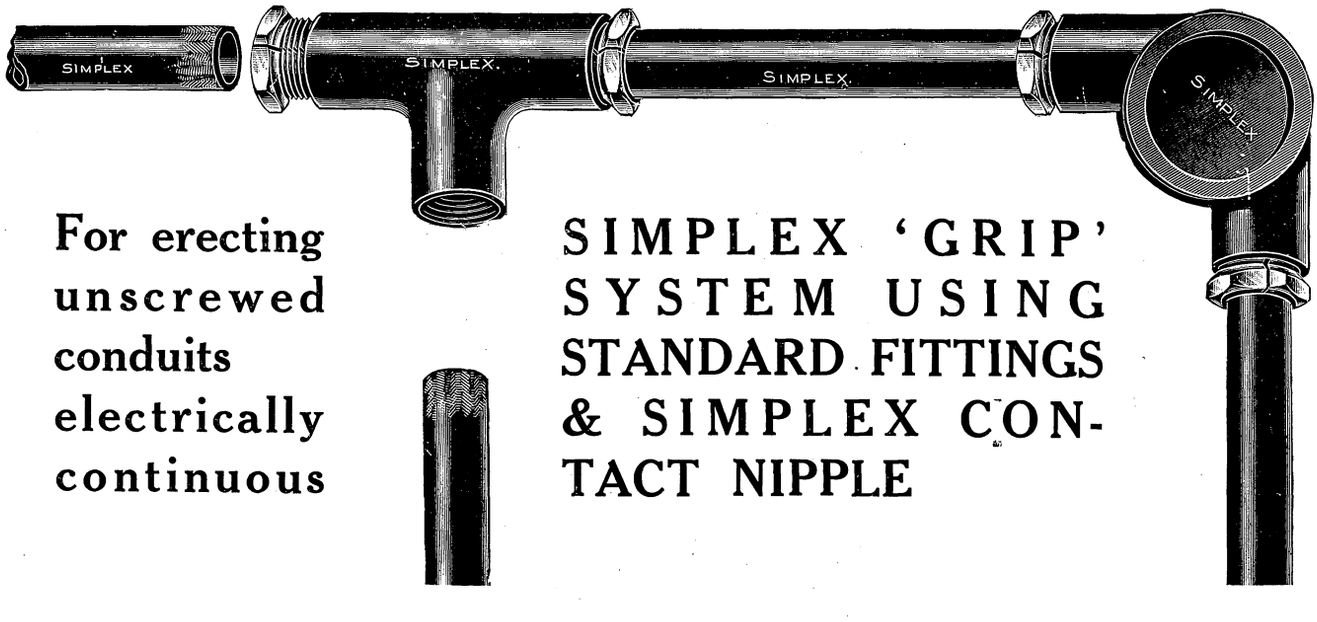
Designed for use with Light Gauge conduit and screwed fittings of standard pattern, it meets the object for which it was primarily designed, viz., for providing a cheap and effective method of allowing a low cost light-gauge conduit installation to be erected electrically continuous throughout. It retains the advantages of the Plain Socket System as mentioned previously. The additional accessory known as the "Simplex Contact Nipple" is manufactured from hexagon steel rod, and has a plain internal surface (similar to the interior of a nipple on a fitting when used with the socket junction) with a slightly coned thread outside. A longitudinal saw cut runs throughout the length.

The illustration shows the general application of the Simplex "Grip" System.

When erecting on this system it should be noted that the Simplex Company have made a very close study of the question of electrical continuity and conduit-wiring matters generally. Many of the developments which have taken place in the Simplex Steel Conduit System and its application to practical requirements have undoubtedly been the outcome of numerous helpful suggestions received by the Simplex Company from their clients. These suggestions have always been welcome and appreciated.

Electrical Engineers visiting the Exhibition at Olympia who have practical suggestions to make on the design or application of the Simplex Steel Conduit System should, if possible, make a point of visiting

STAND Nos. 148 AND 163.



For erecting unscrewed conduits electrically continuous

SIMPLEX 'GRIP' SYSTEM USING STANDARD FITTINGS & SIMPLEX CONTACT NIPPLE

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THE ELECTRICAL EXHIBITION OF 1911

(FOURTH NOTICE.)

TOWARDS the end of last week the numbers visiting the exhibition somewhat increased, and on Saturday evening Olympia was quite crowded. On Monday and Tuesday, however, the exhibition was very thinly attended except by the exhibitors and their staffs, who are certainly indefatigable. Those exhibitors whose products appeal to the select few, or to the electrical engineering rather than to the general public, are expressing themselves well satisfied with the visits to their stands and the inquiries left there, but manufacturers whose goods are exhibited largely for the benefit of the general public, are still complaining that the number of visitors remains so few.

Among those who visited the exhibition on Tuesday and yesterday were central station engineers and members of electricity committees from Hackney, Kettering, Stafford, Salisbury Electric Lighting Co., Southend, Woking Electric Supply Co., Lowestoft Corporation, Newport (Mon.), and Gillingham.

To-day visits from Lowestoft, Newport (Mon.), Stratford-on-Avon, Darlington, Colne, West Ham, Ipswich, Sheffield, Hampstead, Hereford, Newcastle-under-Lyne, and Dover are expected, and Mr. Bury, of the East India Railway of Calcutta, proposes to visit the exhibition.

On Friday there will be deputations from Hammersmith (accompanied by the Mayor), Birmingham, Manchester, Perth (accompanied by the Lord Provost), Gravesend, Chester, and Merthyr-Tydvil.

On Saturday the visitors from Manchester, Merthyr-Tydvil, and Chester will pay a second visit, and there will be representatives from Govan, Shipley, Gloucester, and Colchester.

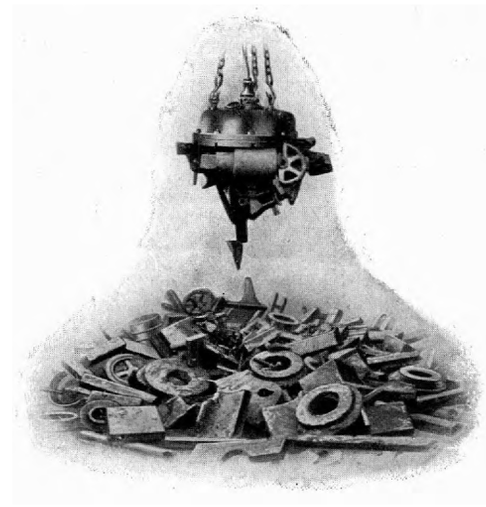
Several other supply-station engineers from the provinces have also notified their intention of coming up, in some cases alone, and in others with members of their committees. Exhibitors are reminded that the dinner of the British Electrical Manufacturers' and Allied Trades Association will be held this evening (Thursday), and we may add that Thursday and Friday are likely to be busy days at the exhibition, as several gentlemen coming up to the dinner from the provinces will be paying visits to the exhibition.

The electricity supply companies are now giving popular lectures at their stand (having engaged Mr. Borlase Matthews for this purpose), and are also holding competitions designed to appeal to the consumer.

A rumour was in circulation on Tuesday that the King intended to visit Olympia in the afternoon, but this report was without foundation.

The Witton-Kramer Lifting Magnet

SINCE the latter part of last week, demonstrations of the Witton-Kramer lifting magnet have been carried out at frequent intervals every day on one of the General Electric Company's stands. The magnet used is capable of lifting seven tons, and is 36 inches in diameter. It is supplied with 17 amperes D.-C. at 220 volts. The demonstration, which



is in the charge of Mr. H. Thomas, has attracted crowds of visitors round it, especially on Saturday.

Piles of scrap-iron, several heavy pigs of cast-iron, and bags of steel turnings are lifted by the magnet, and the current is then turned off to allow them to drop with a crash. Magnets of this class are being widely used in large engineering shops, shipyards, etc., and are found of considerable service for moving about heavy iron and steel parts of miscellaneous shapes. We understand that an order for fifteen of these lifting magnets has been placed by the Japanese Navy through Sir William Arrol.

TECHNICAL BOOKS

There are few booksellers who are in a position to keep in stock a complete library of the latest and best technical books. It is an enormous convenience to engineers and students who wish to obtain a book on any particular subject if they can go to a bookshop with the confidence that they can immediately be shown there the latest, best, and most up-to-date books which treat of it.

Arrangements have been made by the Kilowatt Publishing Co., Ltd., to afford this facility to electrical engineers who are visiting the Electrical Exhibition at Olympia.

At Stand No. 152, which bears in bold letters the legend "Electrical Engineering," there is, open to inspection and purchase, almost every good book on electrical and allied subjects. These have been selected under the guidance of the editorial and reviewing staff of ELECTRICAL ENGINEERING, which includes eminent specialists in all branches. The stand is situated near the centre of the hall, slightly to the right of the main avenue.

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SOME OF THE EXHIBITS

Marconi's Wireless Telegraph Co., Ltd.,

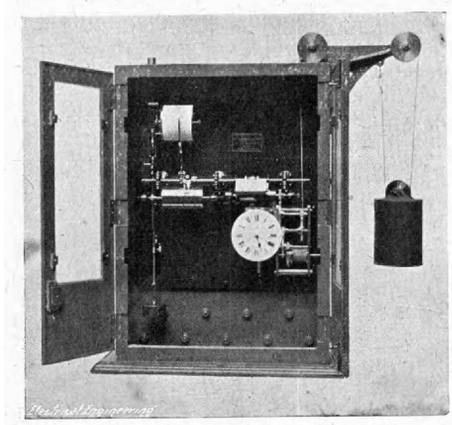
WATERGATE HOUSE, ADELPHI, W.C. (STAND NOS. 154 & 246.)

Wireless Telegraph Equipment.—On their stand in the main hall the company have erected one of their standard ship pattern 1½-k.w. wireless telegraph sets, as used upon large numbers of liners. This equipment has a working range up to about 2,000 miles, and is of the size most usual on passenger ships. In some special cases, such as the *Olympic*, larger sets up to 5 k.w. are employed, and for cargo boats, &c., a ½-kw. set has been recently developed. One of these is shown in action on the company's stand in the gallery. Both sets shown are provided with short aerials, mounted on the standard Bradfield ship insulator, so that they can intercommunicate, but distant messages are not being taken at the exhibition. In the standard ship sets as here exemplified, current is taken usually from the ship's lighting circuit, but a battery of accumulators and a coil are provided for emergency work. The D.-C. supply is first converted to A.-C. at 100 volts by a small converter set, and is then stepped up to 40,000 volts by a special oil transformer. At this pressure it is supplied to the rotary disc-type discharger, mounted for convenience on the shaft of the converter. This is constructed to give four sparks per revolution, the regular sequence of which produces a clear musical note in the receiving telephone, easily distinguishable from the effect of atmospheric disturbances. The whole of the transmitting apparatus, except the sending key, control switches, &c., is placed inside a sound-proof cabinet. The principal item of the receiving equipment is the Marconi travelling band magnetic detector used in conjunction with the Marconi multiple tuner with variable condensers, by which adjustment can be made over a great range of wave lengths. The ½-kw. set in the gallery is generally similar. The converter, however, has a vertical instead of a horizontal shaft, and the discharger is enclosed in a silencing casing ventilated by a small fan. An air-cooled transformer is used, and the condenser consists of a battery of glass tubes which are copper-plated inside and outside, carried on a metal stand and fitted with a protecting spark gap. There is thus entire absence of oil tanks for either the transformers or condensers. In addition to these two complete sets, the company show a few other examples of wireless telegraph apparatus, including their wave meter and an example of their latest receiver of the oscillation valve type mounted complete as one piece of apparatus with the multiple tuner.

The Lea Recorder Co.,

28 DEANSGATE, MANCHESTER. (STAND NO. 28.)

Water Recorders.—In addition to the standard pattern of their well-known recorders of the flow of water through a V notch, the company are showing a new pattern of instrument in which, as well as a record being obtained on a paper drum, there is also an integrating mechanism reading on



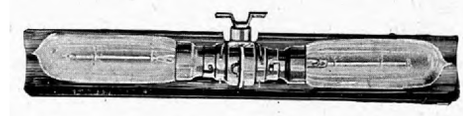
New Integrating Form of Lea Water Recorder.

meter dials. In this mechanism the counting train is put in gear with a drum, continuously driven by a clock movement, for a greater or less part of each revolution according to the rate of flow of the water at the time. This drum has teeth extending over a varying portion of its actual length, which gear into the counting train pinions as they come round. An illustration of the complete instrument is given here, from which it will be seen that the left-hand part is the standard Lea recorder, and that the integrating mechanism is worked by an extension of the same travelling spindle which carries the recording pen. The position of this is determined by the thread on the surface of the main drum driven by the float, cut in a curve corresponding to the law connecting head and flow in a V notch.

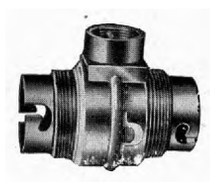
Benjamin Electric Co., Ltd.,

117 VICTORIA STREET, S.W. (STAND NO. 151.)

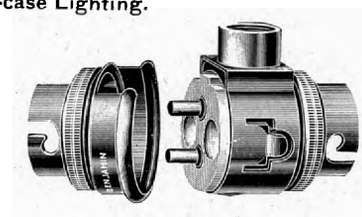
The large number of ingenious devices at the small stand of the Benjamin Electric Co. are attracting much attention. The "wireless cluster" fitting is well known, which takes the place of the ordinary ball fitting so troublesome to wire. Clusters of lamp-holders from two to ten in number are mounted on the fitting, which is internally connected, so that it is only necessary to bring the wires to a pair of conveniently accessible terminals. A collection of reflectors for shop-window lighting, in which this firm specialises, are exhibited: we illustrate one of these—an adjustable reflector in which the reflector itself can be rotated round the lamps so as to throw the light in any desired direction. The reflector can also be pulled off for cleaning without loosening any screws. In these double reflectors a special twin lamp-holder is now employed, shown in our next two illustrations. This, it is seen, is considerably shorter and more compact than two ordinary holders placed end on, and, in saving length, increases the available useful length of the reflector. Wiring contractors who have much shop-window lighting to do will be well advised to obtain particulars of such accessories from the Benjamin Co. Another speciality of the firm is the "Benco" weatherproof lamp-holder; the illustrations above show the construction. Another weatherproof holder made of china throughout instead of metal is shown at this stand. Besides being weatherproof it is of neat appearance and is particularly to be recommended for outside signs. Some thousands are in use at the exhibition, and it is employed on the effective sign on the Pope Electric Lamp Co.'s stand. Our last illustration is a "friction drive" screw-driver with a loose head and free swivel connection. This tool can be easily worked with one hand. During the forward rotation



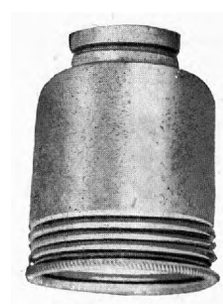
Adjustable Reflector for Shop Window and Show-case Lighting.



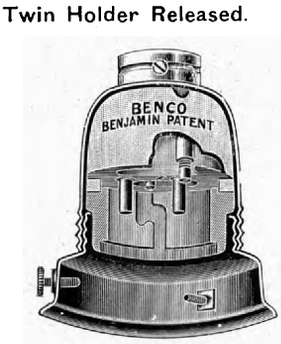
Twin Holder.



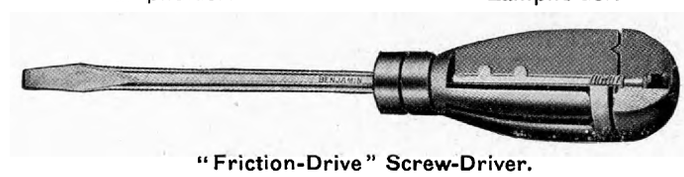
Twin Holder Released.



"Benco" Weatherproof Lampholder.



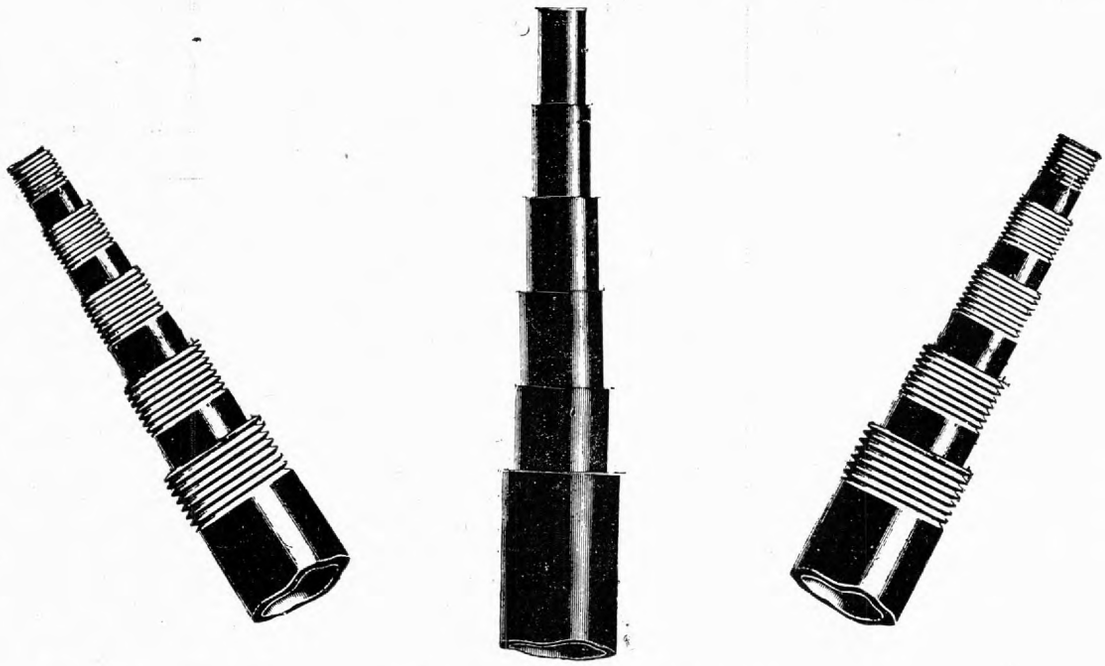
Section of Weatherproof Lamphulder.



"Friction-Drive" Screw-Driver.

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"GEEKODUCT"

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BRANCHES: Manchester: Victoria Bridge. Glasgow: 71, Waterloo Street. Birmingham: 42, High Street. Newcastle-on-Tyne: 30, Gallowgate. Dublin: 13, Trinity Street.

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REGD TRADE MARK

TRADE MARK

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The ELECTRICAL COMPANY'S SINGLE-PHASE METER has many unique features :—

It is thoroughly reliable ;

It is easy to adjust, both for low loads, heavy loads, and alterations in the power factor of the circuit ;

It runs on a ball footstep bearing ;

It has a self-oiling top bearing ;

The cyclometer dial is of our own special pattern, which experience has shown to be THE BEST ;

The coils are wound on our special machines of our own design, and the possibility of breakage of the wire, or failure of the insulation, is effectually precluded ;

Variations in pressure and frequency over exceedingly wide limits do not affect its accuracy ;

It has large overload capacity ;

It has low losses ;

The terminals are substantial and convenient for use ;

It is PERMANENTLY SATISFACTORY in every respect.

When you are tired of cut prices and cut quality, try our meter for a change. It will please you.

THE ELECTRICAL CO L^TD

METER DEPT.,

122-124 CHARING CROSS ROAD, LONDON, W.C.

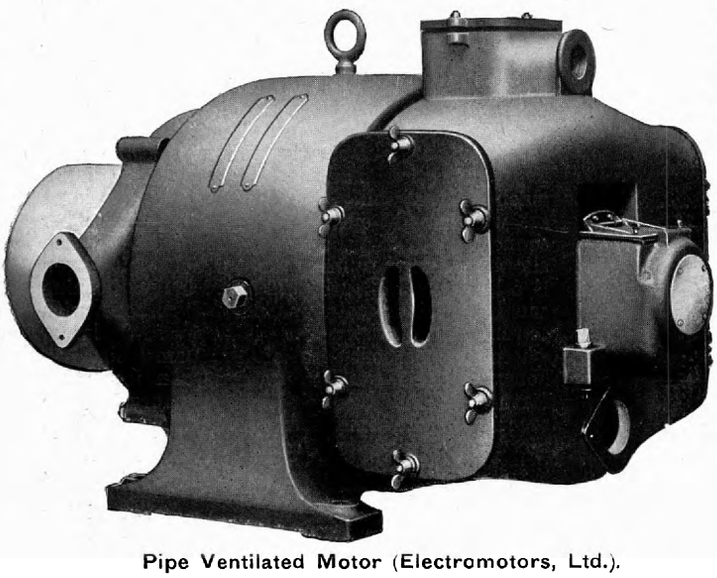
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the frictional surfaces between the cap and the remainder of the handle engage, and the spring in the handle releases the friction on the return motion, so that the cap does not then rotate with the palm of the hand. It is far more convenient to use than the ordinary screw-driver.

Electromotors, Ltd.,

OPENSHAW, MANCHESTER. (STAND NOS. 126 & 133.)

Continuous Current Motors and Dynamos.—On this attractively arranged stand, which has no partitions, pillars, or roof to obstruct the view of the exhibits themselves, are displayed numerous examples of the high-class continuous motors and dynamos in which the firm specialise, with some examples of their applications. A representative series of standard enclosed ventilated machine, ranging from 1 to 30-h.p., is staged, and the particularly easy accessibility of the brush-gear and the several good points of the brush-gear itself, in which the brushes can readily be withdrawn and replaced when the motor is running, can be studied. An interesting machine is the 20-h.p. pipe-ventilated motor similar to the one illustrated, but provided with a weatherproof cowl over the air outlet. These motors are self-ventilating by means of a fan carried on the armature, but have the advantages of a fully enclosed motor. A small 4-kw. steam ship-lighting set is also shown, and motors are exhibited driving plunger and centrifugal pumps and fans of various patterns. Attention should also be drawn to a compact electrically-driven builders' 5-cwt. friction hoist, made throughout by the company, and a motor complete with worm-gear and electric brake, as supplied to lift makers.



Pipe Ventilated Motor (Electromotors, Ltd.).

R. Waygood and Co., Ltd.,

FALMOUTH ROAD, S.E. (STAND NOS. 75 & 97.)

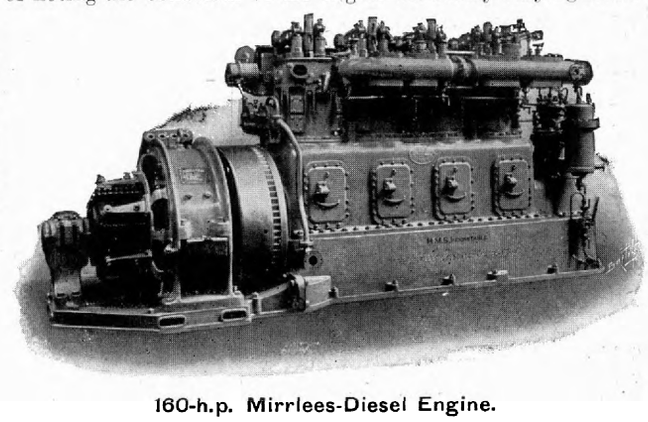
Electric Lifts.—This stand is so placed that visitors can be taken by an electric lift forming one of the exhibits direct to the gallery. This is fitted with car-switch control, and is driven by a contact machine at the side with under-driven worm-geared drum, and with the motor and control board mounted on one bed-plate, all the connections being neatly arranged on a small slate panel. A very fine model of a full automatic push-button passenger lift is also to be seen on the stand, as well as a band-power goods lift. A new pattern of electric goods lift is shown at work, capable of raising ½ cwt. at about 100 feet per minute through a travel of 15 feet. This is controlled by three pushes, up, down, and stop, and has a novel arrangement of a single steel guide on one side. Numerous safety appliances are shown, both on these lifts and separately, and among these may be specially mentioned an electrically-actuated rope grip, which prevents the rope of a rope-controlled lift being pulled when any gate or door is open, and also instantly brings the car to rest should a gate be opened when it is in motion. This is equally applicable to hydraulic and electric rope-controlled lifts. Another new device, exhibited for the first time, is a partly electrical and partly mechanical gate lock, which prevents the gate being opened unless the car is at the floor in question. The usual slack cable and other devices are shown on the working lifts, and an effective demonstration of the working of the latter was made on the lift to the gallery by purposely loosening one of the ropes.

Mirrlees, Bickerton & Day, Ltd.,

HAZELGROVE, NEAR STOCKPORT. (STAND NO. 8.)

Diesel Engine.—The only generating set of considerable size running in the exhibition is the 160-h.p. Diesel engine on this stand. It is of the four-cylinder, completely enclosed design, with forced lubrication similar to a number of engines supplied for driving dynamos on British warships, and is direct coupled to a 105-k.w. continuous current dynamo running at 400 r.p.m., made by the Lancashire Dynamo and Motor Co.

Four separate oil supply tanks containing different oils, respectively Texas, shale, gas, and paraffin oils, are connected with the engine in such a manner that the engine can be switched over from one grade of oil to another, whilst running, the object of this arrangement being to demonstrate that no alterations are necessary to enable the engine to work with widely varying qualities of oil. The dynamo is connected with a water resistance, and suitable switches are provided, so that full load or partial loads can be switched on and off as desired. Thus visitors will have an opportunity of noting the behaviour of the engine on widely-varying loads.



160-h.p. Mirrlees-Diesel Engine.

Among the special features of the engine may be mentioned the compressed air starting arrangements fitted to two of the cylinders. The starting lever lowers the fuel valve levers of the cylinders away from their cams, and puts in action the levers actuating the special compressed air valves. A two-stage air compressor of a particularly silent pattern is employed, in which the valves and valve seats are very easily drawn out for inspection. Special provision is also made for the easy removal of the main exhaust valves without dismantling other parts by the construction of the exhaust valve levers in two parts bolted together. The fuel pump has separate plungers for each cylinder, and the governor controls the time of opening of its suction valves carrying a varying proportion of oil, to be returned to the tank when the whole cylinderful is not required. The speed is governed to well within 3 per cent. The set is remarkably compact, and only occupies 8 ft. by 18 ft. of floor space.

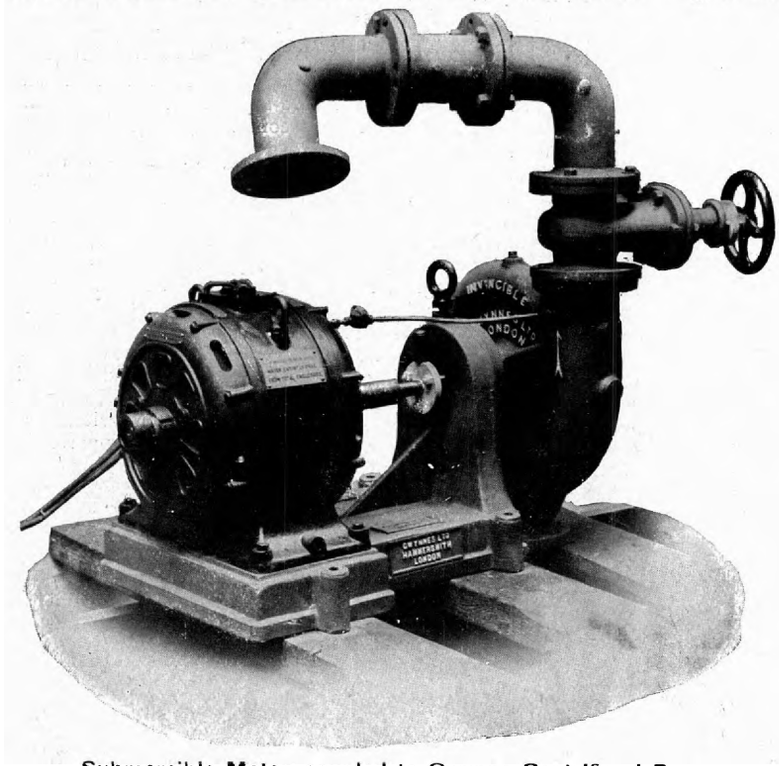
Submersible Motors, Ltd.,

23 ST. SWITHIN'S LANE, E.C. (STAND NOS. 317 & 318.)

Motors to work under water.—A striking exhibit in the gallery is that of this company, who show a three-phase induction motor of the "Macdonald" submersible type working under water and driving a Gwynne centrifugal pump, delivering 30,000 gallons per hour. These motors, the great utility of which is obvious, are made at the J. L. Works, Southall, and do not depend on being water-tight or totally enclosed, but, on the contrary, water is encouraged to circulate around and within the motor to assist in cooling; and, indeed, a greater output is obtainable submerged than in the air. A by-pass pipe, connected to the delivery side of the pump, supplies water to and forces it through the interior of the motor. This tends to keep down its temperature, and enables a greater output to be obtained from the motor when it is immersed than when it is working dry. A certain amount of work is wasted in the churning of water by the rotor, but it is stated that this is small, and that the overall efficiency of the motor compares favourably with that of motors working under more usual conditions. The stator windings are covered with a special waterproof insulation, but the rotor is not so fully protected, but relies on the fact that it is so designed

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that no part differs in voltage from any other part by as much as 1·5 volts, so that the water cannot be electrolysed and acts as an insulator. The motor should have an enormous



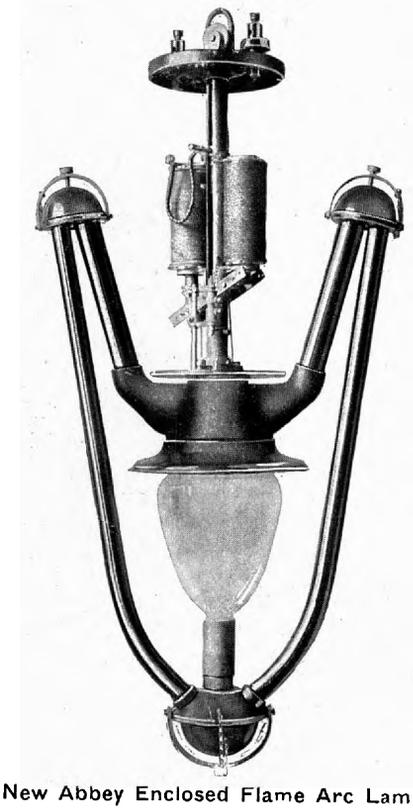
Submersible Motor, coupled to Gwynne Centrifugal Pump, as shown running under water.

field of utility in mining and salvage work, as well as for a variety of other purposes. Examples of the J. L. motor with laminated fields, special brush gear, and several other original features to recommend it are also shown.

The Abbey Electric Co.,

17 Victoria Street, S.W. (Stand No. 5.)

Arc Lamps.—A new enclosed flame arc lamp, made in the 350 to 400-watt size, and with several points of originality and



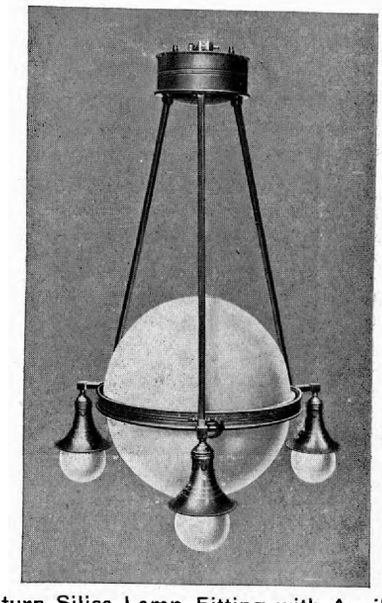
New Abbey Enclosed Flame Arc Lamp.

interest, is shown. The general arrangement of the lamp is seen in the above illustration. The tubes at the side permit of a thorough circulation and cooling of the gases, causing all fumes to condense in the tubes, thus keeping the glass clear. The covers at the elbows are easily removed, but the tubes only need to be cleaned out about every other time the lamp is trimmed. The feed mechanism is of the simplest character, with a clutch and rocking arm worked by shunt and series solenoids, and a substitutional resistance with automatic cut-in can be provided inside the case. The most interesting feature of the lamp is the special carbon employed, made by the Fluorundum Flame Carbon Company, of Brighton; this is hollow-cored and cylindrical, with the chemical composition outside the carbon. As the thickness of the chemical coating is uniform, which is not the case with fluted carbons, the arc can travel round without causing any flickering. The outside chemical material is quite non-deliquescent, so that the carbons can be kept in stock any length of time without special protection. The colour of the light they give is the pleasantest we have seen of any arc lamp, being a pale cream colour, sufficiently yellow to give good fog penetration while white enough to distinguish colours well. Several details of the lamp are well thought out, as, for example, the rubber connection to the bottom of the globe, which allows the top to make an air-tight joint even if a little out of truth. 20 to 30 hours' burning can be obtained with one pair of carbons with continuous current, but in the A.-C. lamp, where the carbons are of the same size, 40 hours' burning can be attained. An important feature of the lamp is that, contrary to the practice with some lamps of the same class, the case is insulated from both poles, and is therefore not live when the lamp is alight. Another new lamp shown is a long-burning enclosed lamp with three pairs of carbons in parallel, giving 200 to 400 hours of burning.

The Westinghouse Cooper Hewitt Co., Ltd.,

151–2 Great Saffron Hill, E.C. (Stand No. 82.)

Mercury Vapour Lamps, Fluorescent Reflectors, Silica Lamps.—The most interesting novelty on this stand is the new light-transforming reflector, coated with fluorescent material, which actually transforms some of the rays falling upon it from an ordinary mercury vapour lamp to a lower frequency, and thus, without any auxiliary light source, supplies the



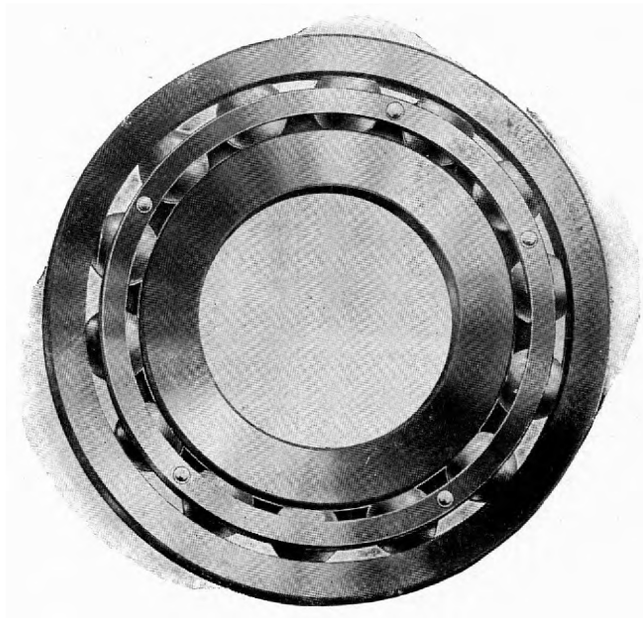
Saturn Silica Lamp Fitting with Auxiliary Incandescent Lamps.

reddish rays which are otherwise wanting in the spectrum of the lamp, and gives the resulting light a pleasanter colour, making the economy of the mercury vapour lamp available over a greater range of conditions than heretofore. The ordinary long inclined glass tube lamps (see Electrical Engineering, Vol. III., January 2nd, 1908, page 19) and the newer

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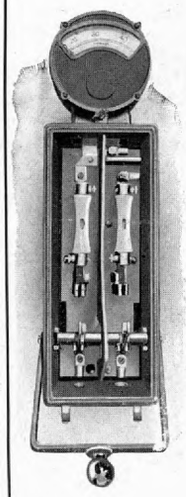
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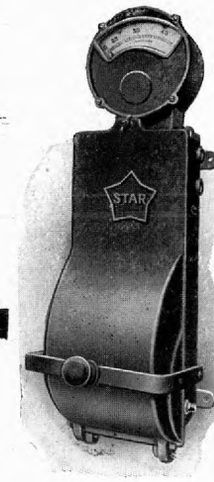


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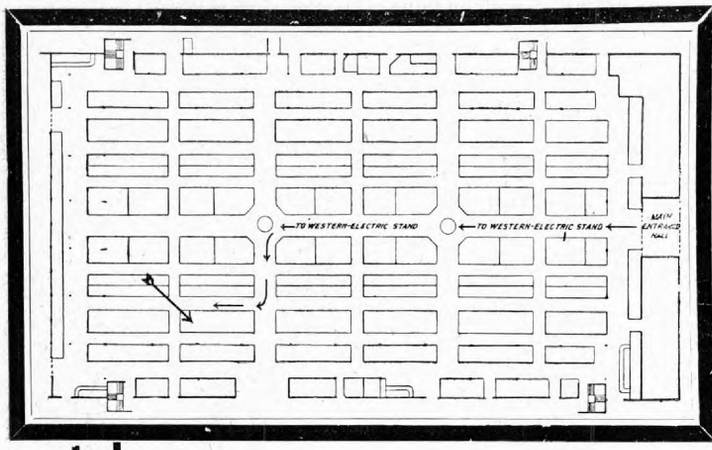
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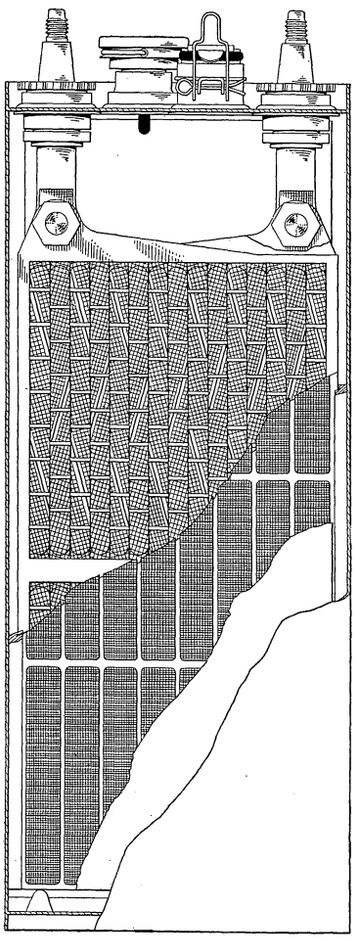
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silica lamp (see ELECTRICAL ENGINEERING, Vol. VI., October 13th, 1910, page 646) are shown in various patterns. One of the new forms in which the latter now appears, combined with a few incandescent lamps to improve the colour of the light, is shown in the accompanying illustration. Mercury vapour rectifiers are also shown, as well as plant for the sterilisation of water by the ultra-violet rays emitted by the mercury arc. The mercury vapour lamp appears to be making rapid headway in this country, and is already largely appreciated in works, including printing and textile as well as engineering establishments, where well diffused illumination is desired. An efficiency of 0·33 to 0·37 watt per c.p. can be attained, and the colour objection has been proved by experience to disappear largely with continued use.

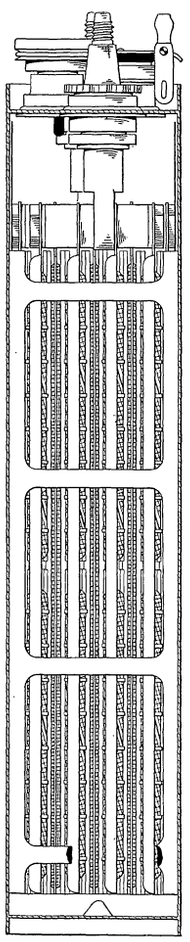
The Edison Manufacturing Co.,

EDISON WORKS, WILLESDEN JUNCTION, N.W. (STAND No. 252.)

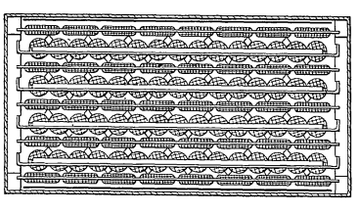
The Edison Storage Battery.—Quite an important feature of the exhibition is the display of the long-talked-of Edison storage cells, which the above company are now putting on the market in England. The general construction of the



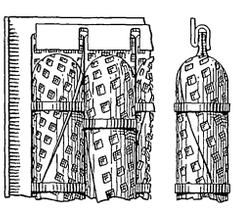
Sectional Elevation.



End View of Interior.



Section.



Detail of Positive Plate. (Full Size)

Details of A4 Edison Cell.

battery with its positive plates carrying rows of perforated tubes containing finely divided nickel and nickel hydrate, its negative plates with pockets filled with iron oxide, and its electrolyte consisting principally of potassium hydrate, is familiar to our readers (see ELECTRICAL ENGINEERING, May 19th, 1910, page 319). The accompanying illustration shows some of the details of one of the types. The method of preparation of the thin zinc flakes for the positive active material is of some interest. A plate about one millimetre thick is first made up of 250 alternate layers of electrolytically deposited copper on nickel; this is chopped into small fragments, and finally the copper is dissolved out, leaving the fine nickel flakes required. The claims of the battery as regards lightness are well known. Something approaching double the ampere-hour capacity of a lead battery of equal weight is claimed, but it must not be forgotten that the voltage is lower (1·7 volts), and the first cost is higher. This last is, however, offset by the greater durability of the Edison cell and its comparative immunity from evil effects of both mechanical and electrical rough handling. Most striking curves of test are shown on the stand, illustrating the way the cell may be short-circuited, repeatedly discharged to zero voltage, reversed, or left unused for long periods without apparent diminution in its capacity. The results of test after mechanical vibration and shock are equally striking. The cell is shown in sizes ranging from the A8 300 ampere-hour cell for tramcar work, &c., down to the B2 40 ampere-hour ignition cell. The latter are shown made up into sets for motor-car lighting and ignition, the set of five cells of the smallest size weighing complete 25 lbs. All are guaranteed for five years. The Edison primary and alkaline battery for telegraph and other work is also being shown on the stand.

The Edison & Swan United Electric Light Co., Ltd.,

36 & 37 QUEEN STREET, E.C. (STAND NOS. 15, 16, 45, 46, 98, & 117.)

Incandescent Lamps.—At the stand represented by the first four of these numbers the company make a brave display of their well-known Royal Ediswan metal filament (tungsten) and carbon lamps. Their lamps are also further exemplified in four large signs in the hall, lighted entirely by 16-c.p. Ediswan metal filament lamps. These lamps are now made for voltages from 2 to 260, and the candle-powers range from 1 to 1,000; and we understand that the company have for some little time been turning out 200-volt metal filament lamps of as small a size as 16-c.p.

Switches, Instruments, &c.—The company's other stand is devoted to switchgear, instruments, &c. Their well-known Philatta switch is, of course, well represented, and among the large collection of switches, wall sockets and plugs, adapters, fuses, ceiling roses, lampholders, and other installation accessories, we notice one or two novelties, including combined switches and wall plugs, where the action of inserting and withdrawing the plug pushes a switch inside the socket mechanically on and off, so that there are no exposed live conductors when the plug is out; and another variety in which the shape of the plug is such that the action of removing it knocks off the ordinary tumbler handle of the switch. The special screw-holders for high candle-power metal filament lamps should also be mentioned.

A particularly striking feature of the accessories stand is the demonstration of the company's water-tight instruments, which are shown immersed in a trough of water. Among other examples of the varying work carried on at the Ediswan factory are shown parts of the Electrelle piano, and the display of tubular fuses should also be mentioned. Among the fittings are some attractive examples of train lighting fittings considerably in advance of those usually seen for this class of work.

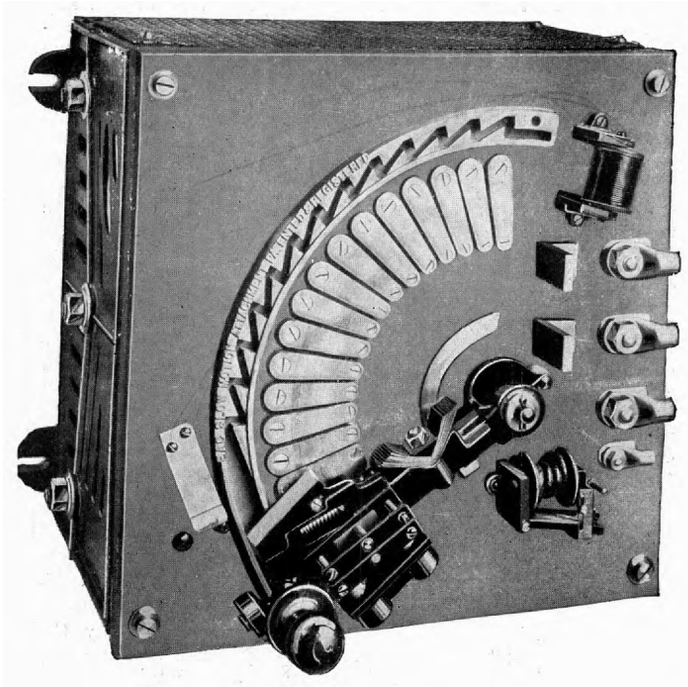
The Electrical Apparatus Co., Ltd.,

VAUXHALL WORKS, SOUTH LAMBETH ROAD, S.W. (STAND NOS. 24 & 37.)

Motor Starters.—On this stand is shown a group of motor starters, including some interesting patterns with special features. One of these, illustrated here, is a slow motion starter, in which a pin carried by the starter lever is constrained in a zigzag path necessitating a pause on every step forward, although the actual change from each step to the next is made rapidly. A considerable range of other types of starter are shown, including an automatic starter comprising a solenoid operated main switch and starter combined. The single-phase induction motor starter controlling both the stator and motor circuits with one handle, worked like that of a continuous current starter, which was described in ELECTRICAL ENGINEERING (June 15th, p. 331), was also shown, and another interesting piece of motor control apparatus is a reversing starter consisting of an ordinary lever starter interlocked with a separate reversing switch, so that neither can be moved unless the other is in the proper position. A particularly neatly arranged potentiometer regulator with one

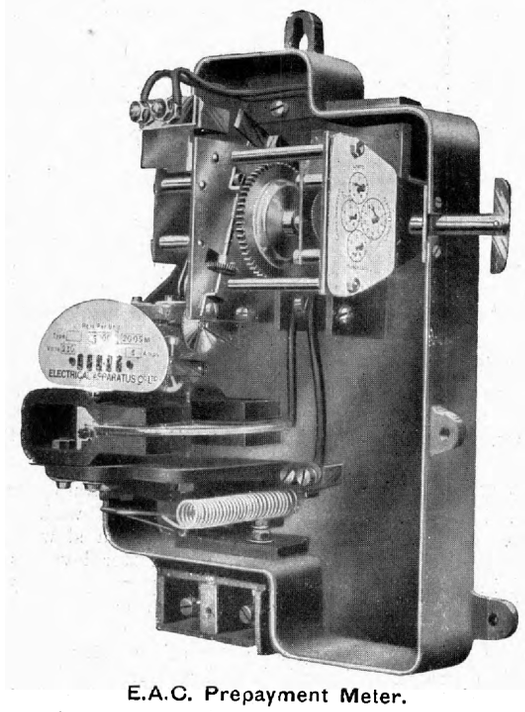
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arm and one set of contacts and with a reversing switch which is knocked over by the regulator switch arm as it passes through the zero position.



Step by Step Slow Motion Starter.

Meters.—Examples are shown of the E.A.C. high torque meter for direct current, which is used by over 120 central stations in the Kingdom. It is particularly suitable for registering small currents, as, being of the commutator type, it can be made as accurate in small as in large capacities. The insulation is mica, the commutator and brushes are 18 carat gold, and the armature coils are totally enclosed in an aluminium case. The meter case is of cast iron, and the joint is packed so as to be absolutely dust proof. This meter is claimed by the makers to have a higher torque than any other



E.A.C. Prepayment Meter.

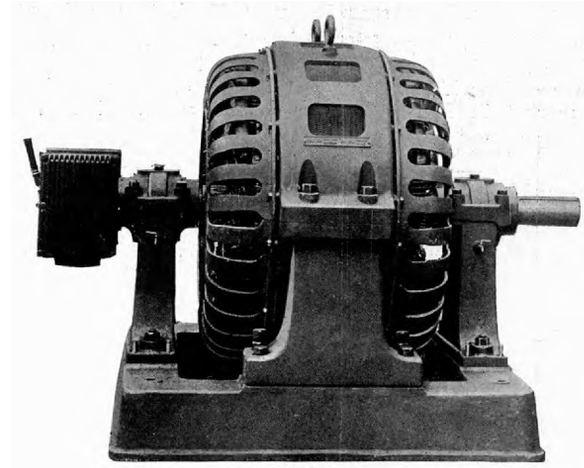
on the market. The company's new prepayment meter, which is also illustrated here, is exhibited for the first time. It comprises the same parts combined with a patent prepayment mechanism, which requires practically no extra work on the part of the motive element; the force for opening the switch is provided by the user when inserting coins.

Other Exhibits.—The company also show cinematograph regulating resistances and examples of their "Koolark" cartridge fuse, in which a liquid is liberated to quench the arc, as well as Electrostan fuse wire with a specially low melting point.

Phœnix Dynamo Manufacturing Co., Ltd.,

THORNBURY WORKS, BRADFORD. (STAND NOS. 59 & 64.)

Mining and other Motors.—One of the most notable of the exhibits on this stand is the 300-B.H.P. 3,000-volt slip ring induction motor illustrated here. This is a special type of machine for running haulages underground, and has the slip rings and all rare contacts enclosed in flame-proof boxes fitted with the Phœnix patent explosion-proof gland, and with all the insulation thoroughly moisture proof. An example of the



300 h.p. Mining Motor with Enclosed Slip Rings.

fully enclosed mining motor which has been developed by the firm is also shown, and another interesting item is a motor-driven plating dynamo. In this machine a special armature winding is employed, by means of which the designers claim that the resistance voltage is reduced to about half its ordinary value, resulting in much better wear of the commutator than is usual in heavy-current machines. A self-regulating electrically driven plunger pump for country-house work, &c., is also shown. Other exhibits include electric drills, grinders, and other portable tools.

Vedovelli, Priestley et Cie.,

PARIS. (LONDON AGENTS: LAING, WHARTON, LTD., 7 GREAT NEWPORT STREET, W.C.) (STAND NOS. 56 & 67.)

Electric Traction Material, &c.—One of the most interesting exhibits on this stand is an example of the light triangular lattice steel conductor used in Messrs. Vedovelli, Priestley's system of semi-rigid overhead construction for single-phase railways, which is one of the six systems (two constructed by this firm) now in experimental use on the French Midi Railway for a contact line pressure of 12,000 volts. This conductor is constructed in lengths of about 40 feet, connected by flexible expansion joints, and is hung from a single catenary wire. An aluminium feeder cable is carried by the steel conductor, and is bonded to it at intervals. Another traction exhibit is a sample of rail bonds welded to the rails by a special acetylene process, requiring only a small plant on a truck, light enough to be lifted from the railways when trains are passing, so that the system is suitable for working during traffic on steam railways that are being converted to electric traction.

High-tension Apparatus.—A 100,000-volt transformer is shown in operation, demonstrating the qualities of the firm's link form of suspension insulator, and special forms of 45,000-volt oil switches are exhibited, in which very rapid extinction of the arc is obtained by having the oil under pressure. Horn break-open air fuses of an easily replaceable type are also shown, as well as several forms of lightning protection apparatus.

Switches, Circuit-breakers, &c.—Among the other items which are too numerous to mention all in detail, are circuit-breakers of the laminated edgewise pattern, motor starters, with special methods of overload and no voltage release, and samples of a line of oil break switches which are being put on the market at particularly low prices.

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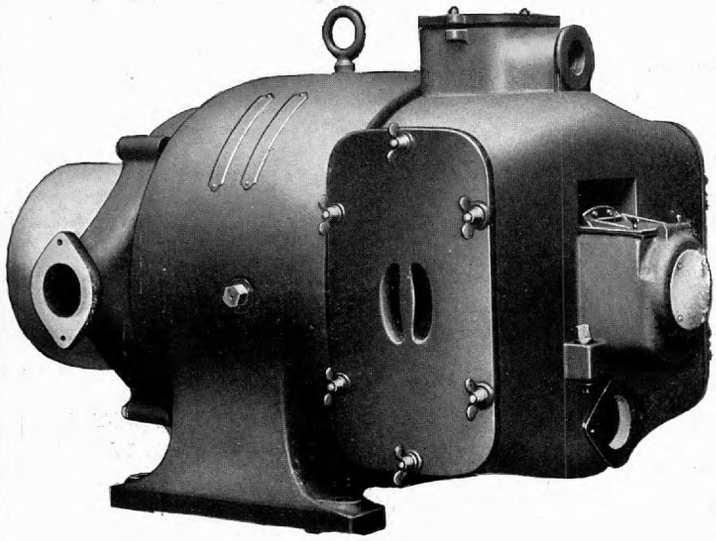
AT OUR

STAND

NOS 126/133

AT

OLYMPIA



ELECTROMOTORS Ltd.

OPENSHAW, Manchester.

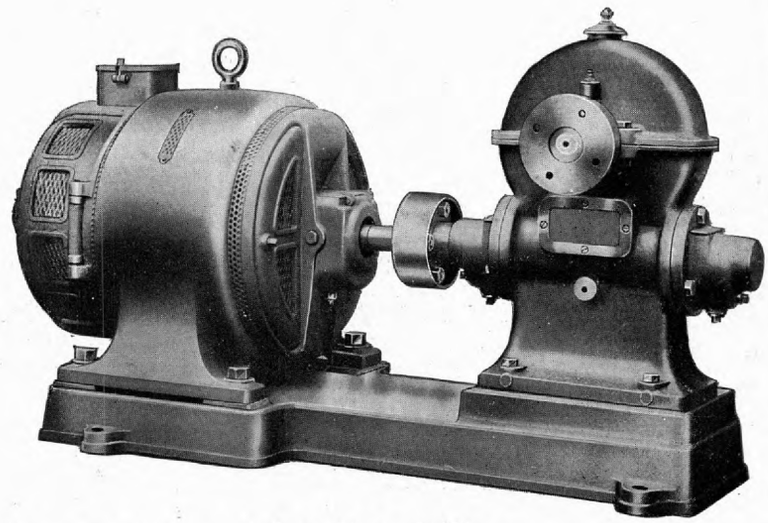
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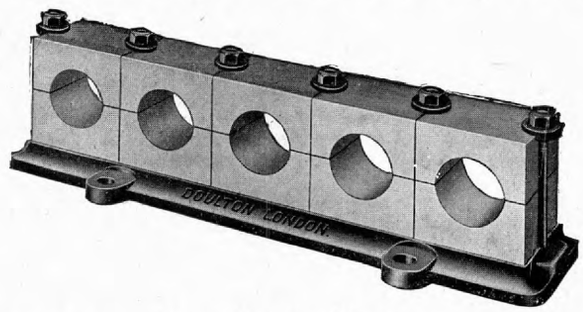
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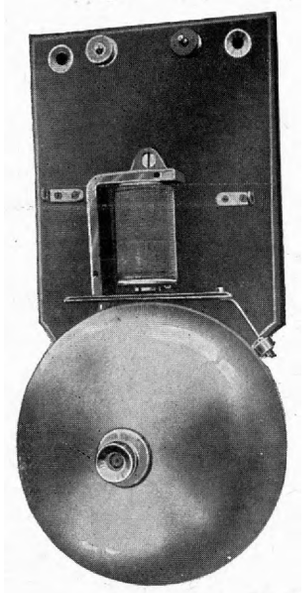
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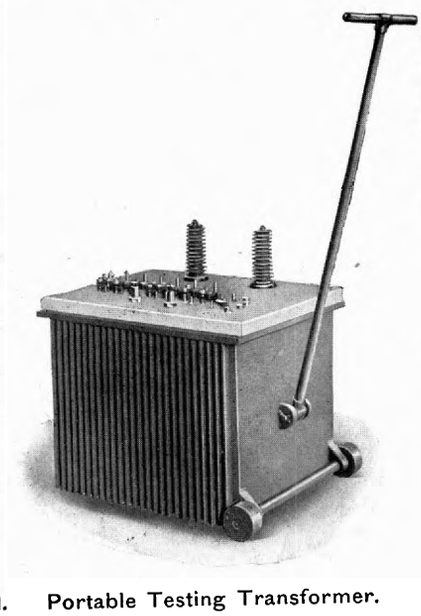
The Foster Engineering Co., Ltd.,

MORDEN ROAD, WIMBLEDON, S.W. (STAND NOS. 194 & 221.)

Arc and Incandescent Lamps.—The company's well-known Brockie-Pell standard enclosed arc lamps are much in evidence on this stand. These lamps are made both for alternating and continuous currents, and some handsome ornamented patterns are shown. A flame arc lamp is also exhibited, as well as a special alternating current lamp for very low frequencies. The Foster metal filament lamp is, of course, well represented, and samples up to the highest candle powers



Alternating-current Bell.



Portable Testing Transformer.

are alight on the stand. An effective comparison is made by means of a pair of wattmeters of the consumption of a row of ten 16-c.p. Foster lamps and a group of carbon lamps of the same candle power. We understand that the annual contract of the Midland Railway has been placed for these lamps, and that their strong filaments have led to their increased adoption for stage lighting.

Transformers.—A considerable range of these is shown, from the small bell transformer and the auto-transformers for low voltage metal filament lamps to quite large units for power purposes. A convenient portable transformer with multiple contact switch for general testing purposes, where a number of different voltages are required, is illustrated here.

Other Exhibits.—Among other items on this comprehensive stand, attention may be called specially to the new alternating current bell entirely without vibrating contacts, which is also illustrated; this is worked off a small transformer similar to those supplied by the company for ringing ordinary bells from an alternating circuit instead of from batteries. Another convenient accessory for alternating current installations is a small lamp dimming switch, which, as it works with a choking coil, avoids the waste of energy of the resistance dimmer. Mention should also be made of the safety switch and plug, in which the plug cannot be withdrawn when the current is flowing, owing to a catch controlled by a solenoid.

The Dowsing Radiant Heat Co., Ltd.,

105 GREAT PORTLAND STREET, W. (STAND NO. 161.)

Radiators and Convectors.—Attention is at once arrested when passing this stand by the life-size figure of a servant released from the duty of grate-cleaning by the advent of the electric radiator, reproducing a well-known poster of the firm. Several new patterns of lamp radiators, convectors, and combined radiators and convectors, ranging up to 4½ kw., are shown including the "tubular" pattern with two tiers of lamps, now made in the four-lamp as well as the two-lamp size, and some designs which are put on the market at lower prices than heretofore.

Cooking and Heating Apparatus.—The company are now turning increased attention to electric cooking, and on their stand is a fine display of such apparatus, including a complete range comprising a 6-k.w. oven of substantial construction, with a special inverted griller above it and three hot-plates of different sizes on the top, with which various degrees of heat can be obtained by different combinations of series and parallel connections. Separate hot-plates and other appliances are also shown, as well as flat-irons in various sizes.

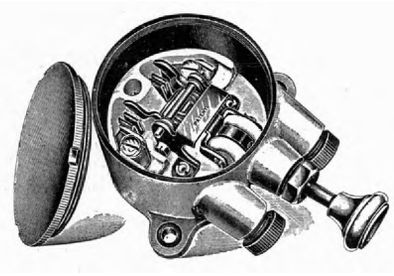
Electro-medical Apparatus, &c.—The electric light bath, or Solarium, is shown in several forms, including a cheap four-lamp bath and a high-class folding bath cabinet of solid oak lined with enamelled iron. A complete high-frequency cabinet is shown suitable for nursing homes and hospitals, and other medical apparatus includes a complete electromedical outfit in the form of a small table, known as the Multistat, for the use of practitioners, providing a small converter, running also as a motor for vibrators, drills, and other flexible shaft apparatus, and all the necessary apparatus and connections for supplying and controlling current in the various continuous, alternating, or interrupted forms as required for inspection lamps, cautery, faradisation, galvanisation, cataphoresis, &c. The whole is without any exposed connections and is most compactly arranged. Vibrators for massage are shown in several forms, and on this part of the stand are also hair-dryers consisting of small motor-driven fans delivering electrically heated air, &c.

Water Sterilisation Apparatus.—Another interesting exhibit on the stand is the latest form of Dr. Nogier's apparatus for sterilisation of water by ultra-violet rays. The water flows through a chamber with highly polished interior, in which is immersed a quartz tube mercury vapour lamp. Convenient means for tilting the lamp for starting it are provided, and a solenoid controlled valve prevents the flow of water taking place except when the current is flowing through the lamp. It is found that by this means both germs and spores which are impervious to boiling or freezing are instantly destroyed, while none of the dissolved gases are affected, so that the water retains its freshness for drinking purposes. The capacity of the apparatus shown is the sterilisation of 11,000 gallons of water with a consumption of 1 k.w.-hour, with a flow of 5,000 gallons per hour.

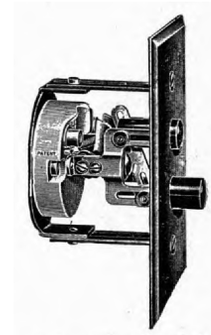
A. P. Lundberg & Sons,

477–487 LIVERPOOL ROAD, N. (STAND NO. 90.)

Switches, Wall Plugs, &c.—The well-known specialities of this firm in tumbler and other switches for ordinary and special purposes, wall connections, ceiling roses, &c., are exhibited in great profusion, and the many special arrangements of switches and connections to obtain various degrees of control of various numbers of lights from one or several points, which have been so ingeniously contrived by the firm, can be studied by the help of a series of ready connected boards on the stand. Among the novelties we were shown an advance example of an exceptionally flat tumbler switch, which will soon be ready in quantities, measuring less than 1½ inches over all from base to knob, and a new intermediate switch of the "Marvel" type with six terminals, by which a "whole or part and off" control of a group of lights can be obtained from any number of positions. The switch, true to its name, is a marvel of ingenuity. The latest patterns of the "Marvel" switch can be supplied with bases as small as 2⅛ inches



Admiralty Pattern Switch.



Push-button Switch.

diameter. Examples are also shown of the "Clymax" edge-wise type of flush tumbler switch, particularly useful where it is desired to place a number of switches side by side in a small space. A large number of switches of this type are used, with ornamental cover plates, at Buckingham Palace. A new pattern of push-button switch with separate on and off buttons is shown, the construction of which renders it specially useful for sunk conduit work, as considerable lack of alignment of the box does not affect its working. Among the many designs of wall-plug may be noticed a very neat edgewise pattern, made in three sizes. An interesting feature of Messrs. Lundberg's plugs is the use of micanite bushes where the pins pass through the fibre base, giving an extraordinarily high insulation resistance. It is impossible to mention more than a small fraction of the articles in the stand. The popular

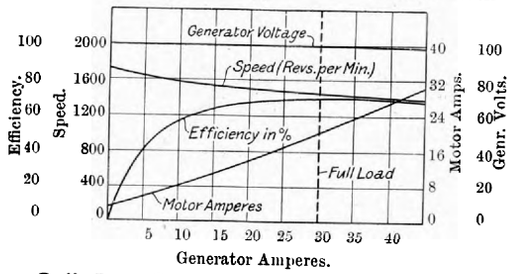
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"Twinob" switches, including a modification for starting small motors where one switch springs back when the knob is released, are well represented, and not the least interesting item is the new water-tight push and pull switch which the firm have specially developed for Admiralty requirements. This is provided with a quick make as well as a quick break action, and is illustrated here.

Bruce, Peebles & Co., Ltd.,

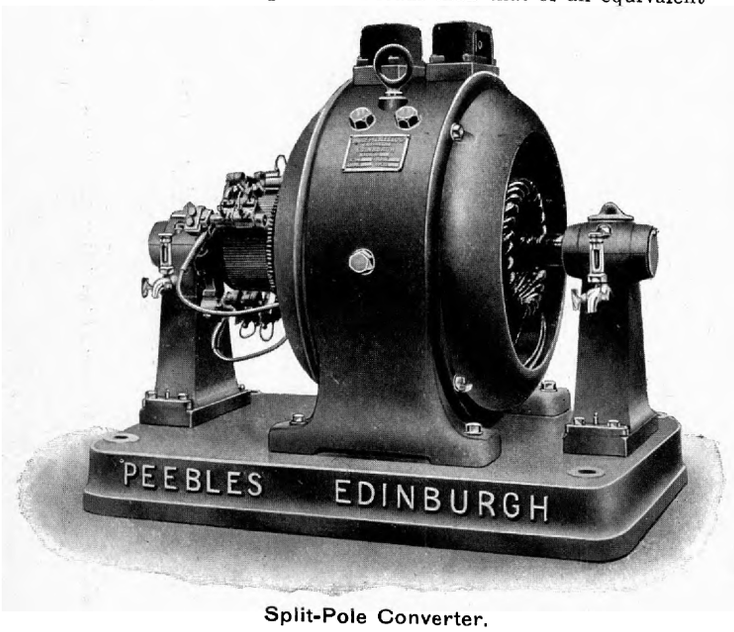
HASTINGS HOUSE, NORFOLK STREET, STRAND, W.C. (STAND NOS. 119 & 140.)

Motor Converters and Motors.—This is one of the few firms showing comparatively heavy machinery, and the largest on the stand is a 500-k.w. La Cour motor converter, the main characteristics of which are well known to our readers. The stator coils for some of these machines consist of a series of rectangular copper bars covered with special



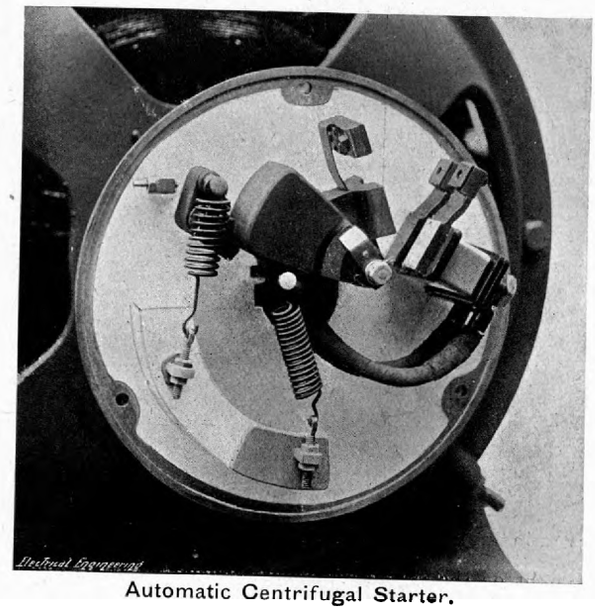
Split-Pole Converter 220-100 Volts D.C.

insulating tape thoroughly impregnated, so that no spaces are left round the copper for corrosion to take place. One end of each coil is shaped on a former, shown on the stand, the ends being left straight. Mica tubes are mechanically forced on, and they are then pushed into the slots. The most interesting exhibit is a D.-C. split pole converter, which we illustrate below. Its efficiency is claimed to be from 5 to 12 per cent. higher at all loads than that of an equivalent



Split-Pole Converter.

motor generator, and the floor space taken up is much less. It can be designed for any ratio of transformation between the limits 10 to 1 and 1-1, and can have shunt or compound characteristics. The field system consists of two motor and two generator poles, as well as two commutator poles. The armature has two circuits, each of which is provided with a set of brushes on the one commutator, one set being connected to the source of supply and the other giving out a current at a reduced or increased pressure. The high efficiency obtained can be seen from the performance curves for a 3-k.w. 220 to 100-volt machine, which we are able to reproduce. Machines of this class can be designed for several purposes, including cinematograph and projector work. Among the A.-C. machines a squirrel-cage rotor is shown, with its end rings cast solid to the conductors, thus eliminating all possibilities of bad joints. The slip-ring type is also to be seen, with the short-circuiting and brush-lifting device, and in another type the rotor winding is short-circuited automatically at a pre-determined speed. The feature of this machine is its high starting torque with small line current, as compared with the squirrel-cage motor. The illustration below shows this device as fitted to a three-phase machine, whose starting torque with full load current is 70 per cent. of full load torque. Another interesting exhibit is a spring-mounted loom motor, and attention should also be given to the haulage type of slip-ring brush-gear, which is designed for very rough use. Each brush-holder is a curved casting, covering nearly a semi-circle, with receptacles for six brushes. These are held in position by an adjustable spring plunger, secured between two steel plates. The castings are supported on insulated spindles attached to the top half of the pedestal bearing. The air gap of these machines can be adjusted by four set-screws fitted in the end covers.



Automatic Centrifugal Starter.

The D.-C. machines include the protected, semi-enclosed and totally enclosed types, a traction and a mining motor. The bearings are rendered flame-proof by thick leather washers, which bear upon the shaft, and are held in position on the inside ends of the bearing cover by steel plates. Rectangular apertures closed with cast-iron covers with glass centres for inspection purposes are also provided in the end shield at the commutator end, and the terminal holes are bushed with brass glands, vulcanite sleeves, and leather washers. A new design of brush gear has been developed, in which thick mica is moulded direct on to the squared end of the spindle, and protected by gunmetal clamps. The brush-holders are of the box type, supplied with an insulated adjusting screw.

The Bastian Meter Co., Ltd.,

KENTISH TOWN, N.W. (STAND NOS. 173 & 190.)

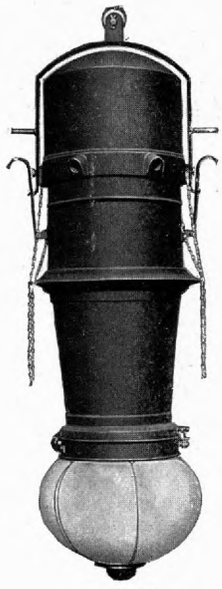
Electrolytic Meters.—On the same stand as that on which the Bastian Electric Heating Syndicate exhibit their heaters, &c., described in our supplement of last week, is a display of examples of the well-known Bastian electrolytic meters. These are shown in several standard sizes, and a novelty is on view in a portable submeter for heating circuits intended to be used by the consumer in series with his heating apparatus when connected to an ordinary lighting circuit, and the reading subtracted from the total metered for lighting and heating, thus enabling separate rates to be charged without the necessity for two circuits. The meter is a standard one, rendered portable by the addition of a special spring valve for the escape of the gas evolved, and a water-tight plug which closes over the filling hole when the top of the case is closed. For charging by the contract system a special meter with a wide tube giving a longer range and a closer scale than the ordinary pattern is shown. The scale reads five units per division, and the full scale reads up to 5 or 600 units. The company will shortly be putting on the market a prepayment meter, but have not been able to have one ready in time for the exhibition.

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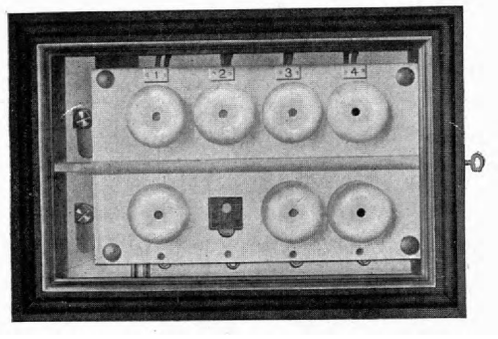
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Pooley & Austin,

25 Victoria Street. (Stand Nos. 49 & 74.)

On this stand are shown the products of the three principal firms for whom Pooley & Austin act as the London office, namely, Mawdsley's, Ltd. (Zone Works, Dursley), Engineering Instruments, Ltd. (Skene Works, Darlington), and Spagnoletti, Ltd. (Goldhawk Road, W.), besides several specialities of their own, such as oil engines, pumps, &c.

Oil Engine Sets.—One of the most prominent exhibits on the stand is a 50-k.w. generating set consisting of a Mawdsley dynamo direct coupled to a four-cylinder vertical enclosed marine type paraffin engine by Dixon Brothers and Hunter. This engine has overhead valves and is arranged to start on petrol or by means of a heated vapouriser on paraffin. At starting the valve levers are lifted by a special lever away from their cams, and the camshaft is shifted sideways. A charge

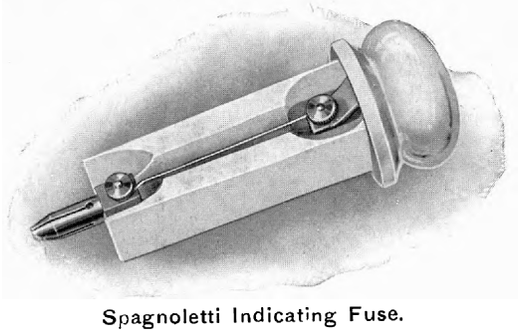


New Type of Spagnoletti Fuse Board.

is sucked into the cylinder by turning the engine round, when the closing of the ignition switch will cause the engine to start. Several smaller oil-driven generating sets are also shown.

Dynamos and Motors.—A number of examples of Mawdsley's continuous current machines with the patent "zone" winding are shown, including motors coupled to various classes of apparatus, such as small pumps, a cinematograph motor generator, a water-tight motor bolted up to the frame, a deck-fan forming a compact combined unit, and examples of a special design of 1/6 h.p. motor running at 1,850 r.p.m., large numbers of which have been supplied to the Post Office. This is a very much more substantial article than the usual fan-motor style of machine of this output, and is, we believe, extensively used for Post Office pneumatic tube exhausters. One of the motors used in the Thomas petrol-electric transmission system (see Electrical Engineering, May 4th, page 236) is also shown.

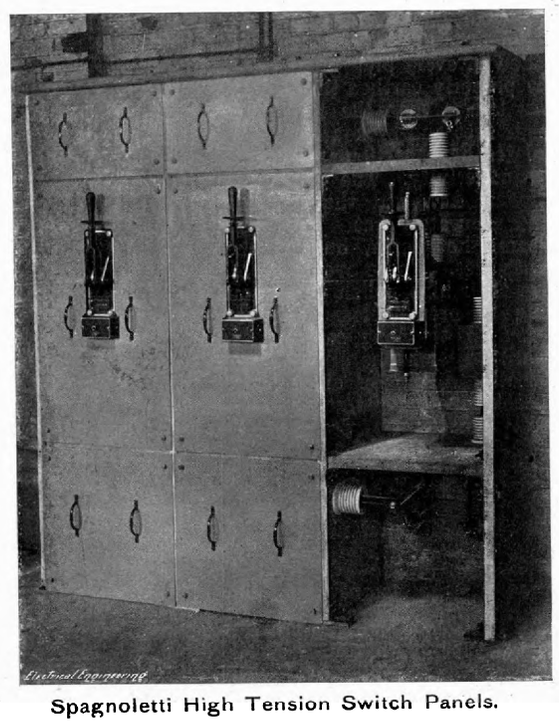
Motor Starters, &c.—A good show of starters and motor control gear of high-class, substantial construction, manufactured by Engineering Instruments, Ltd., is made, including



Spagnoletti Indicating Fuse.

ironclad switches, motor control panels, &c. The starters are all fitted with resistances capable of remaining at least one minute in circuit, and are provided with renewal contacts easily removable from the front by withdrawing a single screw in each. The "directon" starter is also shown among other types. In this starter one motion only is necessary to switch on the motor. When the starting handle is pressed home, a spring is compressed, and this spring drives the starter arm over the contacts against the suction of a totally enclosed oil dash-pot. Thus the attendant has no control over the speed at which the resistance is cut out of the armature circuit, and the overload and no volt releases are operative during the whole time of switching on.

Switchgear.—Of the manufactures of Spagnoletti, Ltd., on this stand one of the most prominent is the complete 6,000-volt oil switch cubicle, illustrated here, which has the current transformer for actuating the tripping coil in the same chamber as the switch, and is provided with particularly complete interlocking arrangements between the isolating links in the top chamber and the switch handle. A 2,000-volt substation panel is also shown, with the firm's latest pattern of loose handle switch. Another item, showing the excellent workmanship throughout all the Spagnoletti switchgear, is a complete and most compactly arranged country-house board. Further exhibits included full-sized feeder pillar, and a large board whereon are mounted a variety of examples of switches, instruments, &c., including a new pattern of indicating enclosed



Spagnoletti High Tension Switch Panels.

fuse, in which one end of the fuse is held in a pivotted clip, which falls so as to be visible through a little window when the fuse blows. Attention should also be drawn to a new pattern of switch, having a quick make as well as quick break, and a cartridge fuse mounted on the switch arm itself. The most interesting novelty from the mining engineer's point of view is the Bowie safety lamp relighter, for electrically relighting miners' lamps underground without fear of explosion. The lid of the stout gas-tight chamber, into which the lamp is placed, is interlocked with the magneto handle, so that it has to be quite closed for the handle to be free to turn. Another particular feature of the stand is the display of the beautifully made moving coil instruments of the firm's own manufacture.

Marryat & Place,

28 Hatton Garden, E.C. (Stand No. 150.)

This firm has erected a full-size 50-ft. automatic push-button lift to demonstrate a new system (for which a patent has been applied) to obviate the difficulty of floor levelling hitherto experienced in lifts of this type. The rope simply passes over a sheave instead of being wound on a drum, an arrangement hitherto always avoided in a push-button lift on account of the difficulty in floor levelling. On the main slow-speed shaft there is a light grooved drum upon which two cords from the cage and counterweight respectively are anchored. This drum drives the selector switch. By this simple means great accuracy is obtained at floor levels without the use of floor switches.



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The Berry Construction Co.,

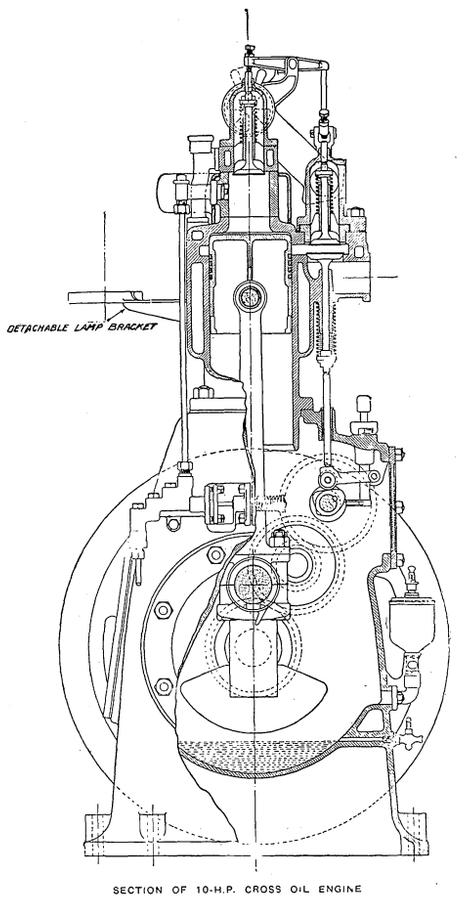
29A Charing Cross Road, W.C. (Stand Nos. 30, 31 & 312.)

Cooking Applances.—On their stand in the main hall the Berry Construction Co. show practically all their patterns of "Tricity" cooking and heating apparatus. The basis of their system, as is well known, is the use of a stand fitted with one or two circular flat-topped hot plates, containing flat disc-shaped heating elements and provided with switches whereby, by connecting the resistances in series and parallel respectively two heats can be obtained, corresponding to consumption of 800 and 200 watts. These can be used on either A.-C. or D.-C. circuits. On the larger outfits, a plug is further supplied for an auxiliary extension hot plate connected to a flexible lead, so that it can be moved about. All the leads are well armoured by flexible metallic tubing, and a third pin is provided in every plug to ensure that the body of the apparatus is properly earthed through the armouring. The earthing pin is longer than the live pins, so that the earth contact is made first and broken last. The vessels for use with these hot plates have particularly flat bottoms to ensure good thermal conductivity. The bottoms are of copper in the metal saucepans, &c., and the earthenware vessels have bottoms ground accurately flat. The ovens are also made to fit over the same hot-plates, but in the latest patterns stand on separate feet. These ovens are of light construction, depending on their high polish to minimise radiation rather than on lagging to prevent loss of heat by conduction. A recent addition to the long series of appliances made to fit the standard heater is the urn here illustrated. Not only is there an effective display of all this apparatus on the main stand, but cooking demonstrations are actually in progress with "Tricity" cookers at Stand No 312 in the gallery.

The Westinghouse Brake Co., Ltd.,

82 York Road, King's Cross, N. (Stand No. 6.)

Oil Engine.—A new design of oil engine which is manufactured by the company, is shown running coupled to a 5-kw. continuous current Westinghouse dynamo. A section of this engine, which can run on the cheapest of oil fuels, is given here. At the head of the cylinder is an unjacketed combustion chamber forming the compression space into which the oil is sprayed. Into it is screwed a small iron bulb, which is heated by a blow lamp before starting, and serves to ignite the charge for the first few explosions. The blow lamp is removed as soon as the engine is running. The piston, on the first down stroke, draws air alone into the cylinder. On the next upstroke the air is compressed. Just before the piston reaches the end of the stroke, it cuts from the combustion chamber an annular chamber or pocket. At or near the end of this stroke, and after the air pocket is closed, the oil fuel is sprayed into the highly-heated air in the combustion chamber, and ignites. When the piston has slightly moved down on its power stroke, the annular pocket



SECTION OF 10-H.P. CROSS OIL ENGINE

Cross Oil Engine.

containing heated compressed air is uncovered, and the additional air makes the combustion complete. Owing to this feature the engines are exceptionally clean, and there is no smoke from the exhaust or deposit of carbon on the valves or the cylinder. Just before the end of the power stroke, the exhaust valve opens the exhaust pipe. The speed of the engine is regulated by a governor, which varies the stroke of the feed pump.

The other exhibits demonstrate the properties of the Morse silent rocker-joint driving chain, of which some very large sizes are shown.

London and Provincial Electric Supply Authorities.

(Stand Nos. 106, 109, 128, and 131.)

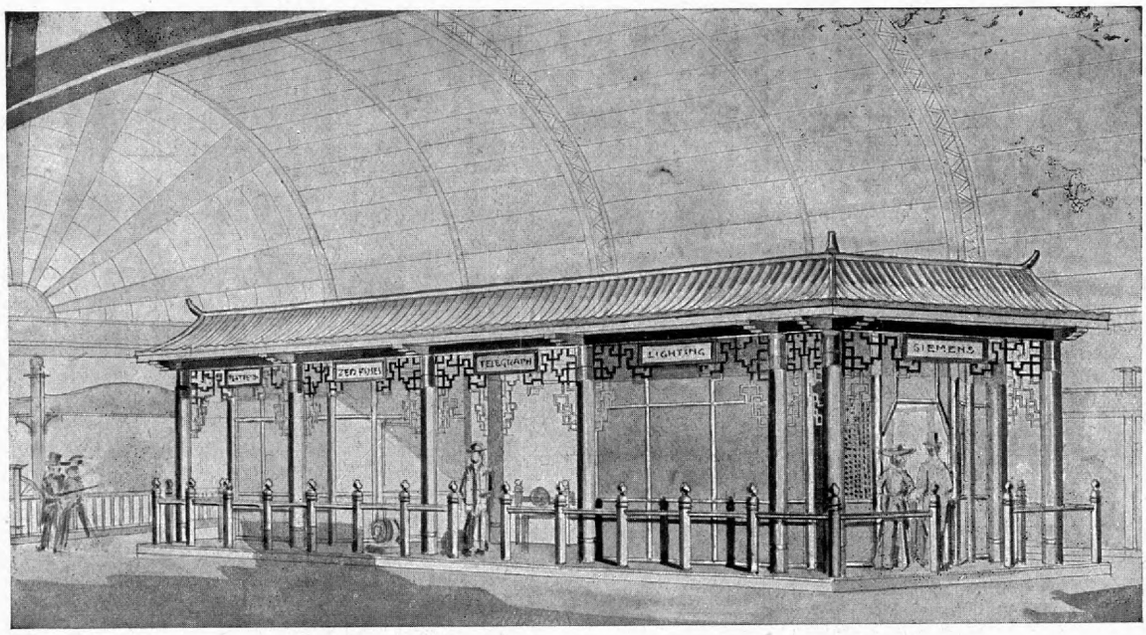
Electric Supply Advertising.—A feature of the Exhibition is the combined stand of the Electric Supply Companies of London and District, in conjunction with certain of the Metropolitan Borough Electricity Undertakings and provincial companies. On the two stands near the entrance, which the above stand numbers represent, an ambitious scheme has been carried out in imitation of an Italian garden, from designs of Mr. Stanley Peach. The whole is under the auspices of the Electric Supply Publicity Committee, and the object is to provide a reception room for consumers and would-be consumers, where information regarding the possibilities of electric supply can be put at their disposal. The well-known series of pamphlets and other literature of the committee are well represented, and one of the stands is fitted up as a lecture room, accommodating about 50 visitors for demonstrations of electric cooking, heating, ironing, and domestic applications



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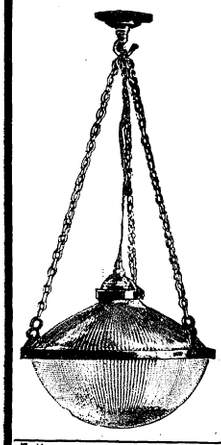
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of power. Lectures are being delivered here on Thursday and Saturday evenings during the Exhibition at 8 and 9 o'clock, by Mr. R. Borlase Matthews, by arrangement with the General Electric Co., on "Electric Cooking and Power in the Home" and "The Comforts of Electric Lighting and Heating." Mr. Matthews will also lecture on Friday, October 13th on Messrs. Spagnoletti's Therol system of cooking.

Elliott Brothers,

CENTURY WORKS, LEWISHAM, S.E. (STANDS NO. 54 & 69.)

Instruments.—The principal features of this firm's exhibits are the improvements that have been made, especially in the portable type of instrument. These include a new form of ammeter and voltmeter, in which the iron case is replaced by wood, the necessary shielding from stray currents being effected by means of thin sheets of Swedish iron. This renders the instruments quite 3 lbs. lighter. A useful improvement has been made in the combined ammeter and voltmeter portable testing set. On the voltmeter side, instead of the usual plugs for altering the range, a circular sliding switch is provided, the handle of which has a groove into which a projection in the lid fits when the switch is on the highest range. In any other position the instrument cannot be closed, so that the instrument cannot inadvertently be connected to the higher voltages with the shunt in the most sensitive position.

The Wimperis recorder for indicating the speed of shafts is shown in operation. In this a magneto generator generates voltage in proportion to the speed, which is shown on the indicator calibrated in r.p.m. The Wheatstone & Baudot telegraph systems are also shown working.

Earth-Driven Clock Co.,

11 BOWLING GREEN STREET, LEICESTER. (STAND NO. 307.)

This clock, which has been patented by Mr. Bentley, is causing great interest on the gallery, as it is understood that it will work without attention until it is worn out. It is supplied with energy from an earth battery consisting of two plates placed three feet below the ground. At the centre of the clock are two sets of three contact strips, the outer ones of which are permanently connected together. The battery is connected between the centre contact on one side and the short-circuited strips on the other. A coil is provided in a cylinder on the pendulum, which slides to and fro on two magnets with north poles placed end to end. It is actuated by gold rollers moving on platinum plates, which send a current through the coil alternately in opposite directions, according to which of the contact strips they are on.

R. A. Lister & Co., Ltd.,

47 VICTORIA STREET, S.W. (STAND NOS. 11 & 12.)

This firm shows a system for isolated generating plants, the feature of which is that it starts up automatically when lamps are switched on. The firm is exhibiting two sets of the Bruston automatic generating plant, which have been erected in the engine-house adjoining the stand, one for supplying 200 lights and the other for 40 lights. These are running on the ordinary town gas, and supply light for the stand and shed. As soon as a few lamps are switched on, a relay is actuated, and this allows current from a small battery to operate a solenoid starter, which starts up the dynamo as a motor. As soon as the engine is belted and the machine is up to speed, the dynamo generates current and supplies the required light. A fuller description appeared in ELECTRICAL ENGINEERING, May 18th, p. 266.

The Westminster Engineering Co., Ltd.,

VICTORIA ROAD, WILLESDEN JUNCTION, N.W. (STAND NO. 165.)

Arc Lamps.—Several Westminster enclosed lamps are shown, and a novelty is exhibited in a hand-regulated 2½-ampere enclosed arc lamp with one horizontal and one inclined carbon for lantern and projector work. A similar 4½-ampere lamp is also shown. A number of specially arranged lamps for photographic purposes are exhibited.

High-tension Apparatus.—The company have on the stand examples of the Partridge safety device for transformers, consisting of a collection of alternate brass and mica discs, which flash over and automatically short-circuit the primary winding, and so cause the circuit-breaker to come out or the fuse to blow in the event of a breakdown of insulation between the primary and the secondary windings. A well-designed but reasonably priced 2,000 to 3,000-volt 15/20-ampere oil break switch suitable for house or transformer service is also shown.

The British Vacuum Cleaner Co., Ltd., PARSONS GREEN LANE, S.W. (STAND NOS. 174 & 189.) *Vacuum Cleaners.*—Demonstrations are given of carpet cleaning by electrically driven vacuum cleaners, which are shown in a variety of patterns. The larger machines have the company's special rotary pump, and a fixed machine of this class driven by a 2-h.p. motor is shown, as well as several small outfits arranged on light hand trucks. Some of the more portable self-contained models are worked by diaphragm pumps, and a domestic set weighing no more than 34 lbs., in which the motion is produced by a centrifugal fan, is also shown.

The Eyre Smelting Co., Ltd., BARDON ROAD WORKS, TONBRIDGE, KENT. (STAND NO. 263.)—Examples of Bamber's non-encrusting zincs are to be seen on this stand. These are amalgamated throughout, so that they are free from encrustation and local action, since, when cleaned by wiping, they give a brilliant mercurial surface, which wears uniformly and remains smooth throughout. Attention is drawn to the tapered designs, especially the zinc rods for Leclanché cells. These are made thicker where the work is heaviest, greatly prolonging their life. The rods wear evenly to a very fine point, and the wires are firmly secured by being cast in. The "Bamber" zinc has undergone severe tests at the National Physical Laboratory, and fully bears out all that is claimed for it. Anti-friction white metal for lining bearings, made by a special process, is also exhibited.

Phillips' Commutator Grinder Co., Ltd., 22 WALBROOK, E.C. (STAND NO. 7.)—Examples are shown of the Phillips patent commutator grinding apparatus for large commutators, for which the power is taken by a rubber-covered friction pulley from the commutator itself, so that no separate motor is required. The feed is automatic, and the same apparatus can be adjusted for a considerable range of commutator diameters.

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CARDIFF—4, Church Street (Mr. H. Nance); **DUBLIN**—Norwich Union Chambers, Dawson Street (Mr. D. J. Doolan);
LEEDS—11, Upper Mill Hill, Boar Lane (Messrs. Casperson Bros.); **MIDDLESBROUGH**—303, Linthorpe Rd. (Messrs. J. T Bell & Co.);
NEWCASTLE-ON-TYNE—1, Higham Place (Mr. F. T. Hanks); **SHEFFIELD**—74, High St. (Mr. Wm. Molesworth).

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ELECTRICAL ENGINEERING

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SUMMARY

The fourth part of our special description of the Electrical Exhibition now being held at Olympia forms a portion of this issue. Our detailed descriptions of the stands are continued. Notes are included among these on a new 1½ kw. wireless telegraph equipment for cargo-boats, and a remarkable motor for running under water. A new enclosed flame arc lamp with some original features is described, and mention is made of a light transforming reflector for mercury vapour lamps. Other novelties described include an indicating enclosed fuse, a system of accurate floor levelling for push-button lifts, some new patterns of meters, and an oil engine with new features. An "earth-driven" electric clock is also described.

A discussion took place at the last meeting of the St. Marylebone Borough Council regarding the policy of continuing the sales branch of the Electricity Department. Mr. Duncan Watson, Mr. Oswald Lewis, and a few others strongly opposed the maintenance of the department, but eventually a joint report of the Finance and Electricity Committees dealing with the matter was passed by a substantial majority. (Page 555.)

A short article describes some new forms of porcelain insulators for various purposes. (Page 555.)

One of the Papers read at the autumn meeting of the Iron and Steel Institute in London gave a review of the electric steel industry in Italy. (Page 556.)

We give a description of Messrs. Veritys. new London show rooms, where fittings are displayed to their best advantage by an arrangement avoiding the juxtaposition of clashing styles. Radiators of a new pattern are also to be seen there, as well as heating and cooking apparatus in great variety. (Page 557.)

A new lamp showcard is illustrated. (Page 558.)

Among the lawsuits of electrical interest which will come on for hearing during the Michaelmas sittings of the High Courts is one for the prolongation of the Strowger automatic telephone patent. Another important action is the one regarding the Sheffield municipal wiring department. (Page 559.)

There is a dispute in progress in St. Pancras owing to the Borough Council having issued a rule that all fuses are to have at least a 3 in. break unless they are of the enclosed cartridge type built up of porcelain, and ironclad main fuses are prohibited. (Page 559.)

A correspondent suggests a safety appliance for stopping a motor when a belt breaks or comes off. Another letter relates to the rating of a battery lamp. (Page 559.)

Two patents have been published during last week in connection with metallic filaments. One, by the British Thomson-Houston Co., provides means for strengthening them at their rigid supports, and the other refers to the elimination of metals added during their manufacture. Another specification published by the Patent Office describes a zinc-carbon dry storage battery.—Opposition has been entered to the grant of a patent to H. G. White for an inter-communication telephone system, in which the receiver is connected electrically with the selector switch. (Page 560.)

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Under "Telephony and Telegraphy" we give the decision of the Lambeth magistrate in favour of the Postmaster-General with regard to the overhead wires in Southwark. We also mention successful wireless messages between San Francisco and Japan, and a proposal for direct telephonic communication between England and Germany, and the most interesting points from the Postmaster-General's report.—A telephone cable with "loaded" circuits has been laid between England and Belgium. (Page 501.)

The Scottish Court of Session has decided against Messrs. D. Stewart & Co. in the action by the Johannesburg Corporation for breach of contract in connection with the gas-driven electricity works. The total amount, including the return of part of the purchase price, breach of contract, and sums guaranteed for non-performance of contract, comes to over £400,000. Messrs. Stewart & Co. have also to pay for costs. (Page 502.)

An Edinburgh Municipal deputation has been strongly impressed with the trolley omnibus system for that city. We also mention in our Electric Traction Notes further difficulties in connection with the Hartlepool tramways, the continued opposition of the Stepney Borough Council to overhead trolley tramways;-a proposed revival of the scheme for running trolley omnibuses between Brighton and Worthing, and also give a description of the moving stairways at Earl's Court Station. (Page 562.)

The Sydney City Electrical Engineer recommends the laying of mains in all streets, and large reductions in the price charged for electricity.—The Birmingham Electricity Department are rapidly laying mains for supply to those districts which were recently incorporated.—The Newport (Mon.) Electricity Committee recommend the appointment of a general commercial manager for the tramways and electricity undertakings.—The City of London Corporation have been asked to sanction further tramways in their area.—Arrangements for mutual supply between the lighting and tramway power stations at Sheffield are being inquired into. (Page 562.)

A Local Government Board inquiry was held at Croydon last week (£10,000); the Darlington Council are to apply for a loan of £3,220, and a loan of £4,859 has been sanctioned at Reigate. Electric light undertakings are contemplated at Biddulph, Clevedon, and Teignmouth. Quantities of telephone material are required in Australia. The Victoria Postmaster-General has accepted a tender for an automatic telephone switchboard. (Page 563.)

The British Thomson-Houston Co. show a net profit of £6,374 for the year to March 31st. At the meeting of Messrs. Willans & Robinson held on Tuesday, it was stated that the Company now only have the Rugby works, both the Queensferry and Thames Ditton factories having been disposed of. (Page 564.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, October 12th.
British Electrical and Allied Manufacturers' Association.
2.30 p.m. Council Meeting at Olympia.
7 for 7.30 p.m. Annual Dinner at Hotel Cecil.

FRIDAY, October 13th.
Northampton Institute Engineering Society.
5.45 p.m. Opening meeting at the Institute.
Junior Institution of Engineers.
6.30 p.m. Visit to "Model Engineer" small-power engineering and scientific exhibition at Royal Horticultural Hall, Westminster, S.W.

SATURDAY, October 14th.
Birmingham and District Electric Club.
7.30 p.m. At Colonnade Hotel, New Street.

TUESDAY, October 17th.
Faraday Society.
8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Discussion on papers by J. Härden, D. F. Campbell, and E. K. Scott read at meeting on October 3rd.

FRIDAY, October 20th.
Electro Harmonic Society.
8 p.m. Smoking Concert at Holborn Restaurant.



HAMLET (Mr. A. H. Seabrook, of Marylebone)—Another hit! What say you?
LAERTES (Mr. Duncan Watson, of Marylebone)—A touch, a touch, I do confess.

HAMLET—Come, for the third, Laertes. You but dally.

(See page 555.)

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THE MARYLEBONE SALES DEPARTMENT

THE opponents of the Sales Department of the St. Marylebone Borough Council found an opportunity to discuss the policy and management at the Council meeting on Thursday last, October 5th. The occasion was the presentation of a joint report of the Finance and Electric Supply Committees, which dealt with a report prepared by the Borough Accountant, Mr. T. H. Puzey, and the Secretary and Accountant of the Electric Supply Department, Mr. E. J. Jennings. The latter report dealt with the financial effect of the operations of the sales section arising from the sale of apparatus and works incidental thereto, as destined for the publicity work in connection with the development and general management of the electric supply undertaking. This apportionment of the charges and revenue showed that the Sales Branch last year made a net profit of £221. The Sales and Publicity Branches as a combined department showed an excess of expenditure over receipts of £2,212. This figure, however, covers the cost of publicity for the whole undertaking and the cost incurred, not only in cultivating and obtaining new business, but also in retaining business already obtained.

In the discussion which followed the presentation of this report, Mr. Duncan Watson and Mr. Oswald Lewis, and one or two other speakers, challenged the apportionment of the expenditure allocated to the Sales Branch, and argued that it had been unduly favoured in this respect, whereas every penny of profit that could possibly be shown had been set down to its credit. Considerable play was made with an item of £500 for advertising, which had been wholly set down to publicity or development, and to the cost of printing, and literature distributed in connection with the undertaking. Both of these criticisms were disposed of by the Chairman of the Electric Supply Committee. Both the Finance Committee and the Electric Supply Committee had agreed by large majorities that advertising is an expenditure which must be wholly credited to publicity, as it would be necessary to spend an equal amount, or even more, did the Sales Branch not exist. The literature referred to, it was pointed out, was largely supplied by the makers of apparatus, the name of the department being printed on, whilst the remainder was issued by the Electric Supply Publicity Committee and would be used by the Electric Supply Department in any event.

The management of the electric supply undertaking received considerable support: indeed, one speaker referred to the opponents as the fourth party, as, he said, it consisted of four members. The charge of competing with the local contractors was dealt with by Col. Hopkins, the Chairman of the Electric Supply Committee, in refuting a specific charge relating to 71 Cornwall Mansions. It was alleged that a contractor had quoted fourteen guineas for a certain job, and that the department, knowing this, had offered to do the work for £10 4s., although the speaker did not make it clear that in spite of this the job went to the contractor. The whole of the correspondence in connection with the job was looked up, and later in the evening Col. Hopkins announced that the department, before the contractor came on the scene, quoted £9 6s. for certain work, that the consumer then asked for a quotation for a larger installation, and this amounted to £10 4s., but that the contractor came along and quoted £2 less and got the job!

After one Councillor had urged the appointment of a special committee, having nothing to do with the Electric Supply and Finance Committees, to investigate the methods and management of the Sales Department, the report was adopted on a show of hands, only a few members voting against.

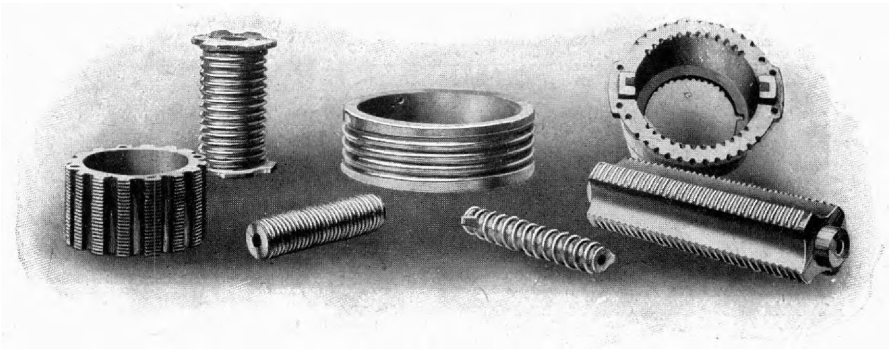
Subsequently the Chairman of the Electric Supply Committee put in a few facts disproving an insinuation that Mr. Holmes, the manager of the Sales Department, is financially interested in some heating apparatus supplied to the Council.

Street Fire-Alarm and Ambulance Telephones.—According to the *Elektrotechnische Zeitschrift*, public loud-speaking telephones have been installed in the streets of Kiel, Germany. The act of opening the door of the iron containing box rings up the fire or ambulance station, and the caller can give full instructions at once as to where the fire or accident is. The articulation at the receiving end is good, in spite of the use of a strong current microphone being necessitated by the excessive street noises.

PORCELAIN INSULATORS, &c.

A LARGE variety of patterns of insulators for many purposes, including a number of new designs, are contained in a new catalogue just issued by Doulton & Co., Ltd. (Lambeth). A particular feature is the collection of special insulators for supporting bare copper conductors of rectangular section, of which a good many are standardised, although the company are always willing to design insulators of this class for special requirements. Other specialities useful in central station work include racks for carrying groups of cables on walls, comprising cast-iron bases, with fixed studs supporting sets of cleats, each consisting of a pair of grooved glaze stoneware insulators.

The company have also taken up the manufacture of resistance bobbins in special admixtures of fireclay for heat resistance suitable for arc lamp and other resistances, and



PORCELAIN BOBBINS FOR RESISTANCES.

heaters of the connection type. A selection of these are illustrated here. Other patterns of insulator listed include telegraph and transmission live pin type insulators, shackle insulators, strain insulators, fuse handles, wall cleats, stoneware liquid resistance jars for theatre dimmers, tubes for cables passing through floors, walls, etc., battery stands, and bridges for cables laid on the solid system. Finally, several pages of the catalogue are devoted to third rail insulators for electric railways, which the company now manufacture for all the schemes of electric traction on the third rail system in this country, as well as for the L.C.C. conduit tramways. The patterns illustrated in the catalogue include the insulators in use on the Great Western Railway (which were described and illustrated in ELECTRICAL ENGINEERING, Vol. II., August 10, 1907, page 182) and the insulators on the London tube railways, illustrated in ELECTRICAL ENGINEERING, Vol. I., January 3rd, 1907, page 38.

Motors for Logging.—The *Electrical World* of New York gives particulars of electric haulage now being used in logging operations in the Spokane (Washington) district, and to be introduced in forests in other parts of the Pacific Slope and neighbouring districts. The apparatus, specially built for severe service, is driven by a 150-h.p. three-phase motor running at 435 r.p.m. on 550 volts at 60 cycles, and equipped with a current-limiting device. Ten machines, to handle from 300,000 ft. to 500,000 ft. a day, will be installed to replace steam engines. A portable sub-station, consisting of a three-phase 150-kw. transformer, will step down the voltage from 11,000 to 550 volts, which will be taken to the motor on the logger by a steel-armoured cable. This will be made in sections, so that the logger can be worked out to a distance of 1,800 ft. from the sub-station. Mr. E. P. Barry, Engineer to the Potlatch Lumber Co., who originated this scheme from experiments carried out, is also interested in the electrification of logging roads. He says that though the first cost of an electric line is much higher than the steam line, the maintenance costs are much less. It is also stated that delays through breakdowns have been reduced to one-third since adopting electricity. The average cost for electric locomotives is about the same as steam of the same power, namely, from £2,200 to £3,200. A great advantage of the electric drive is that the large quantities of fuel at present burned as refuse by the lumber mills can now be utilised.

Engineering Course.—We have received the prospectus of the Borough Polytechnic Institute (103 Borough Road, S.E.), giving full information regarding the full courses in electrical engineering at this Institute, which cover four years.

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

ALUMINIUM.—Two leaflets from the British Aluminium Co. (109 Queen Victoria Street, London, E.C.) illustrate aluminium high-tension transmission lines and aluminium feeders on light railways and tramways.

LIQUID FUEL.—The British Petroleum Co., Ltd. (22 Fenchurch Street, E.C.), have sent us a booklet dealing in an interesting way with the advantages of liquid fuel, and describing its applications for boiler firing in the navy and mercantile marine, for industrial furnaces in metallurgical work, glass blowing, enamelling, &c., for railway locomotives, fire engines, and stationary boilers. The Carbogen and Kermode liquid fuel burners are described, and a useful list of makers of burners is given. Finally, the Diesel engine is dealt with, as well as other oil engines for land and marine work, and a list of makers of internal combustion engines is given.

ELECTRIC MOTORS, HOISTS, AND LIFT GEARS.—A collection of lists from the Victoria Dynamo & Motor Co. (Craven House, Kingsway) deal with continuous-current motors and two- and three-phase induction motors, electric pulley blocks, builders' hoists, lift gears of several types, hand-rope lift controllers, and push-button controllers.

ARC WELDING PLANT.—A pamphlet from the Allgemeine Elektricitäts-Gesellschaft gives particulars of the apparatus which they have developed for arc welding, in which continuous current is employed, taken from a specially designed heavy current generator with a falling characteristic. Striking illustrations of repairs to castings, &c., which have been executed by this process, are given.

AEGMA LAMPS.—A booklet from the Electrical Co., Ltd. (122-4 Charing Cross Road, W.C.), gives some details of these lamps. We understand that 35,000 are made daily, and that from recent tests the full candle-power is maintained within 5 per cent. for a life of 1,000 hours, and within 12 per cent. over 2,000 hours. They can be had in voltages from 20 to 260. A record of one of these lamps is given, in which it burnt for 6,090 hours, having been switched on and off 699 times.

THE TURIN EXHIBITION.—We have just received from the Exhibitions Branch of the Board of Trade copies of the catalogue of exhibits in the British Chemical Industries Section and of the French edition of the catalogue of mathematical and scientific instruments in the British Section. The former of these is considerably more than a mere catalogue, as it contains a series of articles by experts giving *résumés* of the technical position of some of the principal branches of the industry. The latter contains some descriptive matter, and is fully illustrated, but both would have been much more useful near the opening than near the close of the exhibition.

METAL FILAMENT LAMPS.—A most effective little booklet bearing the inscription, "Mazda means electric light for everybody," and addressed more particularly to consumers, is being issued by the British Thomson-Houston Co. It is bright and breezy in its writing, and the style of the illustrations is shown



"Just One-fifth of what the First Lamp Required"

by the one which we have chosen out of the whole series of eight to reproduce here. The prevailing note is, of course, the cheapening of light by the Mazda Lamp, and this and other points in its favour are well driven home by ingenious similes and solid arithmetical facts.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ARC LAMPS.—The new enclosed flame arc lamp and the long burning enclosed arc lamp of the Abbey Electric Co. (17 Victoria Street), which are described in our special Exhibition Supplement this week, are dealt with in new leaflets just issued by the firm.

ELECTRIC SUPPLY ADVERTISING.—New issues made by the Electric Supply Publicity Committee include a handsome brochure entitled "Electricity in the Home," which contains a series of coloured illustrations putting before non-consumers or those who are consumers only to a limited extent the full possibilities of electricity as an artistic illuminant, as well as the various domestic uses to which it can be put. Another leaflet entitled "Public Safety" reproduces a humorous illustration from the *Tatler*, showing the electric lamp and the safety with which moths can approach same without the proverbial singeing of wings, with a few congratulatory words as to the precautions taken in modern times. A new power poster of very striking design has also been issued.

INSTRUMENTS.—The Cambridge Scientific Co., Ltd. (Cambridge, England), has issued a new list of electrometers. The titled gold-leaf electrometer has an adjustable inclined charged plate for varying the equilibrium of the gold leaf. The universal portable type is specially designed to measure the potential of the atmosphere. The micro-electroscope, the string electrometer, and the Dolezalek quadrant electrometer are also described. The H-type of Weston Normal cell has been modified and made more portable. The crystals are retained in loose contact in a constricted portion of each limb, which serves to keep the other contents in their proper places. Another leaflet from the same company describes a method of measuring the mechanical and electrical equivalents of heat.

ELECTRICAL CONDUITS AND FITTINGS.—The Brotherton Tubes & Conduits Co., Ltd. (66 Victoria Street, S.W.), has sent us an illustrated price list of steel conduits and fittings. The Excelsior conduit inspection fittings, which are made of malleable iron, are shown in two types, the watertight and the split type series of bends, tees, junction boxes, &c. Watertight and special flush switches, and combined switches and plugs are also included. Special cover-plates can be had for the latter, designed to match almost any decorations or furniture. Much useful information is contained at the end of the list, including a table of conductors, extracts from the wiring rules and the Phœnix Fire Office rules, and a list of British, Colonial, and foreign electricity and supply stations. We understand that the firm has found it necessary, owing to a great increase in business, to remove their stores to Brewer's Green Yard, Victoria Street, S.W.

ELECTROMETALLURGY IN ITALY

AMONG the Papers read at the autumn meeting of the Iron and Steel Institute, which was to have been held in Turin, but finally took place in London, was one by R. Catani, of Rome, on the applications of electricity in the metallurgical industry of Italy. Steel is manufactured in Italy in the electric furnace both direct from ore and from iron products. Stassano has carried on experiments from 1898 on the former process, and finally adopted a roofed-over furnace of the hearth type with long arcs playing between the mass of the charge and the arch of the furnace. His first series of experiments with a high-class hæmatite ore point to a cost as high as 93s. per ton, but later experiments appear to indicate a lower price under industrial conditions. With the electric furnace, however, the general practice is to use pig-iron prepared in the ordinary way to charge the furnace for the production of steel, and using even liquid charges where the energy is costly. The first such installation in Italy was a 200-h.p. Stassano furnace at the Artillery works at Turin, and subsequently the Stassano Electric Furnace Co. established an electric steel works in the same town, but on the closing of this establishment in 1909 some of the furnaces were transferred to the "Elba" Company at Portoferraio, and some to the Milan Steel Works. Two Heroult furnaces are used by the Mannesmann Tube Co. at Dalmine in Bergamo, and a 350-k.w. three-phase quod furnace is being erected at the steel works of the Cornigliano Ligure of the Ansaldo Co. All these are cold-charging furnaces. The first furnace for liquid charging in Italy was a Kjellin furnace at the Gregorini Co. at Castro. This is a 300-k.w. induction furnace producing about 10 tons daily with a consumption of about 690 k.w.-hours per ton. Experiments have been carried out by Carcano on the production of pig-iron from residues of pyrites, but complete economic results are not available. The chief metallurgical products manufactured in the electric furnace in large quantities are ferro alloys, but the only one of these manufactured in Italy on an important scale is that of ferro-silicon. The greater part of this is produced from quartz and scrap iron. The first works in Italy which manufactured ferro-silicon on an industrial scale were those of the Societa Elettrochimica at Bussi, which produced 606 tons in 1909.

In 1909 the Piedmontese Company for the Manufacture of Carbide of Calcium and Allied Products produced 22 tons of ferro-silicon. The furnace for smelting ferro-silicon is identical with that used for the production of carbide of calcium. The author has also experimented in the production of ferro-silicon, using pig-iron in place of scrap. The yield corresponded to 2·112 kilogrammes of ferro-silicon per kilowatt-day.

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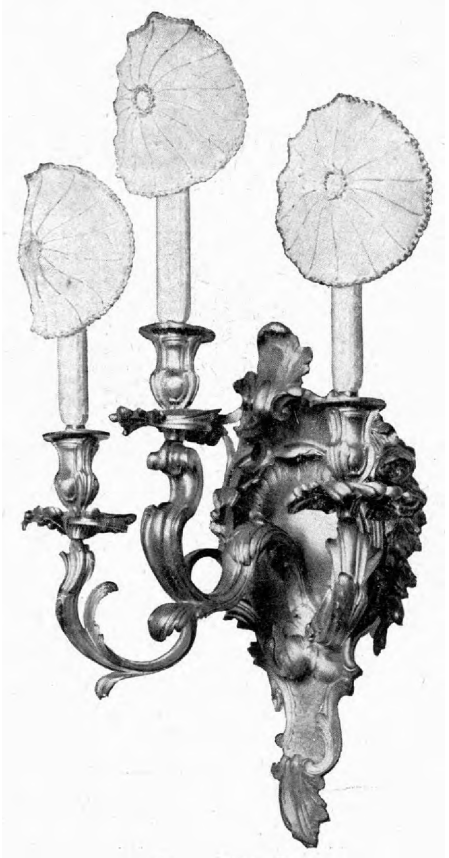
A NOVELTY IN SHOWROOMS

Verity's Newly-arranged Premises

IMPELLED by the constantly increasing nature of their business, and by the demand in London for something novel and effective in the way of a showroom, Messrs. Verity's, Ltd., have recently extended, at considerable expense, and entirely reorganised their well-known showrooms and premises at King Street, Covent Garden. The frontage of the buildings has been greatly improved, and the whole of the ground floor has been altered and given over to a series of showrooms and trade supply counters, with the exception of some space in the front of the building, retained for the purposes of the Admiralty and Government departments, which have of late been exceptionally busy.

In planning their new showrooms, the chief objective of the firm has been to periodise the various rooms according to the fittings, and thus to prevent the horrible contrasts between antique and modern fittings which it is difficult to avoid in showrooms of a more limited capacity. The scheme of decoration in each room has also been made to harmonise with the style of fitting, and with most successful results.

The first showroom is dedicated to fittings designed after the styles of the Louis XIV., XV., XVI. and other French

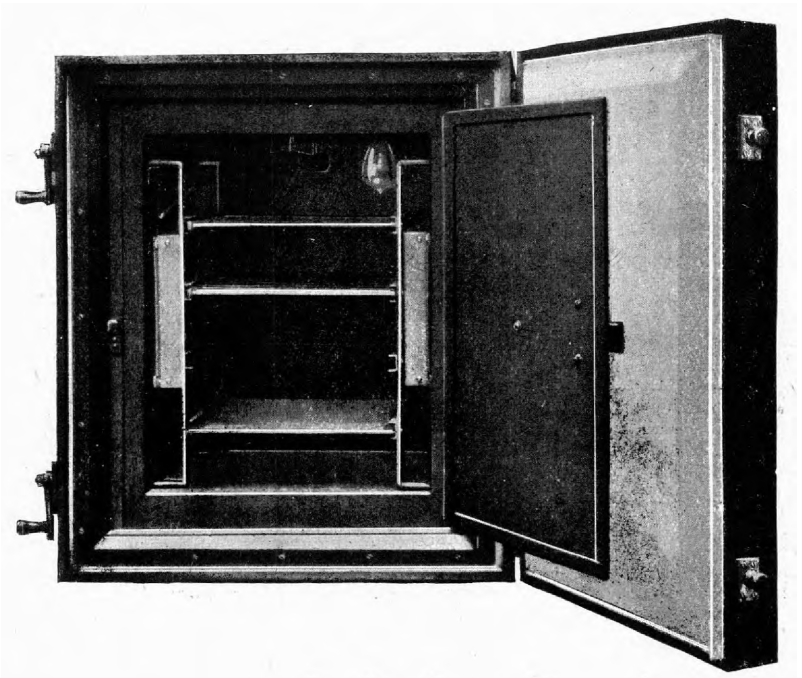


LOUIS XV. BRACKET.

periods, and it may be noted that many of the candelabra in this room are designed from copies collected in the old French palaces by Mr. George Verity. This room has medium-blue felt panelling, which admirably shows up the chased brasswork of the fittings, framed in waxed mahogany. In a smaller adjoining room with dark blue panels set in white are fittings in the Adams and similar styles, the fittings in the third room, which is employed also for general trade purposes, exemplifying the modern and less expensive styles. The next room, with dark green panels and dull oak woodwork, is devoted to Tudor, Stuart, and early Georgian fittings mostly finished in antique brass. The last room, or eighteenth-century room, is probably the most artistically arranged, and its yellow panels framed in a specially stained decorated woodwork shows off to the best advantage the silver, lustre, and cut glass of the Chippendale, Georgian, Sheraton, and similar styles.

Radiators.—The highest classes of radiators are as carefully periodised, and they take their places in the rooms already mentioned. Special mention should be made of a line of inexpensive radiators specially designed for hiring-out by supply companies. Messrs. Verity's have developed a new style of radiator of the hot-wire pattern, with particularly easily removable elements, and arranged for various combinations of series and parallel, giving a great range of temperature. A point to be noted is that the reflectors and cases of all radiators made by the firm are either in solid brass or solid copper, copper and brass-plated sheet metal having been completely discarded as unsuitable to stand the heat. This new pattern of radiator is stocked to match all the English styles of fittings mentioned above, and has been adopted by the Admiralty and by many of the leading shipbuilding firms.

Heating and Cooking Apparatus.—Although Messrs. Verity have long been manufacturing this class of apparatus, they have just completed some novel developments, and have set aside a special showroom for the purpose of pushing these novelties on the market. A hot-wire element similar to that of the radiators is employed. The apparatus in this room includes every conceivable appliance for cooking or heating, from shaving-pots to large ovens. One speciality



THE NEW ELECTRIC OVEN.

is a small cooker with double-side heater at different temperatures, so that boiling, &c., can be carried on on top and grilling or toasting underneath simultaneously, and the heating element can be turned so as to have the maximum heat on top or bottom as required. This room also includes a range of apparatus for factory use, such as soldering irons (which have been well taken up by the food-canning and similar trades), glue-pots, wax-melters, &c.

The greatest novelty in this room is, however, the new Verity electric oven. This has very excellent heat-retaining properties, and the oven will maintain a good cooking temperature for six hours after the current has been switched off. It consists of an outer case of teak, which gives it the appearance of a cabinet rather than an oven, and an inner casing of the ordinary sheet-iron. Between the two casings is inserted a special manufactured packing designed to retain the heat for a long period. The oven is provided with an outer door of teak and the inner of sheet-metal. There are eight heating elements fitted in the oven itself on either side, and a range of three different temperatures is given.

In this same room are shown a variety of the well-known Aston signs and illuminated fixtures, for which we understand there is a very big demand at the present moment. Some of the largest signs erected on the south side of the Thames, and which form a conspicuous feature of the view from the Embankment at night, were supplied by Messrs. Verity's, Ltd.

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Adjacent to the heating and cooking showrooms are various large showcases in which are placed measuring instruments both of the switchboard and portable type, relays, mining-bells, batteries, hand-lamps, &c.; medical apparatus of every description, including X-ray work; motor-car lamps and



Georgian Pendant.

accessories. The firm have developed a very efficient lamp for motor cars, for head-lights, side-lights, &c., with a parabolic reflector which gives a perfect centre of light. The lamp is so constructed that in case of damage any part, including



Radiator in Design of the Stuart Period.

the glass and reflector, can be removed and replaced in a few seconds.

That part of the ground floor not occupied by showrooms is given over to trade counters for the supply of general accessories, cables, wires, lamps, fans, shades, &c., &c. Each counter has its own stock immediately at the back of it, so as to minimise time in serving customers. In this space also is a special show of inexpensive fittings and fixtures such as are generally used by supply concerns to hire out. These fittings are priced from 2s. 9d. gross upwards, and a very large stock is kept in London so that immediate delivery can be given. There are also shown a large range of lanterns for lighting streets, shops, railway stations, &c., including a special pattern adopted by the G.P.O., and of which over 1,000 were supplied for the new Post Office, and a lantern with a radiant-diffusing globe which we understand is being largely adopted for street and shop-front lighting.

Electric Clocks.—An interesting feature of the newly arranged premises is that they are fitted throughout with Aston electric clocks, all controlled from a master clock on the ground floor. These clocks are manufactured at Messrs. Verity's Aston works.

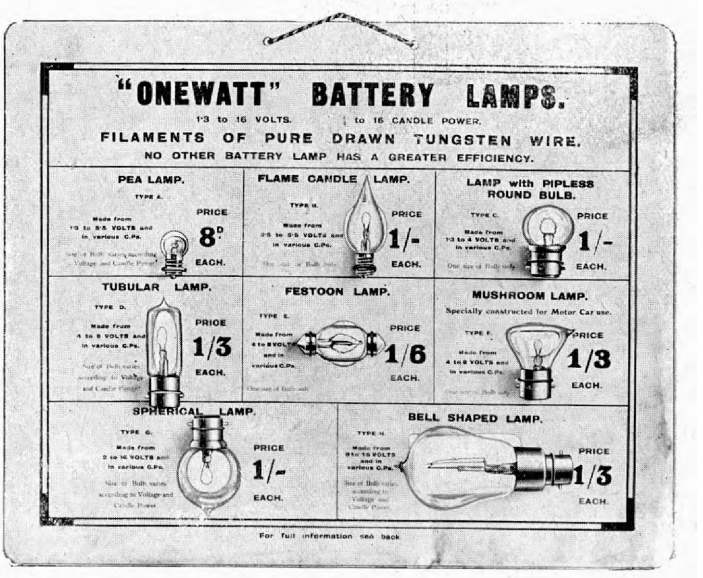
The engineering and Admiralty and Government departments dealing with dynamos, motors, switchboards, controllers, arc-lamps, large fans, &c., &c., have been provided with offices on the premises.

In order to deal with increased business, Messrs. Verity have also found it necessary to enlarge their works at Aston and have just completed the addition of a large new bay.

It is impossible in the space at our disposal to deal with all the manufactures of this firm, but suffice it to say there is no electrical plant or apparatus which cannot be supplied by Messrs. Verity. We found our tour of inspection round their new showrooms exceedingly interesting, and we can confidently recommend a visit on the part of any of our readers who are interested.

A NEW LAMP SHOWCARD

We reproduce here an illustration of a showcard for the use of contractors, which Siemens Brothers Dynamo Works, Ltd., have prepared in connection with their "one-watt" battery lamps. A sample of each type of lamp is mounted on



New "Onewatt" Battery Lamp Showcard.

the card, which is suitably cut away for their reception, and on the back of the card are printed full particulars of all the sizes obtainable. The design is printed effectively in red and blue, and the whole should be of great use in assisting contractors to push the sale of these lamps.

Turkish Electrical Enterprise.—We recently referred to the establishment of a company to control electrical undertakings in Turkey. From information sent by the British Acting Consul-General at Constantinople, says the *Board of Trade Journal*, it appears that the object of the syndicate is to control the transport and lighting enterprises of Constantinople, including the tramways of Constantinople, the Galata-Pera tunnel, and the "Société Anonyme Ottomane d'Electricité (Ganz & Co.)," which has already absorbed the "Société Anonyme pour l'Eclairage de la Ville de Constantinople."It is proposed also to obtain the concession for a tunnel from Chichli to Stamboul, passing under the Golden Horn, and to take up other transport, lighting, and power enterprises in Turkey. A Belgian company is to be formed under the name of the "Union Ottomane—Société d'Entreprises Electriques à Constantinople," with a capital of 90,000,000 frs. (£3,600,000). The syndicate is composed of French, Belgian, Belgo-Hungarian, German, and Swiss groups.

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PENDING ELECTRICAL LAWSUITS

(Strictly Copyright.)

THE Michaelmas sittings at the Law Courts commence to-day, and one of the most interesting cases of electrical interest (which will, however, be fairly late on the list and will probably come on about the middle of November) will be an application for the prolongation of the Strowger automatic telephone patent No. 809 of 1898. The Strowger British patent is held by the British Insulated and Helsby Cable, Ltd., and we understand that the petition for the prolongation of the patent in question will be opposed by three telephone manufacturing companies—the Western Electric Co., and, we believe, the Adnil Electric Co. (representing the Deutsche Telephonwerke), and Siemens Bros. & Co. Apparently there is to be no opposition on behalf of the holders of the Lorimer patents, and that it is doubtful whether there will be opposition by the Attorney-General. The case will come on before Mr. Justice Parker in the Chancery Division, and will presumably be based on the usual grounds of inadequate financial return to the patentee. The application is of great importance in view of the fact that the Post Office is, for the first time, equipping two actual exchanges as an experiment with automatic systems (see ELECTRICAL ENGINEERING, July 20th, p. 417).

Another action to which a great deal of attention will be paid is that of the Attorney-General, at the instance of a ratepayer, against the Sheffield Corporation, with regard to the municipal wiring department, some particulars of which we have already given (ELECTRICAL ENGINEERING, Sept. 28th, p. 535). It is anticipated that the action will come on before Mr. Justice Eve during the next few days, and that it will really take the form of an appeal against the decision of Mr. Justice Nevill in the Leicester case. This held that it is illegal for a municipality to carry out wiring work on a consumer's premises where the Corporation has no Parliamentary powers other than those contained in the General Electric Lighting Acts. Mr. P. O. Lawrence and Mr. Maurice Drucquer will appear for the contractors who are bringing the action, and Mr. Danckwerts, K.C., and Mr. J. Serjeant for the Sheffield Corporation.

There is no other action of outstanding interest in the Chancery Division. The much-anticipated patent action by the Osram Lamp Works against the "Z" Electric Lamp Syndicate has had to be postponed through delay in completing the pleadings.

In the Court of Appeal, the dispute between the Metropolitan Electric Tramways, Ltd., and the Tottenham Urban District Council with regard to the rating of their tramways, will be heard. The tramway company claim that lines sanctioned under the Light Railways Act should only be assessed as railways, *i.e.*, one-fourth the rateable value, but this contention was dismissed at a Middlesex Petty Sessions. By agreement, the appeal of the Company to a Divisional Court in June this year was dismissed without argument in order to hasten the case getting to the Court of Appeal.

DISPUTE re MUNICIPAL WIRING RULES AT ST. PANCRAS

AN interesting and unusual application has been made to Mr. Bros, the Magistrate at the Clerkenwell Police Court. It appears that the St. Pancras Borough Council Electricity Department issued a regulation at the end of last year as follows: "On and after January 1st, 1911, all main fuses should be of the enclosed cartridge type built up of porcelain. If other types are used, a clear break of not less than 4 inches must be provided for main fuses and 3 inches for sub-fuses. All main fuses to be enclosed by preference in hard-wood boxes lined with asbestos. Ironclad and double-pole main fuse boxes prohibited."

As the distance between contacts in the fuse of a standard distribution board is about 2½ inches, and is certainly quite ample for all ordinary purposes, the regulation in question is naturally a cause for complaint among electrical contractors working in St. Pancras, and the prohibition of ironclad main fuses is, to say the least, remarkable.

The battle against the Borough Council has been opened by Mr. Syer, of the firm of Macdonald, Syer & Co., who is a St. Pancras ratepayer and at the same time a wiring contractor. It appears that the Borough Council had refused to connect up a new 150-light installation which this firm had completed in Fitzroy Square, owing to ordinary cartridge fuses having been used instead of the porcelain cartridge fuses specified in the rule. Mr. Syer, who appeared in person, applied to the magistrate for the appointment of an electrical inspector to settle the dispute, under Section 28 of the St. Pancras Lighting Order, which is as follows:—

Appointment of Electrical Inspector by Court of Summary Jurisdiction.—A Court of Summary Jurisdiction, on the application of any person supplied with electricity by the undertaker within the area of supply, or by the undertakers, shall from time to time appoint, or shall appoint and keep appointed, one or more competent persons to be electric inspectors for the purpose of inspecting electric lines and works and certifying meters under this Order.

The application was opposed by Mr. Barrington Ward on behalf of the Borough Council, who raised various technical legal objections, and the case has been adjourned until October 19th, when Mr. Syer will probably have legal assistance. The Electrical Contractors' Association are watching the case.

The procedure is somewhat unusual. The St. Pancras Electric Lighting Order dates back to 1883, and in the case of later Provisional Orders and Special Acts it rests with the local authority or Board of Trade to appoint an electrical inspector, but, as seen above, at St. Pancras application has to be made to a magistrate. Further, it is doubtful whether it would fall within the duties of an electrical inspector, if appointed, to decide with regard to a dispute as to the method of wiring premises.

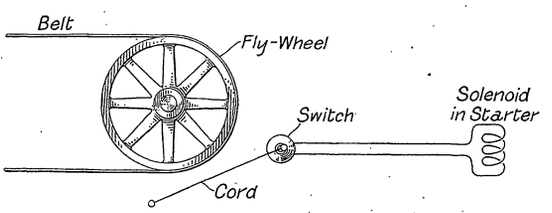
Even if the St. Pancras Borough Council are within their legal rights in insisting on the observance of the rule in question, or in making its observance a condition in the consumers' contracts, we cannot but think that they will be well advised to drop it, as it is certainly an unnecessary restriction. Were it an essential to good wiring work, ninety-nine hundredths of the wiring for electric lighting in this country would be bad.

CORRESPONDENCE

A SAFETY DEVICE.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—I enclose, for the benefit and safety of your readers who have charge of any power installations, a rough sketch of automatically stopping a motor should a belt break. Passing under a fly-wheel or driving belt is a cord, one end secured to a bracket, and the other end secured to an ordinary 5-amp.



switch knob. From the switch two wires are run to the no-voltage release coil of the starter.

When the strap breaks, it fouls the string, and closes the switch, which short-circuits the release coil of the starter and stops the motor. I have had it in use some time, and it has been of great value. It cost about 2s. 6d. to fix.

Yours truly,

Sept. 25th, 1911. F. C. MOINS.

A MINER'S LAMP.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—With reference to the notice in your Mining Supplement of the 5th inst., regarding a miner's electric lamp made by the Electrical Power Storage Co., I do not quite see how 27 hours' light could be got from the battery mentioned. The latter is stated to give 10 ampere-hours 4 volts, or, say, 1½ watts for 27 hours. The lamp gives 2½ c.p., which would make its consumption 0·6 watt per c.p. I have never heard of a metal filament lamp with as low a consumption as this.

Yours truly,

J. S.

[Our correspondent is certainly justified in his criticism. The lamp can only consume 1½ watts if it will burn 27 hours on one charge, as the makers claim. Presumably they have taken the reflector into account when estimating the candle-power at 2½.—ED. *E.E.*]

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Oct. 5, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications. Names in italics indicate communicators of inventions from abroad.

26,119/10. **Commutator Motor.** J. Gray (*Latour*). A method of controlling a series-connected polyphase machine of this kind is described in this specification. Each phase of the stator winding is permanently connected in series with the corresponding phase of a transformer, the secondary winding of which is taken to the brushes. By means of a two-way switch the stator can be star-connected for low speeds and for starting, and delta-connected for higher speeds. One figure.

28,755/10. **Secondary Batteries.** G. Inrig and Gavan Inrig, Ltd. A dry storage battery, with no plates to buckle, is made up as follows:—The positive electrode is a carbon block of star-shaped cross-section, fitted into the centre of a block of depolarising material. The electrolyte is separated from a zinc electrode of square section by a series of cane strips ⅛ in. square to allow for air circulation. In charging the cell, contact is made with the zinc through the moisture absorbed by the cane strips from the electrolyte. As the charging proceeds, a spongy deposit collects on the zinc and makes a permanent porous connection between the zinc and the electrolyte. Two figures.

30,323/10. **Filament Supports.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). The strength of filaments at their points of support is increased by this method of mounting. The copper leading-in wires are flattened and perforated at the ends, through which the filament is passed. It is then surrounded at this point by a helix of some tough material, such as drawn molybdenum, and the wire, filament, and helix are welded together by an arc. The filament is supported at the curved end of the bulb by a similar helix, which is fused at one end into a glass support attached to the bulb. The filament is then slipped over one of the coils of the helix and mounted so that a certain amount of tension is exerted on the filament. Should this tension be too great, it is adjusted during incandescence, as the heat communicated to the helix causes it to soften, and the coil adjoining the filament is drawn out. Four figures.

1,162/11. **Manufacture of Lamps.** H. G. Moller. The auxiliary metal, which is always added to the refractory material to render it workable, is by this method almost entirely eliminated before mounting it on the supporting frame. It is maintained that the small quantity, about 1 per cent., that is left in gives the filament sufficient flexibility to enable it to be mounted and to receive the necessary bends. At the same time, the percentage of this metal becomes so small that the lamp can be manufactured with this amount still present, which will leave it during use.

12,976/11. **Condensers.** Aktieselskabet Hovlands Radiotelegraf. These comprise hollow bodies of insulating material in the form of inverted truncated cones, provided with inner and outer metallic coatings. The end of these are well separated by means of a coned flange placed reversely at the open end of the body. To reduce the space, and at the same time to obtain a large capacity, these are placed one inside the other, so that the outer and inner coatings of neighbouring condensers are in contact, and connections can therefore be made between alternate pairs of the contacting coatings and one terminal, and between the remaining pairs and the other terminal. Nine figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables, and Wires: Burnside [Sealing conductors through vitreous substances] 1,880/11; Chemische Fabrik Griesheim-Elektron [Method of using batteries to supply lamps] 15,447/11.

Dynamos, Motors, and Transformers: Montgomery [A.-C. rectification] 25,385/10; Rucker [A.-C. automatic feed-regulator] 30,054/10; Ozonair, Ltd., and Joseph [Transformer] 7,295/11.

Electrometallurgy and Electrochemistry: Ampère Ges. and Müller [Production of metals and alloys] 21,603/10.

Meters: Glover and George Glover & Co. [Coin-controlled meter mechanism] 25,172/10.

Switchgear: Berry [Switches for heating apparatus] 21,943/10; Weymouth [Switches] 4,922/11; Harhorn [Reversing switch for hub-motors] 5,871/11; Venner and Griesbach [Automatic switches] 13,103/11.

Telephony, Telegraphy, and Signalling: Scott [Signalling apparatus] 13,837/10; Jones [Selective systems for printing telegraphs] 14,484/10; Wirth and Beck [Varying the tuning of receivers] 28,973/10; Girardeau [Automatic commutator for radiotelegraphy] 3,946/11; Ges. für Drahtlose Telegraphie [Production of slightly damped oscillations] 8,712/11; Girardeau [Mounting receiving and transmitting apparatus] 11,999/11; Macku [Production of slightly damped oscillations] 8,524/11.

Traction: Jack [Conduit system] 22,120/10; Siemens Bros. & Co. (*Siemens & Halske Akt.-Ges.*) [Electric supervision of railway points] 774/11.

Miscellaneous: Johnson (*Badische Anilin & Soda Fabrik*) [Purification of gases] 30,194/10; Weissmann [Illuminating bodies] 3,950/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Motors: Spalazzi [For transmitting angular movements] 9,555/11.

Miscellaneous: Allgemeine Elektricitäts Ges. [Arc rupturing devices] 20,409/11.

The following amended Specification can now be obtained.

C. A. Parsons [Turbines] 25,651/09.

Amendment

23,077/05. **Electric Welding.** L. S. Lachman. This specification referred to in Electrical Engineering, April 6th, 1911, p. 183, has been amended by making Claim 1 more explicit. The specification relates to a process of welding together sheet metal articles, on which projections are made, and sufficient space is provided to allow for the spreading out of the fused metal projections, so as not to interfere with the close contact of the parts.

Opposition to Grant of Patent

22,239/10. **Telephone System.** H. G. White. Opposition to the grant of this patent has been entered. It relates to an intercommunication system in which each station is provided with a relay. This has a movable armature connected to the receiver, which operates between two contacts connected respectively to the home line and selector switch, so that when the relay is energised by pressing the ringing key, the receiver is disconnected with the home line and placed in contact with the selector switch without mechanical aid, and is kept in this position as long as the receiver is off the switch hook.

Expiring and Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: W. R. Ridings, 13,025/05.

Insulating Materials: W. A. Phillips and F. Hutchins [Insulation for conductors] 13,943/07.

Dynamos and Motors: C. H. Iles and W. Armistead [Separate excitation arrangement] 14,433/06; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Armatures, field magnets] 14,203/07; T. S. S. Marshall [Brush-holders] 14,413/07.

Storage Batteries: H. E. R. Little [Secondary batteries] 13,983/07; E. L. Oppermann [Secondary batteries] 14,255/07.

Switchgear and Fuses: A. B. Reynders, C. B. Auel, R. D. T. Alexander, and J. R. Spurrier [Switches, cut-outs] 13,911/03; J. H. Golding [Switches] 14,111/04; A. B. Webber and Standard Time Co. [Switches] 12,999/05; M. Kallmann [Switches] 14,058/06.

Telephony, Telegraphy, and Signalling: A. Muirhead [Aerials] 14,060/06; W. H. Wheatley (*C. Govenz*) [Telephone system] 14,090/06; A. J. Boult (*Zorge Safety Railway Equipment Co.*) [Railway signals] 14,398/06; E. E. Moore and W. Powles [Signalling] 14,150/07; C. Enderlein, W. Landwehr, and K. Schulz [Signalling system] 14,183/07; British Insulated & Helsby Cables, Ltd., and W. Bartlett [Telegraphs] 14,238/07; C. F. Blundell [Switches] 14,259/07; H. W. Lake (*C. M. Thompson Co.*) [Telephone switches] 14,368/07.

Traction: G. R. Forster [Trolley collector] 13,940/07.

Electrometallurgy and Electrochemistry: S. Z. De Ferranti [Furnaces] 13,949/06 and 13,949A/06.

Incandescent Lamps: H. J. Haddan (*Bergmann-Elektricitäts-Werke Akt.-Ges.*) 13,986/07.

Meters: D. J. Steele and C. Kratt [Meters] 13,973/03.

Miscellaneous: J. A. and E. W. Timmis [Electromagnets] 14,109/02; A. Denny and C. H. Johnson [Dynamometers] 13,690/03; S. O. Cowper-Coles [Pointing needles, pins by electrolysis] 13,980/07; H. Henning [Testing a cut-out] 14,426/07.

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TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Some interesting statistics of the past year's working appear in the Postmaster-General's fifty-seventh annual report on the Post Office. We note a satisfactory increase in the use of the wireless coast stations. New stations are to be provided at Newcatle-on-Tyne, and in the neighbourhood of the Island of Valentia, and at Land's End to replace the existing station at the Lizard. The ranges of the two last-named will be 500 and 250 miles respectively. New licences for 107 land stations were granted during the year. All of these, with the exception of one, were for experimental purposes. With a view to the quicker despatch of telegraph messages between London and the larger provincial offices, the Wheatstone apparatus and Gell keyboard perforators are now used. The Baudot apparatus has been installed experimentally on the London-Birmingham circuit, and the Murray multiplex apparatus on the London-Manchester circuit. Trials have also been made of Undulator apparatus between Bristol and Cork. The licences for the municipal telephone systems at Hull and Guernsey expire at the end of the year, and the continuation of the service is under consideration. The licence of the Portsmouth Corporation does not expire until 1926, and the Corporation do not wish to sell the system to the Post Office nor to purchase the National Telephone Company's plant. The Post Office will, therefore, have to compete with the Corporation until 1926. A submarine cable with loading coils for the Anglo-Belgian service is also referred to. This, we may mention, has now been laid. Reference is made to the repeated opposition of the local authorities to the erection of overhead wires, and appeals to the Courts have had to be made in many instances. We refer to one elsewhere on this page.

There has been an interesting dispute between the National Telephone Co. and the Hythe (Kent) Council with regard to the retention of overhead wires in the Borough. For some time past the Council have been agitating for the removal of a number of poles and wires in the Grove and the Mayor's Avenue, which are two of the beauty spots of the town, and require the company to transfer the wires underground. The company refused to do this owing to the expense involved, and as the Council insisted upon having its own way, and ordered the wires to be removed, the company agreed to do so, intimating at the same time that the subscribers would be left without telephonic communication. Not deterred by this threat, the Council insisted upon the wires being removed, and the company informed the particular subscribers affected, numbering 72, that after yesterday they would not be able to secure any telephonic communication. The determination of the company apparently brought the Council to its senses, for they have now asked the company to withhold any action until they have interviewed the Postmaster-General in order to ascertain the possible attitude which he will take up in the matter when the Government take over the Telephone Company's system.

Particulars as to an application for the extension of the Strowger automatic telephone patent appear under "Pending Electrical Lawsuits," on another page.

It is stated in the daily papers that some successful experiments have just been carried out at Portsmouth in the control of submarines by Hertzian waves. The experiments, it is stated, were conducted off Selsey with one of the Holland type submarines.

According to the *Daily Telegraph* New York correspondent, wireless operators at San Francisco have exchanged messages, for the first time, with Japan over a distance of 6,000 miles of ocean. The connection was established with the Japanese operator at Hokesu, which is the most northerly wireless station in Japan.

Successful trials are reported over the new telephone line between Paris and Madrid.

We referred in our issue for September 28th, p. 537, to a case in which the Southwark Borough Council objected to the erection of overhead wires by the Postmaster-General in certain streets. Mr. Hopkins, Magistrate at the Lambeth Police Court, delivered judgment on Monday in favour of the Postmaster-General. The proposal was to connect two or three fire alarm posts with one of the County Council fire stations, and the erection of overhead wires was estimated to cost £90, whilst the proposal of the Borough Council to put them underground would involve a cost to the Post Office of £340. The magistrate said that he made up his mind on the matter without any difficulty. He had walked over the streets in question, and had failed to imagine how they would be worse for the addition of fifteen telegraph poles at intervals throughout their length. He had been unable to discover any reason for apprehending either danger, disfigurement, or inconvenience.

The Bissao-Bolama cable communication with Quillenges and Lubango, the Falmouth-Bilbao cable, as well as the Malta-Tripoli cable, are *hors de combat*, and with respect to the latter it is said that it has been cut.—Turkey has issued notices that code telegrams between that country and Italy are not admitted.—The Alaska lines have not yet been repaired, but telegrams are being sent by wireless telegraphy. —The *viâ* Fao route was down on the 3rd inst., and on the folowing day the lines in Angola to Bucoio and Balombo were not working.—On the 5th inst. the El Arich route beyond Beyreuth ceased working, and the Fao route was in working order.—We are also able to state that lines in Hayti, West Indies, are practically again in normal condition.—The 6th inst. saw the restoration of the El Arich route, while wireless communication with Derna Guelemicho was interrupted. —Code telegrams between Abyssinia and Turkey have been prohibited since 6th inst., and finally we are in a position to inform our readers that a "Coronation Durbar" station has been opened to the public since 2nd inst. The full name is "Coronation Durbar," India."—The cable-ship *John Pender* arrived in England from Bilbao.—On the 9th inst. the Sierra Leone-Bathurst cable was repaired.

ELECTRIC TRACTION NOTES

The Darlington Tramway Engineer has prepared a report upon the adoption of trolley omnibuses, but the Electricity and Light Railway Committee recommend that no further steps be taken in the matter at present.

Subscriptions are being invited for 16,895 6 per cent. cumulative preference £1 shares of the Mansfield and District Tramways, Ltd. This is the balance of 80,000 preference shares.

The deputation appointed by the Edinburgh Town Council to inspect trolley omnibus systems at Leeds and Bradford have issued a report strongly favouring this method of traction. The report contains illustrated descriptions of the two systems now in operation, and discusses the advantages of trolley 'buses as compared with the overhead trolley system. Whilst not suggesting any specific routes, the deputation point out that there are many suburban streets and roads in Edinburgh where trolley omnibuses would be suitable.

The ratepayers of West Hartlepool still seem dissatisfied with the attitude of the Corporation with regard to the tramways. Some time ago, by a small majority, the Corporation committed itself to the purchase of two sections, and after prolonged negotiations have been unable to come to terms with the tramway company to take a further lease of these lines. Consequently, the Council decided to purchase the whole of the lines, and applied for powers to do so, and also for the construction of additional lines. This decision was arrived at by a majority of six, and there is a strong feeling that the matter has been rushed. It has now been suggested that it would be in the interests of the ratepayers if the Corporation, after having secured the control of the whole of the lines, put them into thorough repair, and leased them to another company.

An extraordinary general meeting of the British Electric Traction Co. is to be held on October 17th, for the purpose of considering a scheme for the rearrangement of the capital, as already mentioned in our columns.

The Stepney Borough Council have decided to oppose the London County Council's proposal to reconstruct the present horse tramways from West India Docks to Victoria Park on the overhead trolley system. As the road authority, the Stepney Council insist upon the conduit system.

The first true moving stairways, or "Escalators," in this country, were opened at Earl's Court Station on Wednesday, October 4th, and are used to transfer passengers from the Piccadilly Railway to the platforms of the District Railway, a rise of about 40 ft. The stairways, which were supplied by the Otis Elevator Co. (4 Queen Victoria Street) are four in number, an ascending and descending stairway being provided for both the up and down platforms. The apparatus consists of a series of travelling steps strung together by an endless chain, which is driven by a 35-40 h.p. motor. Each step has two front and two rear wheels, arranged with a wheel base six inches longer than the tread of the step. Separate rails are provided for the front and rear wheels, and

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these are at different levels, while the steps are travelling on the incline, but are level when the steps are travelling flush with each other at the landings, so that the tread is always level. The rate of working is one step per second, and since each step can take three people, the maximum carrying capacity of each stairway is 180 persons per minute, or 10,800 per hour. Hand rails moving at the same speed as the stairway are provided, and these are laterally inclined to facilitate stepping off at the ends. Arrangements are made whereby in case of stoppage of the ascending stairway, the corresponding descending stairway can have its direction of motion reversed. We understand that four of these escalators are being erected at Liverpool Street Station.

The Birmingham Tramways Committee have withdrawn from their programme for 1912 a number of tramways upon which opinions were somewhat divided, but have re-submitted to the Council a number of other tramways, and recommend the authorisation to promote a Bill in Parliament next year.

An interim dividend at the rate of 5 per cent. per annum on the ordinary shares, free of tax, has been declared by the Calcutta Tramways Co.

The St. Helens Corporation have agreed to appoint a special committee to inquire into the relations between the St. Helens Tramway Company and the Corporation.

It is stated that the scheme for constructing a system of trolley omnibuses between Brighton and Worthing, which was abandoned last year, is to be revived.

JOHANNESBURG ELECTRICITY WORKS

£400,000 Damages Awarded

JUDGMENT was issued on Tuesday by Lord Ormidale in the Edinburgh Court of Session in the action by the Johannesburg Municipal Council against D. Stewart & Co. (1902), Ltd., Glasgow, and William Beardmore, shipbuilder and steel manufacturer, for sums amounting to over £400,000 in respect of Messrs. Stewart & Co. having failed to complete contracts for installation of gas engines and electrical plant for tramway, lighting and power purposes. Messrs. Stewart & Co. denied the breach of contract, and stated that the installation was made according to the specification, and that any failure to reach the prescribed tests was due to the unsuitability of the coal supplied for gas-producing purposes. W. Beardmore was guarantor for the performance of the contract, his liability being limited to £115,134. The balance of the sum sued for was £145,000 for repayment of part of the purchase price paid to Stewart & Co., and about £200,000 for damages for breach of contract.

Lord Ormidale found in favour of the plaintiffs, and granted a decree against Stewart & Co. and Wm. Beardmore, jointly, for the payment of £115,134 6s. 6d., with interest at the rate of 4 per cent. per annum from July 1st, 1908, until payment, reserving to Wm. Beardmore such right of relief against Stewart & Co. as might be competent to him. His Lordship further decided against Stewart & Co. for payment to the plaintiffs of (1) £27,961 3s. 1d., with interest at 5 per cent. per annum from July 1st, 1908, till payment; (2) £127,907 8s. 6d.; and (3) £69,175, with interest on these sums of £127,907 8s. 6d. and £69,175 at 5 per cent. per annum till payment. Messrs. Stewart & Co. alone were found liable for costs. In the specification on which the contracts were based, Section A was for gas-producing plant and accessories, Section B was for gas engines, and Sections C, D, and E were for electrical generating machinery—(C) two-phase alternators, (D) direct-current dynamos, and (E) balancers. His lordship said he had to decide, in the first place, whether in fact the contractors repudiated their contracts. He held they did. It seemed to him to be enough, in the view he took, that the contractors admitted that the plant and machinery were not in a condition to allow the stipulated tests to be carried out, and that they threw up the contracts and ceased working. They made no proposal that they should be allowed further time in order to put the plant and machinery in a condition that would satisfy the tests, and their acknowledgment of its inability to satisfy the tests was universal, and included Sections A to E. By their ceasing to work on a day's notice, or rather on a few hours' notice, and withdrawing their workmen from the station, the contractors made it absolutely impossible to apply the provisions to satisfy the stipulated tests, or, indeed, any other provisions of the contracts. He had no doubt that the pursuers were entitled to treat the contracts as at an end, and this obviously involved the guarantor.

LOCAL NOTES

Australia: *Sydney: Policy of Electricity Undertaking.*—Mr. R. Forbes-Mackay, the Sydney City Electrical Engineer, has prepared a report upon the future of the electricity undertaking, in which he recommends extension of mains in all directions and to sell electricity at the lowest possible price for all purposes with the object of helping manufacturers, and superseding obsolete, dirty, and unwholesome methods of lighting and power production. The Electricity Committee have postponed their discussion on the matter, the Town Clerk having been asked to submit a report on the policy followed in Great Britain and other countries.

Batley: *Electricity Committee.*—Alderman George Hirst, one of the members of the Electricity Committee, has informed the Council that in consequence of what he deems to be the entire lack of management and the lack of business principle in connection with the Electricity Committee, he feels he can no longer continue to be a member.

Birmingham: *Supply in Moseley.*—Considerable progress is being made with the laying of mains for the supply of electricity to Moseley, which is one of the districts recently incorporated with Birmingham. A sub-station has been erected for supplying this district, and others are to be erected for supply to Harborne, King's Norton, and Yardley.

Bristol: *Pupils' Premiums.*—Hitherto it has been the practice for the premiums received from improvers at the electricity works to be divided between the Corporation and the Electrical Engineer, and these payments have been taken into consideration in fixing the amount of his salary from time to time. The average amount received by the Electrical Engineer during the last ten years from this source has been £102 per annum. The Committee now recommend that the whole of the premiums received should be paid over to the Corporation, and that the Engineer be paid £100 per annum in lieu thereof, to be considered as a salary.

Canada: *Electric Power Supply.*—The Imperial Trade correspondent at Toronto, says the *Board of Trade Journal*, reports that a company with a capital of £8,200,000 has been granted a charter in Canada with powers to purchase lines and water powers for the generation of electric energy. An address to which communications may be sent is on file at 73 Basinghall Street, London, E.C.

Cheltenham: *Extension of Area.*—The Council have decided to apply to the Board of Trade for an electric lighting provisional order to considerably extend the present area of supply.

Hull: *Electricity Supply.*—The Electricity Committee have been in negotiation with the Hessle Council with regard to the supply of electricity, and have made an offer of 2d. per unit up to 70,000 units, and 1½d. per unit up to 100,000 units.

London: *City of London Tramways.*—The L.C.C. have asked for the consent of the City Corporation for the construction of tramways from the City boundary at Norton Folgate to a point near the Great Eastern Hotel, Liverpool Street, and for the construction of tramways from Charles Street, Farringdon Street, to the north side of Ludgate Circus. The lines would be the property of the City Corporation, as in the case of the tramway over Blackfriars Bridge, and would be leased for a nominal sum to the London County Council. It is understood that the Improvement and Finance Committee will recommend the City Corporation to give its approval.

Hackney: Electricity Sales Department.—In his annual report, the district auditor points out that owing to the transactions of the wiring and fittings department having increased considerably, it is necessary to carefully consider the system upon which the cost of the works is recorded. He recommends that in order to put the matter upon a satisfactory basis, a slight addition to the clerical staff is necessary.

Middlesbrough: *Electricity Accounts.*—After meeting capital charges, &c., there is a net profit on the working of the electricity undertaking last year of £2,078. This sum has been transferred to reserve fund. The total costs were reduced from 1·157d. per unit to 1·083d. per unit.

Newport (Mon.): *Commercial Manager.*—The Electricity Committee have decided to recommend the Council to appoint a general commercial manager for the tramways and electricity undertakings, with Mr. H. Collings-Bishop as Electrical Engineer to both undertakings. According to the *South Wales Daily News*, Mr. Collings-Bishop has prepared a lengthy report, in which he defends the present method of carrying on the undertakings.

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Ross (Herefordshire): *Street Lighting.*—The question of whether the streets shall be lighted by electricity or gas has been referred to a special committee.

Sheffield: *Electricity Supply.*—A proposal is to be placed before the Council that the chief officials of the tramways and electricity departments should report as to the advisability of arranging for inter-communication between the Neepsend and Kelham Island power stations. The former belongs to the electric light undertaking, and the latter to the tramways.

Worthing: *Plant Extensions.*—The Local Government Board have sanctioned a loan of £4,532 for extensions at the electricity works. Tenders for this plant have already been accepted, and they include Diesel engines.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Biddulph.—The Town Clerk has been instructed to write to several consulting engineers for terms.

Clevedon.—It is stated that an electric lighting company has been formed for this district, and that shares to the value of £6,000 have already been taken up.

Croydon.—A Local Government Board inquiry was held last week concerning a loan of £10,000, of which £9,500 is for the extension of mains for street lighting, and £500 for transformers. There was no opposition. Having gone into some of the figures, Mr. H. Ross-Hooper, the inspector, expressed the opinion that the undertaking seemed to be in a very satisfactory condition.

Darlington.—A loan of £3,220 is to be applied for in connection with the new generating plant at the electricity works.

London: *Hackney.*—The London County Council have agreed to grant a loan of £4,364 at 3¾ per cent. for electricity purposes. Mains extensions are to be carried out at an estimated cost of about £200.

Reigate.—The Local Government Board have sanctioned a loan of £4,859 for new engines, switchboard, &c., repayable in 17 years, and £1,118 for prospective expenditure on mains, house services, and transformers, repayable in 15 years.

Teignmouth.—The Council are discussing the question of electric lighting in connection with an application by Dr. J. W. Purves for permission to apply for an order. The Town Clerk has been instructed to employ a Parliamentary Agent, and, if necessary, a Consulting Engineer, in connection with the proposal.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Coventry.—Considerable extensions to Coventry and Warwickshire Hospital. Particulars from F. J. Cox, 2 Verulam Buildings, Gray's Inn, or H. W. Chattaway, Trinity Churchyard, Coventry.

Croydon.—Electric theatre, Windmill Road. J. J. Taylor, Westminster.—24 houses, Baring Road, H. R. Hunter, Sydenham.—12 houses, Ashburton Avenue, P. Crowley, Burlington Road.

Lancashire.—New County schools at Failsworth and Denton. H. Littler, 16 Ribblesdale Place, Preston.

Swansea.—Tenders are invited for an electric light installation at the Corporation's cattle market and slaughter-house. Borough Electrical Engineer.

Tunbridge Wells.—New County school for the Kent Education Committee. F. W. Crook, Caxton House, Westminster.

Uxbridge.—Tenders are to be invited for the electric wiring of the scarlet fever and diphtheria wards at the Kingston Lane Hospital.

Winchester.—Elementary school. Architect, A. H. Johnson.

York.—Stores for hotel department, North Eastern Railway. Secretary.

MISCELLANEOUS

Australia.—The Deputy Postmaster-General, Melbourne, invites tenders by November 28th, for 2,000 ebonite telephone ear pieces, and 5,000 stoneware insulators.



Enfield.—Tenders are invited by October 25th for the installation of eight telephone instruments and the overhauling of two existing 10-line exchanges at the Chase Farm Schools. Consulting Engineers, Messrs. May & Hawes, Caxton House, Westminster.

Rotherham.—The Council have agreed to several extensions of the tramways in the Borough.

Russia.—According to the *Board of Trade Journal*, the Russian Administration of Posts and Telegraphs have applied for powers for laying an additional line between Moscow and St. Petersburg, at an estimated cost of about £21,100.

Truro.—Tenders are invited by October 21st for an internal telephone system at the new County offices. Particulars from the Clerk of the Works.

TENDERS RECEIVED AND ACCEPTED

Australia.—The *Australian Mining Standard* states that the Victorian Postmaster-General has accepted the tender of the Automatic Electric Co. for an automatic telephone switchboard for the new Geelong telephone exchange, at a cost of £14,293. There were two tenders for automatic boards, the accepted one being the lowest. The departmental experts have reported to the Postmaster-General that the automatic system will probably prove suitable in Geelong, though they are less certain of its suitability for the metropolitan exchanges at Sydney and Melbourne. The board in question is being installed as an experiment.

Lewes.—The Electric Lighting Committee have again recommended the acceptance of the tender of the Lewes and District Electric Supply Co. for street lighting. A similar recommendation a short time ago was referred back for further consideration. The tender of the Electric Lighting Co., which is now accepted, involves a saving of 6s. 3d. per post compared with the price previously paid for gas.

London.—Messrs. Willans & Robinson, Ltd., have received an order from Messrs. D. Napier & Son, Ltd., for a Willans-Diesel oil engine to drive a 200-kw. direct-current dynamo, for installation at their works at Acton Vale, London, W.

South Africa.—According to *Commercial Intelligence*, Messrs. Siemens Bros. & Co., Ltd., submitted the lowest tender for the Potchefstroom electric lighting contract, but the Town Engineer has recommended the division of the work between two other contractors, Messrs. Reunert & Lens, and Messrs. H. Davies & Co. The tenders of these two firms amount to £12,487, as compared with £12,243 tendered by Messrs. Siemens for the whole work.

APPOINTMENTS AND PERSONAL NOTES

A mechanical superintendent is required at the West Ham power station. (See an advertisement on another page.)

Seventy-four applications were received by the Hackney Borough Council for the position of third-class clerk in the Electricity Sales Department, at a commencing salary of £105, rising by £7 10s. per annum to £120 per annum. The Electricity Committee put forward the names of W. E. Bates, Prime Cost Clerk, Southwark Electricity Department; F. G. Jennings, Prime Cost Clerk, Poplar Electricity Department; and G. Woolley, at present with the Western Electric Co., Ltd.

Mr. E. L. Joseph, Managing Director of Ozonair, Ltd., has appointed Mr. R. Borlase Matthews as Manager. Mr. Matthews informs us that he is relinquishing his present work as consulting engineer to take up the appointment.

Mr. W. C. Field wishes to notify his numerous friends that he is in charge of the stand of Metalite, Ltd., at the Electrical Exhibition, Olympia, where he will be glad to see any of them.

The Secretaryship of the Junior Institution of Engineers, rendered vacant by the resignation of Mr. Walter T. Dunn, has been filled by the appointment of Mr. A. Clifford Swales, Engineering Assistant to the City Engineer of Leeds.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars c.i.f. port of arrival, quoted on Tuesday night, was £56 15s. to £57 (last week, £56 15s. to £57 5s.).

Liquidations.—A meeting of creditors of the Lahmeyer Electrical Co. will be held at 133 & 135, Oxford Street, London, on Thursday, October 19th, at 12 noon.

Creditors of the Howe Electrical Engineering Co., Ltd., are requested to send particulars of their claims to Mr. A. Thraves, 7 Victoria Street, Liverpool, before October 11th.

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Bankruptcies.—A first and final dividend of 5s. 6d. in the £ will be paid in the bankruptcy of George Barker, Electrical Engineer, Roundhay, Leeds, on October 16th, at the Official Receiver's office, the Red House, Duncombe Place, York.

The first meeting of creditors in the bankruptcy of W. F. Flint, Electrical Engineer, 53 Jameson Street, Hull, was held last week. The gross liabilities were estimated at £1,785, and the deficiency at £1,106. The bankruptcy is attributed to loss on contracts, and a committee of inquiry has been appointed.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"White's Engineering Pocket Book." 93 pages, 5 in. by 3½ in. (Wigan: Thos. Wall & Sons, Ltd.) 1s. 0d. net; abroad 1s. 1d.

"The 'Cole' Code." 123 pages, 7½ in by 10 in. (Rugby: The "Rugby Advertiser," Ltd.) 10s. net; abroad 11s. 1d.

"Electrical Mining Installations," by P. W. Freudemacher. 188 pp., 6½ in. by 4¼ in. 36 figures. (London: Constable & Co., Ltd.) 1s. net; abroad, 2s. 2d.

"Mill and Factory Wiring," by R. G. Devey. 197 pp., 6½ in. by 4¼ in. 128 figures. (London: Constable & Co., Ltd.) 2s. net; abroad, 2s. 2d.

"Pitman's Shorthand for Electrical and Engineering Correspondence." 90 pp., 6½ in. by 4¼ in. (London: Sir Isaac Pitman & Sons, Ltd.) 1s. 6d. net; abroad, 1s. 8d.

"The Electric Propulsion of Ships," by H. M. Hobart. 167 pp., 8¾ in. by 5½ in. 43 figures. (London: Harper Brothers.) 5s. net; abroad, 5s. 4d.

"Boilers and Boiler Control," by J. B. C. Kershaw. 59 pp., 7¼ in. by 4¾ in. 17 figures. (London: Davis Bros.) 1s. net; by post, 1s. 1½d.

NEW COMPANIES

LEITNER ELECTRICAL CO., 7 Princes Street, Westminster, S.W. Capital, £27,500. To acquire from H. Leitner a license to work his electric train and boat lighting system.

GLAIS ELECTRICAL CO. Capital, £2,000. To take over the electric lighting station now carried on by E. Lewis, at Glais, Glamorganshire.

MUNICIPAL TRAMWAYS ASSOCIATION (Incorporated). Registered with 300 members, each liable for £1 in the event of winding up. The management is invested in a Council, the first members of which are:—J. Dalrymple, H. E. Blain, C. J. Spencer, A. L. C. Bell, J. Aldworth, H. Linsley, A. R. Fearnley, A. Baker, P. Fisher, S. Flint, J. B. Hamilton, J. M. McElroy, H. Mozley, W. F. Russell, L. Slattery, E. R. Pickmere.

INDUSTRIAL PLANT CO.—Capital, £40,000. Manufacturers of all classes of machinery in connection with the generation and supply of electricity. The first directors are Mr. F. S. Newall and Mr. R. P. Sloan (Newcastle).

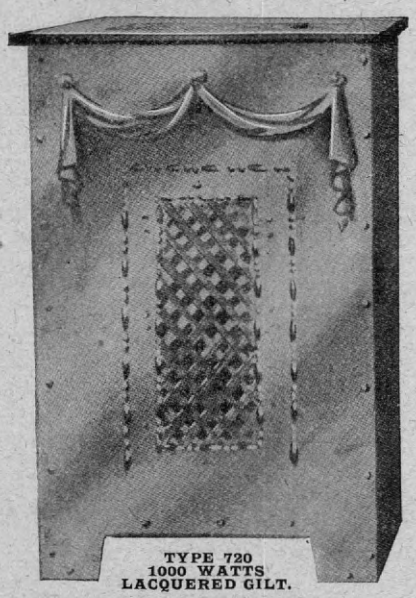
ORMSKIRK ELECTRIC SUPPLY CO.—Capital, £3,000. To acquire an Electric Lighting Provisional Order granted in 1900 to the Ormskirk Council. The subscribers are Messrs. Rhodes Motors, Ltd., A. L. Rhodes, and J. W. Speight.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Willans & Robinson.—The half-yearly meeting was held in London on Tuesday, Mr. A. C. Peache presiding. He pointed out that the recent law case, which had involved the company in a heavy loss, arose out of contracts carried out by the Queensferry Works. The Rugby business now stood on its own merits, and since the close of the year the Thames Ditton Works had been sold. The loss of £7,692 for the past half-year was entirely due to the continued low scale of prices. The debtor balance of £91,948 was owing to the fact that their business was largely with municipalities, whose custom was to spread payment over twelve months after delivery.

British Thomson-Houston Co.—The report for the year to March 31st shows a net profit of £6,374, and after writing off £628 depreciation on office furniture, &c., and £5,343 depreciation on apparatus, meters, supplies, &c., a balance of £403 is carried forward. Satisfactory business in all departments is reported.

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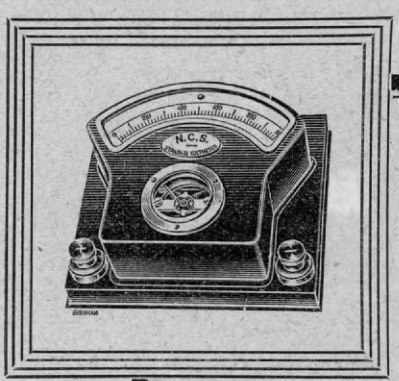


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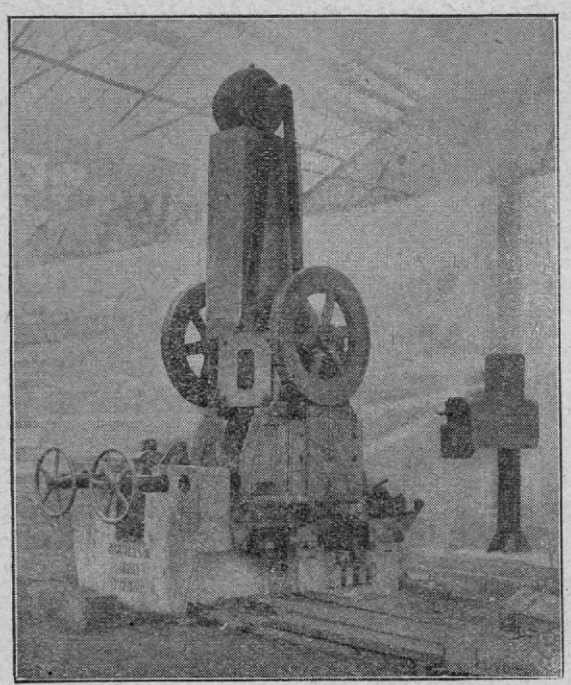
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WIRING CONTRACTORS. See page iv.

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THE ELECTRICAL EXHIBITION OF 1911

PART V.

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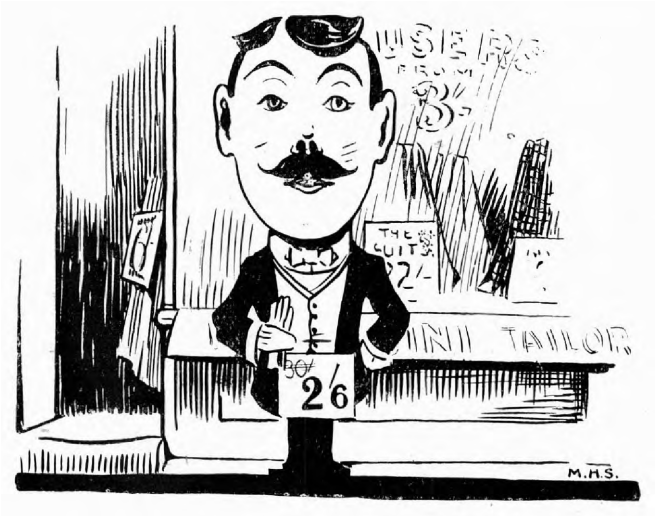
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CHEAPNESS

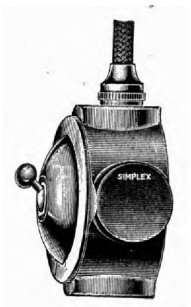
is an object which has been aimed at by all classes to such an extent that it has almost become a craze by those people who regard low price as the only qualification necessary. It is an admitted fact, however, that the best is the cheapest in the end, but in no case has the demand for cheapness been more pronounced than in electric wiring, and the same qualifications apply. It is probably through the introduction of the metal filament lamp and the consequent reduced cost of electric lighting that has brought the consideration of lower costs for installation work much to the fore during the last eighteen months. The Central Station Engineer now finds it necessary to reach a consumer who before did not merit his attention, either because his bill was already sufficiently high with the old carbon filament lamps, or because the price he found it necessary to charge for electricity per unit was such as to place this form of illumination beyond the means of the small consumer. The trade is, therefore, faced with the problem of finding a cheap and efficient system of electric wiring which can be installed in small villas, artisans' flats, and dwellings on a wholesale basis at a very low cost.

Although the electrical contractor himself has possibly no particular desire to use cheap systems of wiring, it has become necessary owing to the force of circumstances mentioned and by the pressure put upon him by Central Station Engineers, Architects, and Builders. There are, at the present moment, numerous low priced systems of wiring available which possess more or less the defects consequent upon cheapness. It is of interest, therefore, to the whole of the industry to be acquainted with those systems which combine the greatest factor of safety at the lowest costs. In this particular connection special mention may be made of Simplex flexible wiring system; the very fact that this system bears the name SIMPLEX, which is synonymous with everything of the best in installation material, substantiates the claim made that the system is worthy of careful consideration. It should not be overlooked that the promoters have had very many years of close practical connection with electrical installation work, and are therefore able to give appreciation of the difficulties and considerations which arise, which many other makers who rush into the business are not able to do.

Briefly described, the charm of the system is the simplicity of its erection. This is arrived at by the introduction of a minimum number of component parts, which go to form the whole system. This flexible wiring system has a circular twin flexible wire, which is supplied in two styles; the first has a flame-proof cover, and the second is braided with tinned copper wire, which, without diminishing in any way the flexibility of the cable, provides perfect mechanical protection against injury, and at the same time allows the whole system to be erected electrically continuous throughout its length. This latter point is one of the greatest importance, and is not met with in any other purely flexible system. For use with this special flexible a Universal cast-iron box has been designed, which will take either a ceiling rose, a switch, a lamp-holder, a wall socket, or any other standard accessory. This box is provided with a patent grip nipple, which effects a secure junction between the cable and the box, and in the case of the armoured flexible, a lasting electrical contact for continuity purpose. It is obvious that as the work is wholly on the surface, one accessory is required that the system can be erected at a minimum price compatible with reasonable safety. Certain extreme conditions which obtain in some situations have led to a modification of this surface flexible system, and out of it has been produced yet another system equally safe and almost as inexpensive, which may be used for external work, wash houses, dyeing and cleaning factories, &c. This is the Simplex lead-covered system, which possesses the further advantage of being watertight. The same fitting—the Universal Box—is used with this lead wire, which is circular twin 1/18's of standard size, the wiring being carried into the box through a special brass nipple in such a manner as to effect a watertight electrically continuous joint between the lead covering of the cable and the box itself.

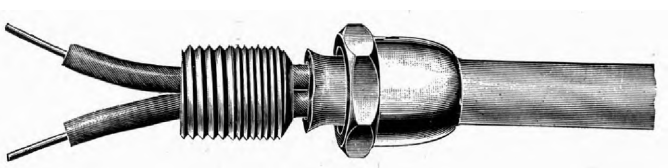
The many engineers interested in this question of cheap wiring should not fail to examine samples of the Simplex Co.'s exhibit at the Electrical Exhibition, Stands Nos. 148 and 163, and particular attention should be paid to the fact that in the case of the lead-covered system there is no soldered joint whatever, connection in both systems being made to specially easily wired terminals of ample proportions on china interiors where jointing work is necessary. The systems have been submitted to many of the leading Consulting and Fire Office and Station Engineers throughout the country, and have secured unqualified approval. Full particulars can be obtained from

STANDS Nos. 148 and 163.









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THE ELECTRICAL EXHIBITION OF 1911

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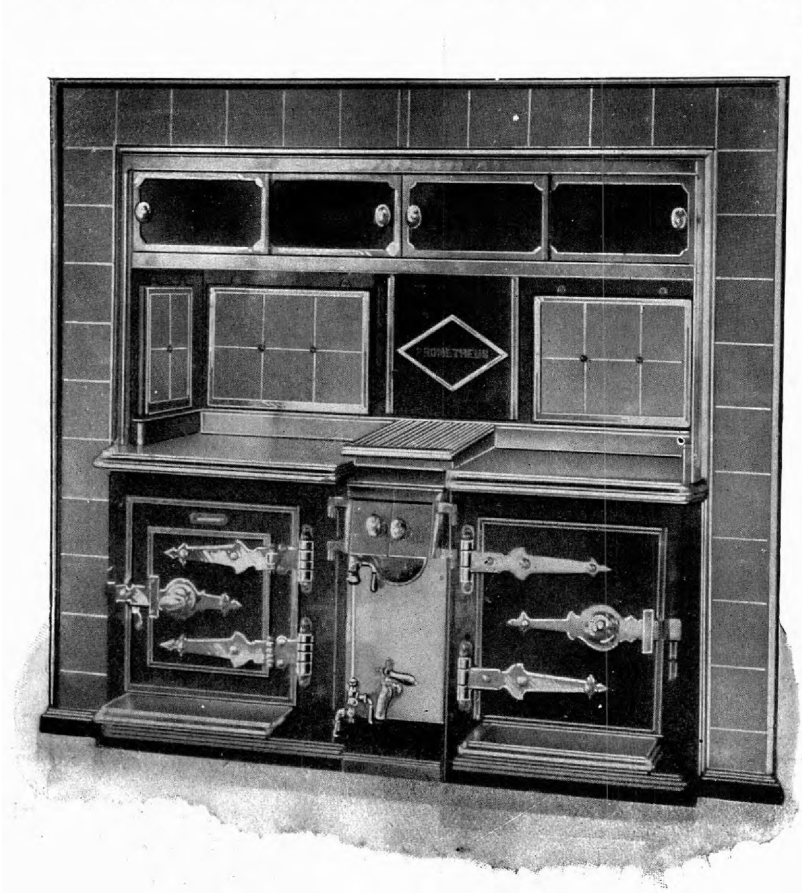
British Prometheus Co., Ltd.,

SALOP STREET WORKS, BIRMINGHAM. (STAND NOS. 197 & 218.)

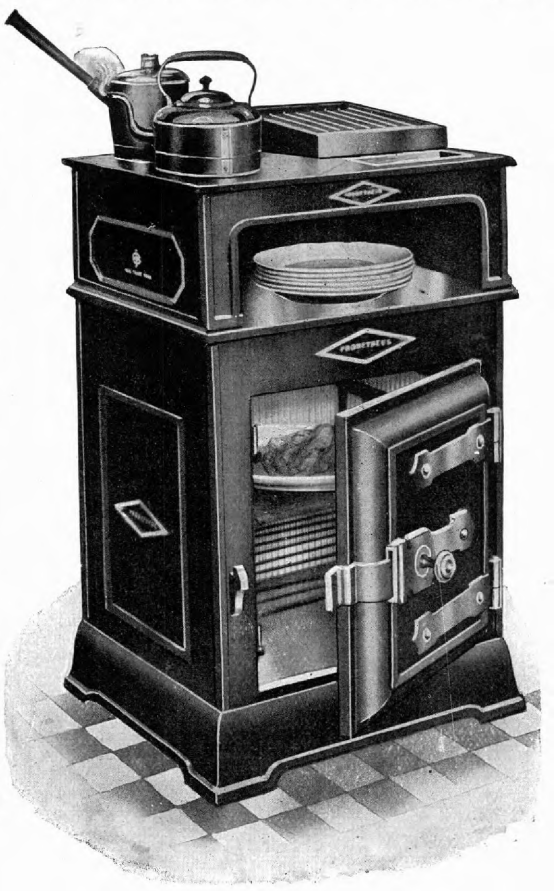
Cooking and Heating.—The interest in the large electric cooking apparatus shown by this firm is considerably enhanced by the statement that the company is prepared to guarantee this apparatus for three years. A large electric cooking range, shown in operation, and capable of cooking for up to sixty people, proves a great attraction. We illustrate this. On the left is a roasting oven 20 in. wide, 19 in. high, and 22 in. deep, taking about 4 kw. at full load. It has an inner glass door so that the food can be inspected without opening the oven. The two sides and back are faced with cast-iron rib plates covered with white vitreous enamel, and behind these are the heating elements, which are constructed on the standard Prometheus principle, namely, very thin films of metal deposited on mica; the mica is backed with an armouring of metal plates. On the top side of the oven is an incandescent heating element (for "browning") made up of rods of "silundum," a highly refractory product of the electric furnace. On the right-hand side is a second oven for baking. The size and arrangement are similar to those of the roasting oven, except that the incandescent heat is omitted. The space between the two ovens contains a cast-iron circulating hot-water boiler, just as does an ordinary coal-fired kitchen range; this consumes about 2 kw., and has armoured Prometheus heating elements at the bottom. Just above this there are incandescent toasting bars of silundum (about $1\frac{1}{2}$ kw., and above this again a nickel-plated grill taking about 2·5 kw. For the grill the Prometheus type of element is again used, and the underside of the grill is machined flat, and is in thermal contact with the armoured elements. Similar elements are employed for a boiling plate and a simmering plate, which are placed one above each of the ovens and take about 2 and 1 kw. respectively. Above the whole is a hot-cupboard, which is sufficiently warmed by the heat rising from the range. It is seen that the total power when all the range is switched on is 17 kw., but in practice the ordinary running consumption is from 6 to 8 kw. only. About half-an-hour is required for the oven to attain its cooking temperature, and as there are eight combinations of heat on each oven, the temperature can be accurately regulated during the cooking; this is facilitated in the case of the roasting oven by a thermometer, the tube of which is outside. When the roasting is practically finished, all the side elements can be switched off and the incandescent element switched on alone for browning off. The toaster, water-boiler, hot-plates, and grill are all subdivided also, so that they can be switched off to half-heat (in some cases also $\frac{2}{3}$ and $\frac{1}{3}$).

A specimen of a slightly smaller oven which the company has supplied in large quantities is also exhibited. This is built on the same lines, consumes $4\frac{1}{2}$ kw., of which $2\frac{1}{2}$ is required for the oven itself and the remainder for the top plate apparatus, and is sufficiently large to cook for twelve to eighteen persons. Its top-plate apparatus comprises a grill, frying-pan, and simmering and boiling plates. A large hot-cupboard and carving table is also shown.

Another large exhibit is a steamer for vegetables and fish. This is supplied by a steam generator taking 15 kw., which has armoured heating elements at the bottom. It will raise steam 15 lbs. per sq. in. in about two minutes. The steamer is in two compartments, each 19 in. wide × $13\frac{1}{2}$ in. high × 20 in. deep, fitted with galvanised iron trays, and it has a total capacity of 1 cwt. of potatoes or 150 lbs. of fish. When the pressure of 15 lbs. is reached the current can be reduced, and we are informed that it will then cook its hundred-



17 kw. Kitchen Range for 60 persons.



4½ kw. Oven, with Grill, Frying Pan, and Simmering and Boiling Plates.

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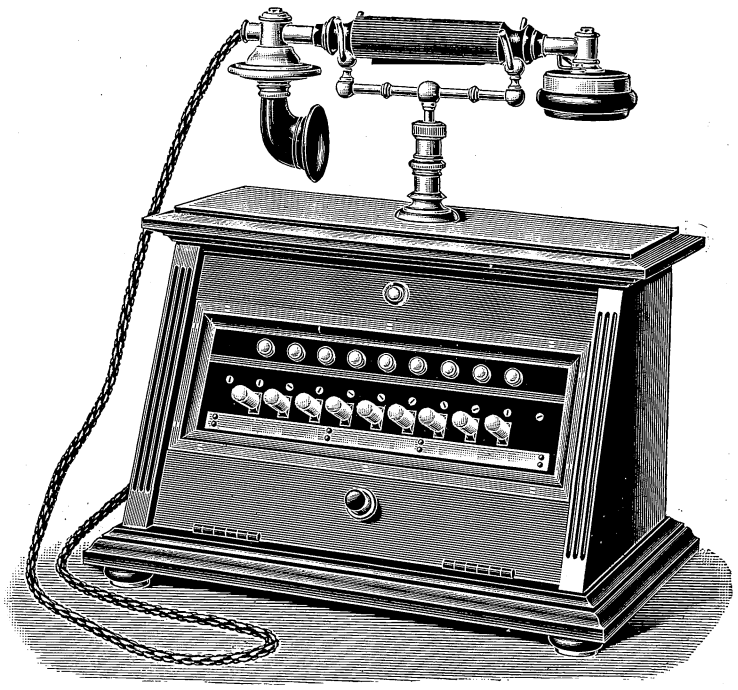
weight of potatoes in from 12 to 15 minutes on a consumption of about 7 kw. Six switches are provided for regulation. The water supply to the steam generator is automatically controlled by a float.

The smaller apparatus exhibited by the Prometheus Co. shows almost endless varieties of kinds and patterns. Various forms of kettles, hot-water jugs with a small heating element at the bottom to keep the water warm, coffee-pots, hot-plates, toasters, and electric irons are to be seen at the stand, and fine examples of convectors for room heating. A "universal voltage" iron with three terminals should be useful; one pair of terminals is for 100 to 125 volts and the other for 200 to 250 volts, so that it can be used almost anywhere. We were also pleased with a plain 12s. 6d. shaving-pot, which will boil the water in one minute, taking 200 watts. Another interesting device is a curling-tong heater, so arranged that the current is automatically switched off when the tongs are taken out.

The Sterling Telephone & Electric Co., Ltd.,

200 Upper Thames Street, E.C. (Stand Nos. 127 & 132.)

Telephones.—In this finely arranged exhibit, the enormous number of sizes and patterns of intercommunication telephones is remarkable. The company's "Primax" interphones, although on the single-wire common return system, are designed to overcome the trouble of induced overhearing and cross-talk from which all common return intercommunication systems are liable to suffer to a certain extent. Two separate batteries are employed, one for speaking (to which heavier conductors are employed) and one for ringing, so that four bat-



Secret Conversation, Lamp-Signalling Interphone.

tery wires are required. In the "Era" interphone, a double line system is employed, so that induced cross-talk is entirely eliminated. The intercommunication telephone "de luxe" is represented by the lamp-signalling, secret conversation interphones. In these last, double lines are used, a cable is run from each instrument to a cross-connection board, and it is impossible for an engaged line to be tipped from another station. A central battery is employed, either a secondary battery or a primary battery of the "sack" type. The lamp indicators give a visual indication of the station calling, and there is also a definite indication to the calling station whether the station wanted is engaged or disengaged. We illustrate the table type of this instrument.

In addition to the interphones large varieties of every kind of instrument are shown, from the cheap "parlyphone" for connecting to bell-circuits to exchange telephones and mining and naval telephones. In the latter the microphone is protected in a practical manner from the shock occasioned by gun-fire.

Bells.—Several examples are shown of the strong, water-tight bells in which the company specialise. In the larger type the entire movement is enclosed in an hermetically sealed chamber, and the motion of the armature is transmitted through a German silver diaphragm, to which the hammer-stem is fixed. The entire movement is insulated from the frame, and the line wires are led in through stuffing glands. The neat design of the company's smaller "Thruster" type bell has been fairly recently described and illustrated in our columns, and will be familiar to our readers. Mention must also be made of the "Unitype" indicator (described in our columns more recently), in which each movement is self-contained in a metal case. The company's ingenious patent hinged backboard is employed with these to facilitate wiring.

The Union Electric Co., Ltd.,

Park Street, Southwark, S.E. (Stand Nos. 101 & 104.)

Arc Lamps.—The most prominent feature of the Union Electric Co.'s stand is the high platform on which is mounted a searchlight projector and a group of the company's well-known Excello flame arc lamps and a very complete exhibit of arc lamps for ordinary use and special purposes such as stage lighting, photographic work, &c. Most of these lamps are fed from a motor generator running on the stand.

Switchgear and Instruments.—Surrounding the lower part of this platform is a series of switch panels representing the company's standard practice in high-tension switchgear. A number of high-tension oil switches of various patterns are shown separately, and one of the most interesting of these is a 6,000-volt 200-ampere remote control switch shown in action complete with control panel fitted with push-buttons and indicating lamps. Examples of mining switches are also shown, as well as complete panels of the safety pull-out pattern. A particular feature of the large representative collection of switchboard and other instruments are the frequency and speed indicators on the vibrating reed principle.

Motors, Transformers, &c.—Among the various patterns of motors shown a novelty is included in a special fully enclosed motor, which is provided with a series of sheet-metal tubes of large cooling surface inside the bedplate, through which the air circulates, giving increased power of dissipating heat while the motor is still fully enclosed. Attention may also be called to the examples of small fan motors, in which all the motor parts are fully interchangeable, this being facilitated by making the carcase of Mannesmann tube instead of from castings.

The London & Rugby Engineering Co., Ltd.,

10 Bush Lane, Cannon Street, E.C. (Stand Nos. 23 & 38.)

Lamps.—Metal filament and carbon lamps, from the very smallest sizes upwards, are shown with every variety of bulb and cap, and specimens of parts of lamps showing the different stages of manufacture are exhibited. Among the special types is a double filament lamp for ships' navigation lights.

Automatic Stokers and Coal Conveyors.—The company are the sole London agents for Proctor stokers, and exhibit both the shovel stoker and the Proctor coking stoker and self-cleaning fire-bars. In the latter stoker the coal is carried well inside the furnace by a ram; the ram travels forward with a charge of coal, and as it returns the coal falls off on to the fire. On the next stroke of the ram, the partially coked fuel is pushed forward, leaving a bright fire underneath to receive the next charge. A ram feed is also the feature of the Proctor coal elevator and conveyor. Jamming and wear of the buckets is prevented by allowing the coal to fall in front of a ram which pushes it forward into the ascending bucket, instead of the buckets being dragged through the coal.

Venner & Co., Ltd.,

6 Old Queen Street, S.W. (Stand Nos. 156 & 157.)

Messrs. Venner & Co. exhibit both inside and outside the tasteful little house which they have erected on their stand, the products of the Credenda Signs Co. (New Canal Street, Birmingham), Chamberlain & Hookham, Ltd. (New Bartholomew Street, Birmingham), for whom they are agents, as well as Venner Time Switches, Ltd.

Signs.—The Venner sign is well known, but it is not often that it has such an excellent opportunity of being compared with other signs, and showing not only how well it can be adapted to decorative work, outlining posters, &c., but how little its brilliancy is affected by neighbouring lights. Each point of light is a glass head closing a hole in the metal front of the sign and illuminated from lamps within. As compared

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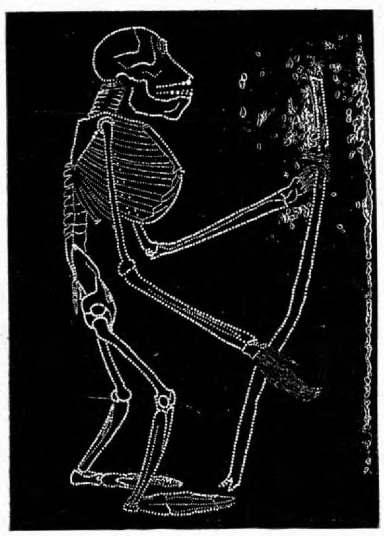
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with signs where separate lamps are used for every point of light, an economy of 70 to 80 per cent. can be obtained. A number of well-known railway posters are shown outlined in this way, and the fearsome skeleton of a gorilla shown here shines out at us by one of the stand entrances. A very pretty effect can be obtained with lamps of several colours, as each



Venner Sign.

colour is reflected separately in every single head. The system is also well adapted to shop window signs, where the same lamps do duty for general illumination as for the sign, and its decorative capabilities are well shown by the design round the top of the stand.

Meters.—A good show is made of Chamberlain & Hookham meters. Among them is the special tramcar meter, with its unspillable mercury container and heavy shunt to avoid damage on short circuits. We understand that 3,000 of these are in use, forming more than 80 per cent. of the tramcar meters in this country. A recent pattern of A.-C. induction type meter is shown, which has a full load torque as high as 7·5 c. grs., and is claimed to have the highest ratio of torque to weight of disc to any on the market. An accuracy within 2·5 per cent. is guaranteed right down to 1/80 of full load, and they are stated to start on $\frac{1}{8}$ of one per cent. of full load. Prepayment meters are also shown, as well as meters fitted with the Lackie maximum demand attachment.

Time Switches.—The Venner time switch (see ELECTRICAL ENGINEERING, Vol. I., p. 730) is well represented, and one of the new patterns shown is a special switch designed for restricted hour service. The switch itself has to be put on by hand, but this can only be done when the clock mechanism allows the catch connecting the loose handle and the switch arm to engage. The switch, however, flies off automatically when the period has elapsed.

The British Electric Transformer Co., Ltd.,

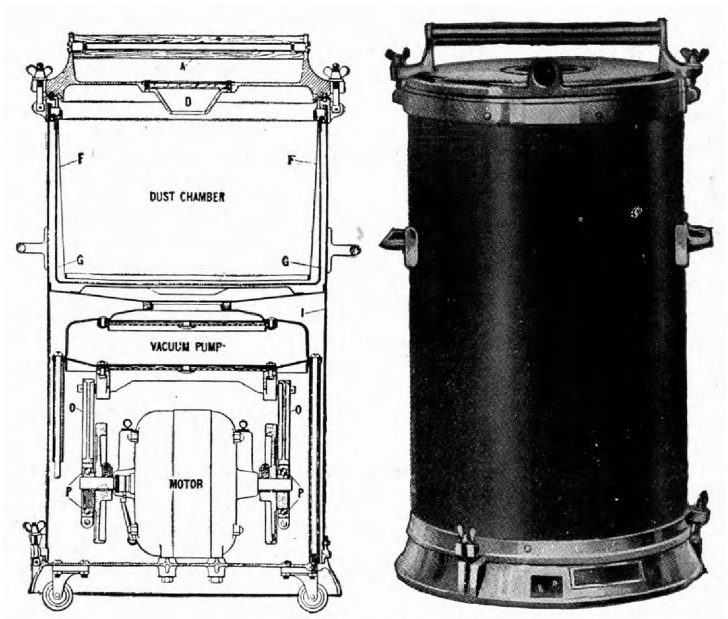
HAYES, MIDDLESEX. (STAND NOS. 30 & 31.)

Transformers and Series Gear.—On this firm's stand are shown two examples of the well-known Berry air-cooled transformer, one for 100 kw. and one for 10 kw., and these are of additional interest as being connected up to the switch-gear known as the Berry series gear, which automatically transfers the load from the large to the small transformer when the demand falls below a certain value, and *vice versâ*, to minimise the light load losses. This system was described in considerable detail in ELECTRICAL ENGINEERING, Vol. III., page 197, February 6th, 1908, but the apparatus now exhibited has some improvements in detail over that there described, principally in that the change-over switch is now enclosed in oil, and, requiring less force to work it, operates particularly smoothly and quietly. It should be mentioned that Berry transformers are used in the special exhibition substation on stand 240, as well as in the permanent Olympia substation, so that the whole of the power used in the exhibition passes through them.

Duncan, Watson & Co.,

62 BERNERS STREET, W. (STAND NOS. 60 & 63.)

Vacuum Cleaners.—This stand is devoted chiefly to demonstrating the firm's portable, electrically-driven, self-contained vacuum cleaner. This apparatus, which is shown in section in the illustration, is of a convenient size for domestic purposes, and contains a positive vacuum pump of the diaphragm pattern, capable of producing a vacuum of 7 to 8 in. of mercury and displacing 25 to 30 cubic ft. of free air per minute, driven direct by ball-bearing cranks



Duncan Watson Vacuum Cleaner.

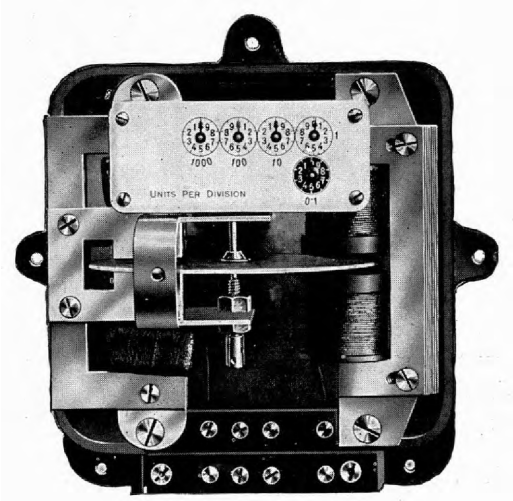
from a $\frac{1}{3}$-h.p. motor. The most approved arrangement of dust filter and receiver is used, and the whole machine runs on ball-bearing castors, but is not too heavy to be easily carried by one person. A particularly complete set of accessories, nozzles, etc., is supplied.

Other Exhibits.—A complete $\frac{1}{2}$-h.p. country-house lighting set with Hornsby oil engine is shown on the stand, and another attraction is a handsome electric fountain.

Haydn T. Harrison,

11 VICTORIA STREET. (STAND NO. 309.)

Street Lighting Fittings.—This stand is devoted to novelties connected with street lighting. Among these are fittings for all classes of streets fitted with Mr. Harrison's special reflectors, which direct the upper hemispherical light rays into the useful angles for street lighting, thus increasing the available efficiency of tungsten lamp fittings by more than 50 per cent. One of the newest of these fittings is

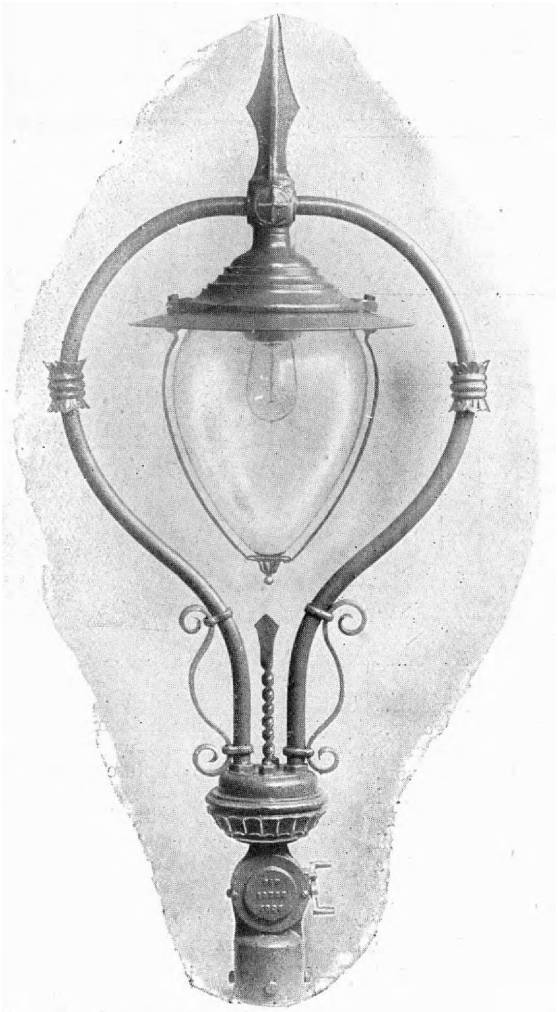


J. B. Meter, with Cover removed.

the high candle-power lantern illustrated on page 88, of which we understand that nearly one thousand have been erected during the last few months to replace open-type arc lamps. In some others combinations of the 100-watt tungsten lamps are used, three of these being necessary to produce 500 effective candle-power. An interesting development in street lighting time switches is exhibited, which does away

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with the necessity of periodically setting for the change in time of lighting or extinguishing. Another interesting feature is the automatic half-night switch, which allows of the number of lighted lamps per lantern being reduced by momentarily switching off the circuits from the switching centres.



New Street Lighting Fitting, to take one 600 c.p. Metal Filament Lamp with Globe, or one 1000 c.p. Lamp without Globe.

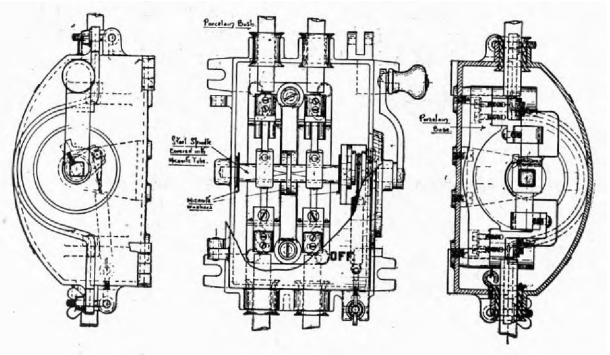
Meters.—On the same stand Johnson Billington Electricity Meters, Ltd. (11 Victoria Street, S.W.) exhibits examples of the J.B. alternating current watt-hour meter, which is quite novel in construction, though the principle of driving by means of a rotary field varying in strength in proportion to the watts is retained. On the other hand the permanent magnet brake with its liability to vary is dispensed with, being replaced by an alternating current magnet excited by coils in series with the fine wire coils of the driving magnet. The advantages gained are absolute permanency, low speed, and low friction losses, perfect temperature correction, and a straight line characteristic under all conditions; the meter will record correctly down to less than 1/100 part of full load, and is not affected by large variations in power factor or periodicity. The construction is extremely simple, and every part is accessible when the cover is removed. An illustration of this meter is given on page 87.

Callender's Cable & Construction Co., Ltd.,

HAMILTON HOUSE, VICTORIA EMBANKMENT. (STAND NOS. 196 & 219.)

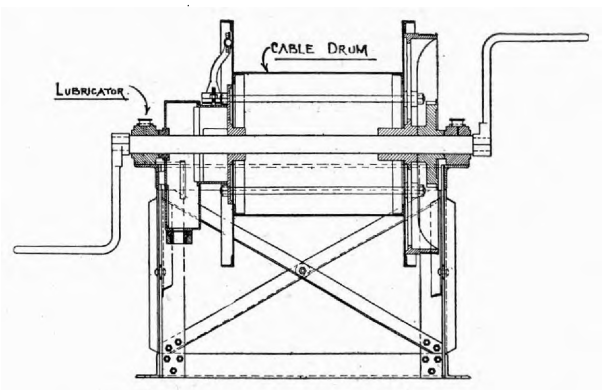
Callender's consider their cables too well known to need exhibiting, but they show several fine specimens of junction boxes.

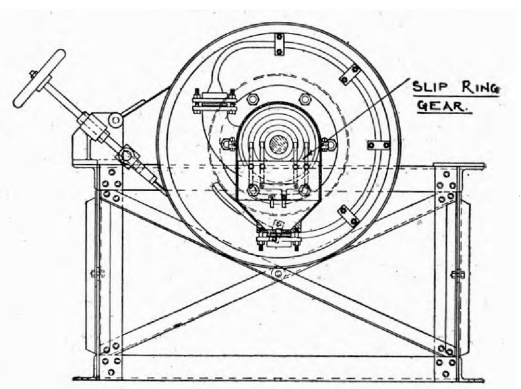
A New Switch.—A novelty is Scott's patent D.P. main switch, which has not only a rapid break, but a rapid spring-controlled make. The moving contact-bars are solid and are on a loose spindle, which carries a cam with two projections. The handle is at the side of the box, and when it is turned towards on, a pawl engages with one of the projections and turns the loose spindle of the contact arm, at the same time extending a helical spring, one end of which is anchored on the box and the other is fixed on the loose moving part of the switch. As soon as the cam passes the dead-point of its rotation the spring carries the spindle sharply round,

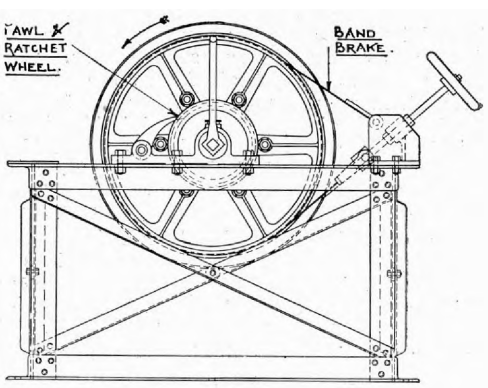


Scott's Patent Quick-make Switch.

drawing the cam away from the pawl, and pulls the contact-bar sharply into the fixed contact blades. A similar action takes place on switching off. The movement is extremely ingenious, and the switch is certain to prove a favourite. An idea of the general arrangement will be obtained from the illustration above.







Cable Sinking Drum for Mines.

Cable Sinking Drum.—Our second illustration shows the largest exhibit on Messrs. Callender's stand, viz., a drum for

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lowering cable gradually during the sinking of a mine shaft. Slip-rings and contacts are provided so that the cable can be connected to the supply at the drum, and as much as is required at each stage of the sinking operations can be drawn off without disconnecting. The drum is of mild steel, and a strong band-brake is provided as well as a pawl and ratchet wheel for raising or lowering. The slip-rings are mounted on a flat disc, and the whole of the slip-rings, contact brushes, and cable terminals are enclosed.

Other Exhibits.—The only piece of cable we saw on the stand was a trailing cable with the strong rubber armouring now known as the "cab-tyre" pattern. Specimens of insulating parts made of a new material called "Kalanite" are exhibited, and also a "Kalbitum" paint which has bitumen as a basis.

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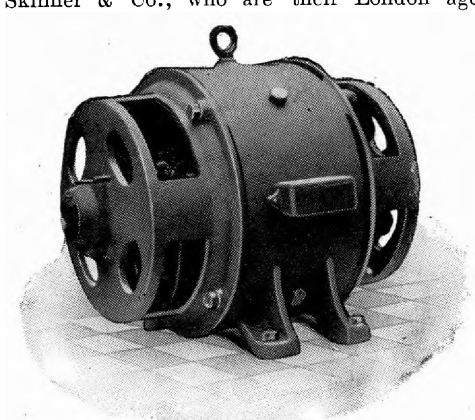
Heating and Cooking Apparatus.—A demonstration is given on the stand in the gallery of the Therol system of water heating and cooking, which has for its object the use of large heat storage capacity in the apparatus to enable a small current only to be consumed continuously throughout the whole twenty-four hours, instead of making a considerable call for energy for a short period while the actual cooking operations are in progress. This system, if adopted universally would greatly improve the station load factors, and by cutting down the maximum demand would avoid large expenditure on services, cables, &c. The Therol water-heater, as is well known, consists of a mass of iron, or other storage medium, continually heated by means of a small electrical heating element, and the whole is thoroughly insulated by means of magnesia. Suitable cored passages are cast in the iron block, and when water is passed through same it can be drawn from the water-heater instantly at any temperature required, from tepid to boiling. The cooking apparatus, which is now exhibited for the first time, is made on the same principle. The current for the cooker, when not being used, is taken up in heating the iron mass placed below the oven. When the oven is required to be used it is only necessary to open two dampers, and in a few minutes the oven reaches the required temperature of 300 to 400 degrees F. By adjusting the dampers the heat can be regulated in the oven to any required temperature.

With the Therol system boiling of water, vegetables, &c., is not done, as is usually the case, by electrically heated hot-plates on the top of the oven, but by a novel method with superheated steam, which by turning a tap can be made to circulate in the special jacketed utensils or steamers. This tap simply lets water from an external tank into the proper heated channels, where it is instantly converted into steam. Small auxiliary apparatus, irons, &c., are worked without increasing the demand by diverting the current from the water-heater or cooker. We understand that several companies are prepared to supply current at specially low rates where the Therol system is employed.

Wright and Wood, Ltd.,

CENTURY WORKS, HALIFAX. (STAND NOS. 129 & 130.)

This firm are exhibiting on the same stand as Messrs. Berry, Skinner & Co., who are their London agents. A



Rotary Transformer for Cinematograph Work.

considerable range of standard continuous and alternating current motors are shown, as well as machines and combinations for special purposes. We illustrate here a new rotary transformer for cinematograph work, which steps down from 460 to 65 volts, at which pressure it delivers 50 amperes. It is a single-field machine without voltage regulation on the generator side. Another special cinematograph set is the "duplex" type motor generator, in which two machines are coupled compactly together so that no bedplate is needed. Other motor generators are also shown, as well as small rotary converters with ball-bearings and a special rotary transformer for ignition cell charging. Polishing motors in several sizes are also shown.

Berry, Skinner & Co.,

78 UPPER THAMES STREET, E.C. (STAND NOS. 129 & 130.)

Switchgear.—A number of examples of the well-known Berry patent push-on and pull-off enclosed fused switch are shown, including one or two new types of recent introduction. One of these has the projecting spindle covered by a hood, and is arranged so that it can only be worked by a lever forming a detachable key. This switch was particularly designed for use in lunatic asylums, but has various other fields of usefulness, such as dockyards, public lighting, &c. Combinations of two switches linked together and interlocked so that they can be used as change-over switches are shown, and further modifications include watertight switches with special glands and a special Admiralty pattern insulated entirely with mica. The company's "Firimine" switch for colliery work, which was described in ELECTRICAL ENGINEERING IN MINES, June 1st, page xlii., is also shown. The way in which the switches are mounted on an iron framework to form complete switchboards is seen on the stand.

The Adams Manufacturing Co., Ltd.,

160 NEW BOND STREET, W. (STAND NOS. 107 & 108.)

Motor Control Apparatus, &c.—A fine display is made by the company of motor starters and controllers for a great variety of classes of work too numerous to detail here. An attractive feature of the exhibit is a revolving octagonal stage, over 10 ft. diameter at the base, and tapering by steps to the apex. The panels forming the eight sides are devoted to examples of switchgear and to photographs, and as the stage is motor driven it is used for demonstrating the effect of the various types of controllers and speed regulators that are exhibited on the stand. Attention may be drawn particularly to some of the new patterns of three-phase gear developed by the company. These include a complete remote control panel for a 100-h.p. motor, in which the time of closing of the contactors in regular sequence, cutting out the motor resistance, is determined by actual value of the rotor current, so that the rate of acceleration is automatically proportioned to the load. The company have also developed a new oil switch, which is shown in the 100-ampere size. Among the continuous current apparatus is a complete motor control pillar provided with a circuit-breaker and starter, so interlocked that the first movement of the handle in the direction for starting causes the circuit-breaker to close, but should an overload occur, it will re-open, and cannot be closed again until the load is lightened, and then only after all the starting resistance has been re-inserted. This starter may be used for "inching" to an unlimited extent, because of the method of interlock, whereby the slightest *backward* movement of the handle, either from the first or last or any intermediate contact, causes the circuit-breaker immediately to open and so confines the duty of opening circuit always to it. Among starters for special purposes are shown examples of the Broadbent starter for printing presses, described in the special supplement on the electrical equipment of Messrs. Richard Clay & Sons' printing works in ELECTRICAL ENGINEERING, May 15th.

Theatre Dimmers.—Another special feature of the stand is a demonstration of the capabilities of the Adams metallic resistance theatre dimmer, which was described in ELECTRICAL ENGINEERING, Vol. VI., page 680, October 27th, 1910, in connection with the installation at the Little Theatre.

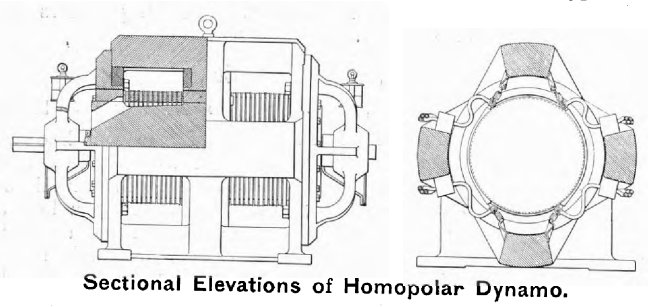
Homopolar Generators,

CRAWLEY DOWN, SUSSEX. (STAND NOS. 27 & 34.)

A New High-speed Generator.—On this stand is shown a complete 100-volt, 50-kw. generator of the homopolar pattern running at 3,500 r.p.m., designed by Mr. R. H. Barbour. The machine is of a type which is being developed with a view to meeting the demand for continuous current generators running at steam turbine speeds, in sizes above the limits now imposed by commutation. The general arrangement of a machine almost exactly similar to the one exhibited is shown in the illustration. Briefly, the machine may be described as having a central pole extending completely round

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the rotor with the same polarity throughout, and two similar end poles. The armature conductors, 12 in number, are mica-insulated rods lying in tunnels in the rotor under the central pole, and each end of these is collected to a slip-ring, so that there are in all 24 slip-rings, the brushes on which are arranged to connect all the armature conductors in series. The slip-rings are grooved and brushes of a special type are



Sectional Elevations of Homopolar Dynamo.

employed, consisting of flexible copper cores with a German silver armouring lying in the grooves around the greater part of the circumference, and kept tight by springs and tension units, as shown in the sectional end elevation. The machine shown has a rotor diameter of 14¼ in. and a length of 29½ in. between bearings. The over-all height is 28¼ in. The generator is shown working driven by a three-phase slip-ring motor controlled by an induction rotor controller with no resistances or contacts, made by the Electrical Apparatus Co.



Pope Shop-window Lamp. About half scale.

Pope's Electric Lamp Co., Ltd.,

HYTHE ROAD, WILLESDEN, N.W. (STAND NOS. 207 & 208.)

Sign.—The sign on this stand is one of the finest, if not the finest, in the exhibition. Four large white wooden boards have been erected to represent beams from a model of a lighthouse, which occupies the centre of the stand, and these bear the words Pope Lamps lined out in 10-c.p. lamps. There are 860 lamps on the sign, and the effect is enhanced by the use of white porcelain Benjamin lamp-holders in place of ordinary brass holders.

Lamp-Bumping Model.—To show the strength of their filaments, the company have exhibited four metal filament lamps on flexible cords, which are lifted and dropped with a jerk. An ingenious gear is used to work the device, which is driven by a small motor.

New Lamp for Shop-window Lighting.—This lamp, which we illustrate about half-size, should prove very useful on account of its length. It is 8⅝ in. long from end of cap to pip, and is made for 220-volts pressure as well as for low pressure; its candle-power is 50. The lamp has a tungsten filament and an efficiency of about 1¼ watts per British candle-power. A 3-pin cap is employed to enable the holder to support the lamp more firmly, and it is used in a Benjamin type reflector.

Several other lamps for special purposes are shown.

The Brush Electrical Engineering Co., Ltd.,

1 KINGSWAY, W.C. (STAND NOS. 84 & 89.)

Generating Sets.—The centre of attraction on this stand, and the only complete large generating set in the exhibition, is a 400-kw. mixed pressure turbo-generator destined for the Brush Company's own works. The turbine is of the Brush-Parsons combined action and reaction type capable of giving up to 300 kw. on exhaust steam alone, or up to 400 kw. on live steam alone, at 2,500 r.p.m., and the generator is a standard high-speed continuous current machine with commutating poles as well as compensating windings. A small 22·5-kw. continuous current set driven by a Brush reciprocating engine is also shown.

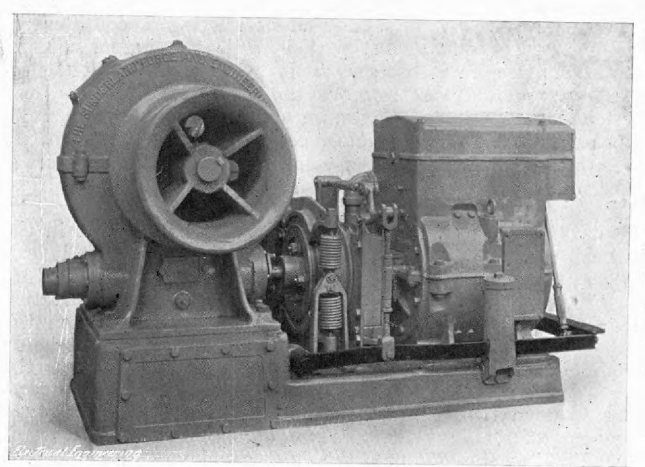
Motors and other Plant.—Among the motors of various descriptions on the stand may be mentioned a variable speed squirrel-cage induction motor, in which four economical speeds are obtained by different groupings of the stator coils to give 4, 6, 8, and 12 effective poles. A 150-h.p. slip-ring motor is also shown. Mention should also be made of two sets of electric pulley blocks, one of the Gese double purchase pattern for 1½ tons, and a worm-geared ½-ton Marshall hoist.

Lamps.—The "Metallum" metal filament lamp is, of course, well represented, and the main illumination of the stand is by Quartzalite mercury vapour lamps, of which a new pattern is shown giving 3,000 c.p. with a consumption of only 3½ amperes. The company also show a new flame arc lamp burning special carbons giving a particularly white light.

The Sunderland Forge and Engineering Co., Ltd.,

SUNDERLAND. (STAND NOS. 99 & 116.)

Dynamos, Motors, Steam Engines, Winches, &c.—We illustrate an electric 2-ton baggage winch, lifting at 70 feet per minute, of a type supplied to the *Olympic* and many other ships. This is worm-geared and particularly silent in action, and in addition to its compactness is interesting on account of the way the foot-brake is interlocked with the controller, returning it to the off position before applying the brake. The centre of the stand is occupied by a large 18-h.p. 30-ton



2 Ton Electric Baggage Hoist.

ship-geared winch with warping heads as well as a barrel. These are driven by motors of the firm's own manufacture, and a number of other examples of these motors, both for alternating and continuous current, are shown. Three sizes of ship-lighting sets with the firm's own open-type vertical engines for 35, 15, and 3 kw. are on the stand.

The Lancashire Dynamo & Motor Co.,

TRAFFORD PARK, MANCHESTER. (STAND NOS. 122 & 137.)

Planing Machine Drive.—Part of the stand forms a combined exhibit of the Lancashire Dynamo and Motor Co. and Joshua Buckton & Co. (Wellhouse Foundry, Leeds). This is a complete Buckton planing machine, to which is fitted the Lancashire system of reversing motor drive, in which the control of the driving motor is carried out on the field of a special motor generator, mounted on the machine, which supplied the current. The system was described in some detail in ELECTRICAL ENGINEERING, Vol. VI., page 114, February 17th, 1910, but the machine exhibited is fitted with one or two improvements, including provision for speeding up between the cuts, when two or more surfaces some distance apart are being planed by means of suitable lappet switches and for allowing the series characteristic of the compound wound motor to predominate when required to obtain a speeding up when the tool has entered the work, while it still overcomes the resistance of the beginning of the cut at a sufficiently slow speed.

Motors, &c.—Among the many examples of the companies' motors may be mentioned a chimney-ventilated type in which air is circulated by a fan carried on the armature, while the whole machine, except for the intake and outlet, is fully enclosed. A special vertical spindle motor is also shown, driving a 36-in. Watson-Laidlaw hydro-extractor provided with a slipping clutch for starting up. Other motors

ELECTRIC LIGHTING CASING. Special clean white 1½ in. at 22/6, 2 in. at 35/6 1,000 ft. Refuse foreign. Support BRITISH industry. We compete, own make. All sizes in stock, also cable troughs for underground, woodwork all descriptions. Send trade card. JENNINGS & Co., 955 Pennywell Road, Bristol.

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Last week we pointed out the advantages possessed by our single-phase meters. Now you may read about our polyphase meters.

Two single-phase elements act on two discs mounted on the same spindle, the spindle being geared into a cyclometer dial.

ALL THE GOOD POINTS of the single-phase meter, therefore, ARE TO BE FOUND IN THE POLYPHASE METER.

Moreover, the POLYPHASE METER can be TESTED and adjusted ON A SINGLE-PHASE CIRCUIT; for by connecting up one current coil in series with the other, but in the opposite sense, while the shunt coils are connected in parallel, the meter must stop at all loads.

The polyphase meter CAN BE USED for EITHER TWO-PHASE OR THREE-PHASE supply WITHOUT ALTERATION, as the two elements are electrically quite independent of each other.

Since the method of testing ensures that all the adjustments in both elements are identical, the meter is INDEPENDENT OF PHASE SEQUENCE.

The meter can be supplied for balanced loads or for unbalanced loads; and for three-wire or four-wire systems, either with earthed neutral or with insulated neutral.

Thus the meter FULFILS ALL REQUIREMENTS, both theoretical and practical.

You cannot do better than send your orders for polyphase meters to—

THE ELECTRICAL CO LTD

METER DEPT.,

122-124 CHARING CROSS ROAD, LONDON, W.C.

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By reason of improved manufacturing facilities the cost of production of MAZDA LAMPS has been lowered.
The following are the reduced prices for
Mazda Lamps
THE LAMPS WITH GENUINE DRAWN WIRE TUNGSTEN FILAMENTS.
100/135 volts, 17, 25, 30, 40 and 60 watts, **2s. 6d.** each
200/260 volts, 30, 40 and 60 watts .... **3s. 0d.** ,,
(Usual terms and extra charges continue to apply.)
THE BRITISH THOMSON-HOUSTON CO., Ltd., Rugby and London.

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include a 5-h.p. continuous current motor driving a Sirocco fan, the impeller of which is mounted on an extension of the motor spindle, and a 15-h.p. induction motor coupled to a Hodges blower.

Engineering and Arc Lamps, Ltd.,

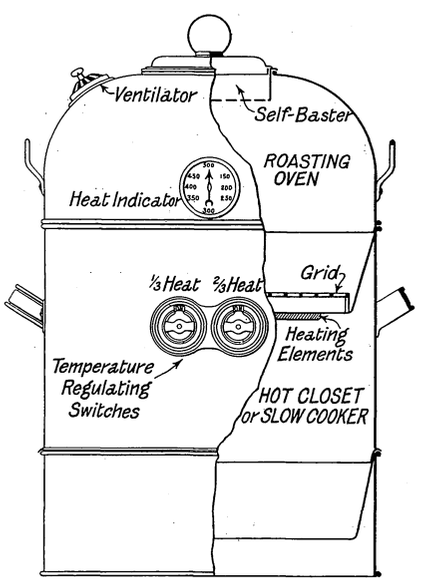
CHINGFORD AND ST. ALBANS. (STAND NO. 327.)

Arc Lamps.—One of the most interesting exhibits on this stand, which is in the gallery close to the right-hand end of the electric home, is the new well-tried Beacon flame arc lamp, which has several features to recommend it. The whole movement is remarkably free and frictionless, the whole case and frame is insulated from the carbons, and all working parts are in a thoroughly fume-proof chamber, and the excellent provision for ventilation keeps the globe free from deposit. Bronze is used throughout in place of brass for screws and small parts, and all constructive details appear to be well thought out. The chief point, however, is the steadiness of the positive ratchet feed, and it is largely this that enables five lamps to be run without a flicker in series on 220 volts, as is being done on the stand, and indeed the behaviour of these lamps is a contrast to some in the exhibition. It may also be mentioned that all these lamps are guaranteed for three years. Other patterns of lamp shown by the firm include the four carbon Sunrae flame lamp, several patterns of Davy and Gilbert enclosed lamps, an attractive new small 5-ampere enclosed lamp, and the White Star lamp specially suitable for shop lighting.

Purcell & Nobbs,

87 & 89 CLEVELAND STREET, FITZROY SQUARE, W. (STAND NO. 159.)

Heating and Cooking Apparatus.—The most interesting novelties on this stand are the "electroyl" steam cooker and oven. The former is made up of several sections. The lowest, at the top of which is a flat heating element, can be used for slow baking or similar operations, and grilling, frying, or boiling, &c., can be carried out on the top in the ordinary way; when used for steaming, however, the next section, containing water, is placed on the hot-plate with further sections above it, through which the steam circulates. In the oven, the arrangement of which is shown in the drawing, the heater is midway between an upper and lower section, where roasting and baking may be performed respectively. The



Electroyl Oven.

hot chamber is provided with a simple form of pyrometer and a self-basting arrangement is provided at the top. Three degrees of heat are obtained by two switches. All the inside and outside surface in both this and the steamer are brightly polished to minimise loss of heat. The company's convenient electrically heated towel-rails (see ELECTRICAL ENGINEERING, February 9th, page 69) are shown in several sizes, and hot-plates in various styles are exhibited, including those of a special material known as "Isolite" and a cheap hot-plate for quick heating up with a sheet steel surface. There is also a very complete selection of restaurant appliances. Radiators, convectors and combined radiators and convectors are well represented. A handsome form of heater for halls, &c., is a real Oriental brazier with a wire resistance frame mounted inside. A novelty is shown in a foot-warmer with a cane top in a mahogany frame, beneath which is mounted a 100-watt resistance net. The company's humidifier (see ELECTRICAL ENGINEERING, February 9th, page 70) is exhibited, as well as a fresh air heater for warming incoming air as it passes through a Tobin tube. Attention must also be drawn to the particularly strongly made soldering-irons with real platinum heating elements.

Bertram Thomas,

WORSLEY STREET, HULME, MANCHESTER. (STAND NOS. 22 & 29.)

Switchgear.—One of the most interesting items on the stand is an automatic continuous current control panel, which is shown in conjunction with a large Alley & Maclellan air-compressor driven by a Westinghouse motor. The starter arm itself is drawn up by a solenoid against the pull of a specially arranged dash pot, which permits of a quick jump from step to step, even though the average movement is slow. The current in the operating solenoid is controlled by auxiliary control switch actuated by a weighted lever worked by a small air-pressure cylinder, and both the pressures at which it cuts in and cuts out are adjustable within wide limits. A very simple adjustment also controls the speed of motion of the starter arm. An ingenious arrangement is provided by which the compressor valves are held up by electropneumatic means to take the load off during starting up. The whole is of most substantial construction, and the details have been very carefully thought out. The same general characteristics of solidarity and thoroughness of design are evidenced in a large three-phase automatic solenoid-operated three-phase starter of the 350-h.p. size, fitted with no-voltage release. A third panel on the same side of the stand contains an automatic battery regulating switch with two powerful operating solenoids, one for each direction, controlled by a floating contact lever. The contacts on this lever are only employed to make the solenoid circuits, as they are broken on a special quick break magnetic blow-out circuit breaker forming part of the mechanism. The switches can be moved by hand by a step-by-step motion, which gives as quick a passage from one step to the next as the automatic motion. Special limit switches are provided cutting the solenoids out of action when the switch reaches either end of its travel. Special means are taken to prevent all possibility of the switch arm being moved by vibration, and particular care is taken to lock all nuts, &c., on the apparatus for the same reason. Another piece of heavy switchgear is a straight line type continuous current step-by-step solenoid starter, constructed with two sets of contacts in parallel designed for 400 amperes each. Several other forms of step-by-step starter are shown, and there is a fine display of the firm's automatic circuit-breakers, including sizes up to 3,000 amperes. These involve a number of good points, which we have not the space to detail. Particularly interesting among them is a remote control circuit-breaker, which is closed and reset by a solenoid action. The reverse current release to these circuit-breakers has a very positive knock-off action, and the time lag mechanism is on the dash-pot principle, with independent provision for instantaneous release on extreme overloads. The auxiliary blow-out contacts are self-cleaning and are placed well away from the main contacts. Various other items of switchgear are mounted on a slate board forming one side of the stand, including a new design of tubular fuse with special cooling vanes between the fuse wire and the contact block.

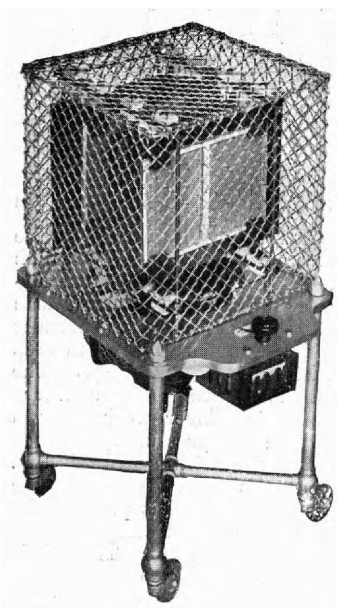
Cooking Apparatus.—The firm are showing on the same stand an example of the Gray patent electric oven, which is solidly made with large heat capacity, and is well lagged to retain the heat. The main feature of this oven is the way in which a circulation of air is maintained inside the oven. The air as it is heated by the resistances is conveyed through flues to the top of the oven, whence it passes down in a continuous stream over the food, and so returns to the heaters, giving remarkable uniformity of temperature. The oven shown takes 2½ kw. to heat up and ¾ kw. to keep hot, and is controlled by a special series parallel switch at the side; two hot-plates are provided on the top. Cooking demonstrations are in progress with this oven, and with a variety of other self-contained utensils, which are shown on a specially attractive marble-topped cooking table with a distribution board, in which all flexible leads not in use are drawn out of the way by weight after the manner of the cords of a telephone switchboard.

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Ozonair, Ltd.,

96 Victoria Street, S.W. (Stand Nos. 53 & 70.)

We illustrate one of the simplest forms of the ozone generators exhibited, to indicate the process generally. This type is of a size for use in large rooms such as hospital wards, &c., for purifying the air by the generation of ozone. There are four sets of gauze plates, each consisting of a pair of plates separated by a sheet of micanite, which overlaps at the sides. The voltage is raised by a step-up transformer, and an invisible discharge takes place from one plate of each pair to the other, producing ozone. As there is no spark and the discharge surfaces are large and evenly distributed, no nitrogen compounds are formed by the discharge. A small vertical shaft motor fan beneath the set of condensers produces the necessary draught to disseminate the ozone, and the consumption of power is only 100 watts. In the smallest sizes 25 watts only are used. When alternating current is not available, a special arrangement of contacts on the fan shaft is employed in conjunction with the transformer for converting the current. In addition to the numerous portable types of apparatus at the exhibition, a ventilating system capable of dealing with 2,000 c. ft. of air per minute is shown in operation. The air is filtered, then passed through the ozone generator and a mixing chamber, and distributed by a fan to the pipe system. A water purifying plant is also shown, capable of dealing with 1,000 gals. per hour. Briefly, the method of purifying consists of atomising the water and bringing it into intimate contact with the ozone in three successive stages. Tests made by W. J. Dibdin & Son of two samples of water collected at the Ozonair stand at Olympia demonstrated that the ozonised water absorbed 8·7 per cent. less oxygen than the water from the main in four hours, and 6·1 per cent. less in 15 minutes, and the colonies per c.c. were reduced from 2,255 to 80.

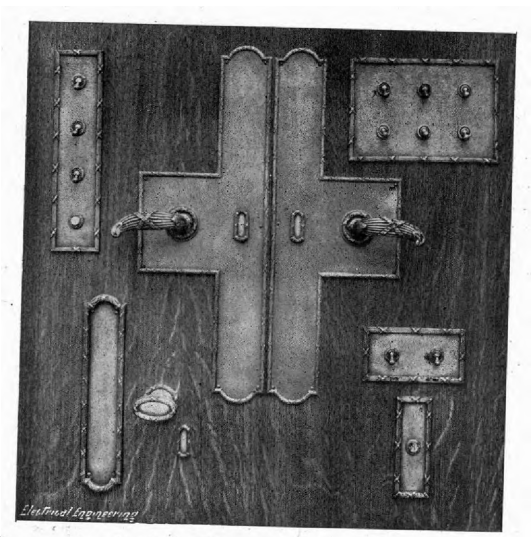


Transportable Ozoniser for large Hospital Wards, &c.

The London Decorative Metal Works, Ltd.,

44–46 Eagle Street, Holborn, W.C. (Stand No. 291.)

Switch Plates, &c.—At this stand in the gallery is a fine collection of examples of art metalwork as applied to switch plates, door furniture, bell pushes, and similar articles, as well as decorative panels, name-plates, &c., in various styles, especially classic French and early English. Among the latter some handsome multiway Georgian plates finished in a soft antique silver will probably attract most attention. The accompanying illustration, which will give a good idea of the class of work made by this firm, is that of a show panel fitted with a Louis XVI. suite, in which the decoration is severely confined to the favourite reed and ribbon border. The workmanship of these articles reflects the same high degree of care as the designs.



Decorative Switch Plates, Ball Pushes, and Door Furniture.

The National Telewriter Co., Ltd.,

20, Bucklersbury, E.C. (Stand Nos. 146 & 269.)

The telewriter is by no means a new instrument; it has been before the public for a number of years, and yet the transmission of autograph messages electrically between the company's two stands on the ground floor and gallery is one of the most popular "shows" in the exhibition. We noted that considerable improvement in the direction of simplification and accessibility of parts for inspection and repair had been made. The master-switch of the transmitter is now electrically operated, so that it cannot be forced out of adjustment; there are simpler arrangements for holding the paper roll, an improved method of pivotting and inking the pen of the receiver is employed, the moving system of the receiver has been modified, and other useful alterations in detail have been carried out. There could be few better tests of the machine than constant use on a busy Saturday afternoon at the exhibition in a succession of different hands, and the telewriter withstood this admirably.



Glass Table Standard.

W. & R. Jacobs,

39c King William Street, E.C. (Stand No. 296.)

Fittings and Shades.—A large selection of glass shades of every description are on view, and the firm also show some very uncommon and artistic designs of glass and metal and glass fittings, some of very elaborate design. A small table standard in Bohemian glass of very attractive design is illustrated here. In some of the fittings remarkable effects are obtained with fringes of long tubular glass beads in conjunction with ornamental glass shades.

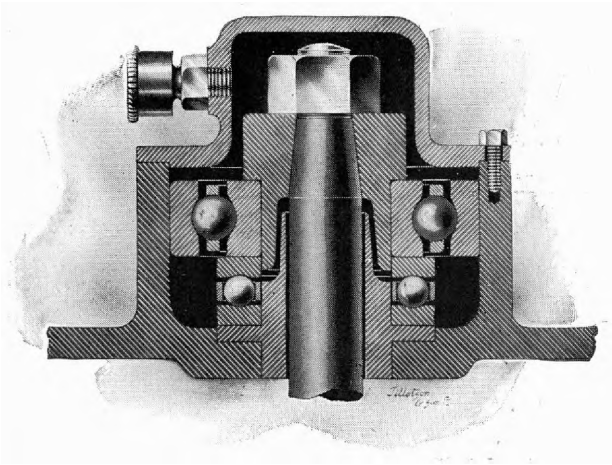
Electrical Novelties.—Another branch of the firm's business to be represented on the stand include small electrical novelties such as pocket flash-lamps, torches, small battery lamps, toy motors, &c.

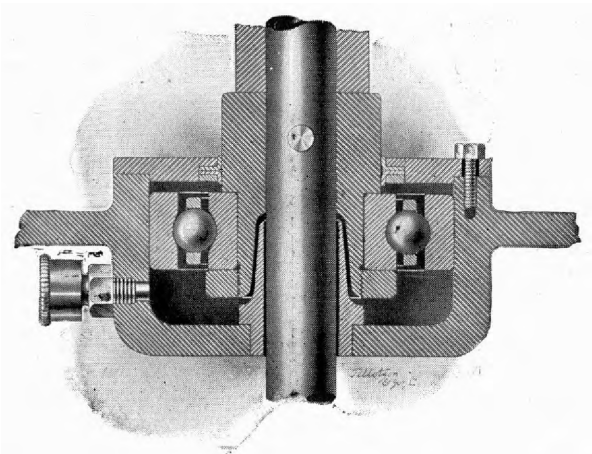
Allen West & Co., Ltd.,

Lewes Road, Brighton. (Stand Nos. 202 & 213.)

Controllers.—Among the controllers shown by this firm we noticed particularly a 100-h.p. oil-immersed drum-type controller for mining work of the pattern illustrated here. In these controllers the drum and contact fingers are not attached to the lid as is sometimes the case, but are carried on a separate hinged framing, so that one man can easily throw open the lid and then lift all the working parts out of the oil, as the connections to the fingers are in the form of flexible strips. The lid is interlocked with the drum, so that it cannot be opened unless the controller is in the off position. A number of other drum-type controllers are shown for various classes of work, all with the same characteristics of solidarity of construction, standardised interchangeable parts, and a special form of contact finger hinged in a manner rendering side-play impossible, and with spiral springs instead of the more usual flat type. One special controller shown is for a 60-h.p. variable speed motor, and is suitable for printing press work. The first step of the hand-wheel puts in the main circuit-breaker and can be used for inching. All the 44 shunt-regulating steps are on the main drum, and the resistances are contained in a ventilated case at the back of the controller. Attention should also be drawn to the special heavy service controllers for steel works, &c. These are of the face-plate type with two sets of contacts at either end of the contact arm in parallel. The finger arm is of massive construction, and is built of iron castings clamped on a mica insulated steel

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BALL BEARINGS

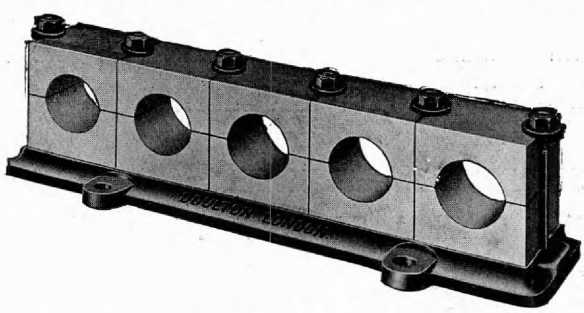
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Stand No. 149/162.

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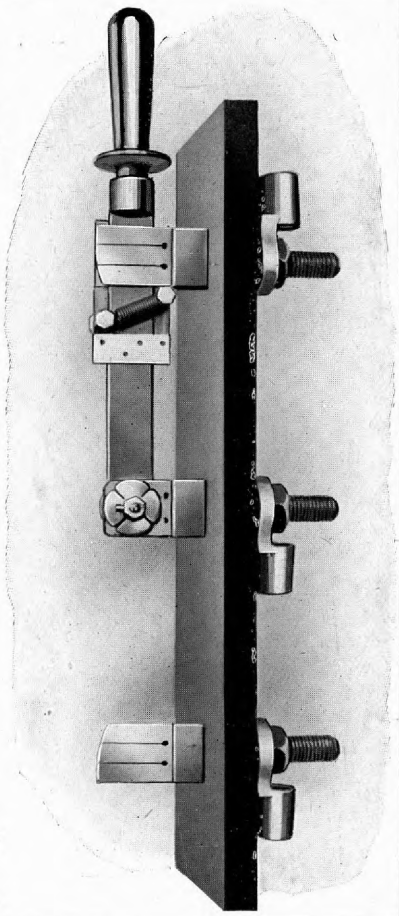
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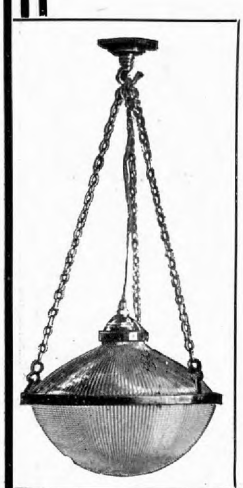


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bar. The fingers are pivoted and pressed against the face contacts by compression springs. They are fitted with easily renewable contact tips of heavy section. The blow-out is very powerful, and the whole field is concentrated on the contacts over which the arm is moving. Crane controllers are shown of a drum pattern made up to 225 h.p., and a large 350-h.p. controller of the double drum type is also exhibited. The firm also make liquid starters and controllers, but these are not represented on the stand. Among the metallic resistances used are a special form of grid of thin stamped sheets and wire resistances of eureka wire wound on tubes and embedded in cement.

Medways Safety Lift Co.,

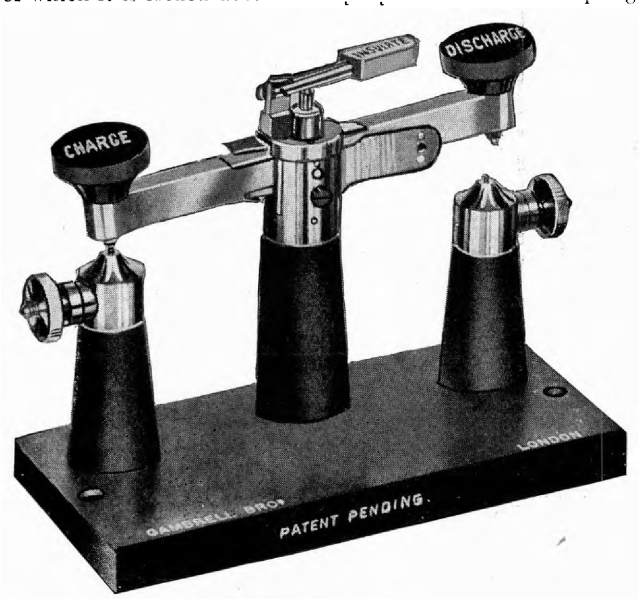
10 Bush Lane, E.C. (Stand Nos. 171 & 192.)

Electric Lifts.—A full-sized lift has been erected on the stand, fitted for demonstration purposes with both automatic push button and car switch control. A special feature of the former equipment is the electrical interlocking system, whereby the lift if empty can always be fetched to any floor irrespective of the gates being locked, but as soon as a passenger in the car closes the floor switch it is necessary for the gates to be shut before the lift can be started. Another point is that should two calls be made simultaneously, or should two buttons be pressed together in the car, no damage is done, but the lift proceeds to the furthest point called for, in the direction in which it was previously moving. The direction switches are in the shaft, and are actuated by cams on the car, so that accurate floor levelling is obtained, irrespective of stretching of the ropes. The actual controller consists, in addition to a panel containing relays for each floor, of a horizontal reversing switch, an eltromagnetic master-switch. The connections are such that the motor field is protected from self-induction troubles by being placed in parallel with the armature circuit. The rheostat is worked by the motor itself. The car switch control is generally similar, and an important feature of the car switch is that the switch can be reversed without damage when running at full speed, as the master-switch is arranged so that once tripped by the car switch passing through the zero position it cannot close again until the motor has stopped and the armature back E.M.F. gone. In addition to the complete lift, separate panels, controllers, and motor gear are shown.

Gambrell Bros ,

Durham House, North Side, Clapham Common, London, S.W. (Stand No. 290.)

Instruments.—A thermo-electric potentiometer for measuring small electromotive forces from 0–5,000 microvolts is on view at this stand. The connections can be seen at a glance, as they are marked out on the surface of the instrument. The slide is adjusted so that one millimetre represents two microvolts. A new key is another feature of the stand. It has three positions, charge, discharge, and insulate, in each of which it is locked automatically by means of a side spring,



Quick Action Key.

shown in the illustration. This has three holes, the outside ones defining the position at charge and discharge, while the centre hole fixes the cross arm when the insulate lever, seen in the middle, is depressed, the key then being out of circuit. A portable bridge, in which Mathers multipliers are used in the ratio arms, is also shown. Another interesting exhibit is Paley Yorkes' working models of practical forms of electrical instruments.

Walker, Horrocks & Co., Ltd.,

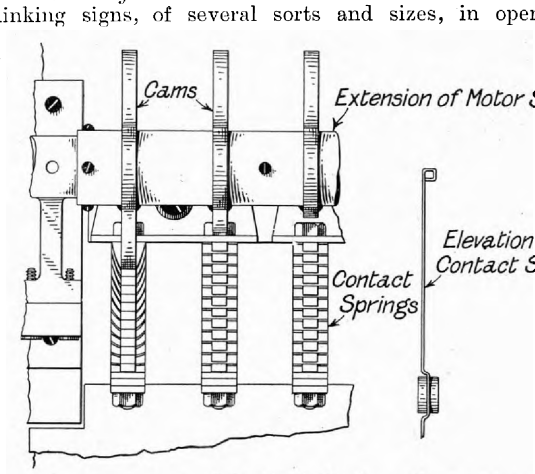
Cornwall Buildings, 45 Newhall Street, Birmingham. (Stand No. 231.)

An automatic generating plant for private installation supply is being exhibited by this firm. It varies somewhat in its operation from the others shown at the exhibition, as the lights are supplied direct from a battery, and the set only starts up when the battery discharge has reached a minimum. The capacity of the battery is such that it gives a voltage slightly higher than is required, but a number of regulating cells are provided to add to this. These are cut in automatically one by one by a regulator as the voltage drops to the minimum. When all these cells have been cut out, and the whole battery is in circuit, the regulator, in trying to cut out another, actuates a solenoid switch of an automatic starter, and sets the machinery in motion in the usual way. The reverse movements now take place; a charging current passes through the battery, and the potential across the cells will rise until the volts have reached a maximum, when a cell is cut out. This will go on until the battery is fully charged, and all the regulating cells have been cut out, leaving only the original number of cells in circuit, and then the regulator automatically shuts the set down, until the regulating cells have again been exhausted. The dynamo is reverse compound wound to give a constant output. Provision is made for the engine failing to fire, in which case a time limit relay is actuated, and attention is drawn to the fact by a red light. The plant is manufactured by the Austin Motor Co., Ltd.

The Sun Electrical Co., Ltd.,

118–120 Charing Cross Road, W.C. (Stand Nos. 104 & 111.)

Electric Signs.—There is a fine collection of flashing and blinking signs, of several sorts and sizes, in operation on

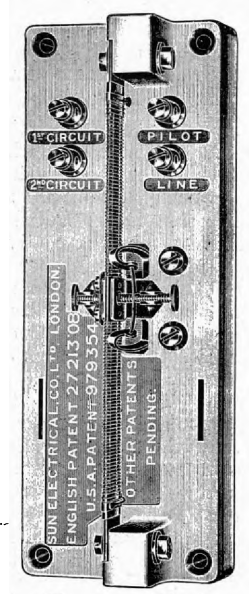


Arrangement of Contact Springs for successive Lamp Switching on Motor Flasher.

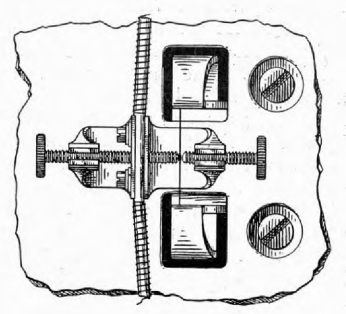
this stand, and the company have specialised particularly in this class of work and are experts in sign design. A new pattern of motor flasher is employed for a large writing sign they have on the front of their stand. A series of blades, one for each lamp, are pressed together successively by a cam on the motor shaft and then simultaneously released as the cam leaves them. We give a sketch of this part of the mechanism. In combination with this is, at the other end of the shaft, a toothed wheel driven by a cam arranged so that the contact is changed once a revolution so that changes of colour or of circuits can be made at regular intervals. Another new device is a two-way thermal blinker. In the ordinary thermal blink, a flat strip of metal, upon which a heating coil is wound, the expansion causes contact to be broken at a contact screw; this allows the strip to cool, and contact is again made. The distance of travel of the contact-maker is small, so that hitherto difficulties have been experienced in making a two-way arrangement with a contact in each position, but this has now been overcome by the bow-spring arrangement seen in the general view and detail drawing. The mercury contact flasher for D.-C. circuits carrying large currents was described and illustrated in our issue of October 20, 1910; an adaptation of this for A.-C.

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circuits is now made. In this new pattern a motor meter movement actuates the mercury make and break switch through worm-gear, and it is fitted with an adjustable brake magnet so that the speed can be varied.



New Two-way Flasher (half scale).



Full-size view of Contact Arrangement of New Two-way Flasher.

Candle Lamps.—The "Flexalite" candle lamp was described in our issue of January 12, 1911. Its characteristic, it will be remembered, is that the candle tube and the lamp are not rigidly supported, so that the candle when receiving a knock will deflect and return to its original position, thus rendering it less liable to breakage. To demonstrate this a slowly oscillating hand with two projecting fingers has been put up on the stand, which works the candle on the fitting backwards and forwards, and clearly demonstrates this property.

Other Exhibits.—Several types of the "Sunlite" trough reflectors are shown, which it is claimed reflect 250 per cent. of the mean horizontal candle-power of the lamps in a direct line, and there is a useful pattern with the front pierced in letters so that it can serve as a shop-front sign as well as a window reflector. A hair-dryer is popular among the lay and lady visitors. It is a thing shaped somewhat like a revolver and light enough to hold in the hand, and contains a small motor fan and a heating resistance, so that a blast of hot air is blown from the nozzle. A good selection of electric light fittings is shown, and last but not least, the "Kalkos" wiring system is well in evidence.

J. W. and C. J. Phillips, Ltd.,

23 College Hill, Cannon Street, E.C. (Stand No. 3.)

Recorders.—A large and varied assortment of these instruments manufactured by the Bristol Company, of Waterbury, U.S.A., are shown on this stand. These include pressure and vacuum recorders, the pens of which are attached directly to the pressure tube. For ranges of pressure above 3 lbs. a helical tube is used, and below this a more sensitive diaphragm type is employed. Several electrical recorders are exhibited for volts, amperes, and watts, and these are made for all ranges of A.-C. and D.-C. Some portable types are also shown. Other interesting pieces of apparatus exhibited are long-distance recording thermometers and pyrometers.

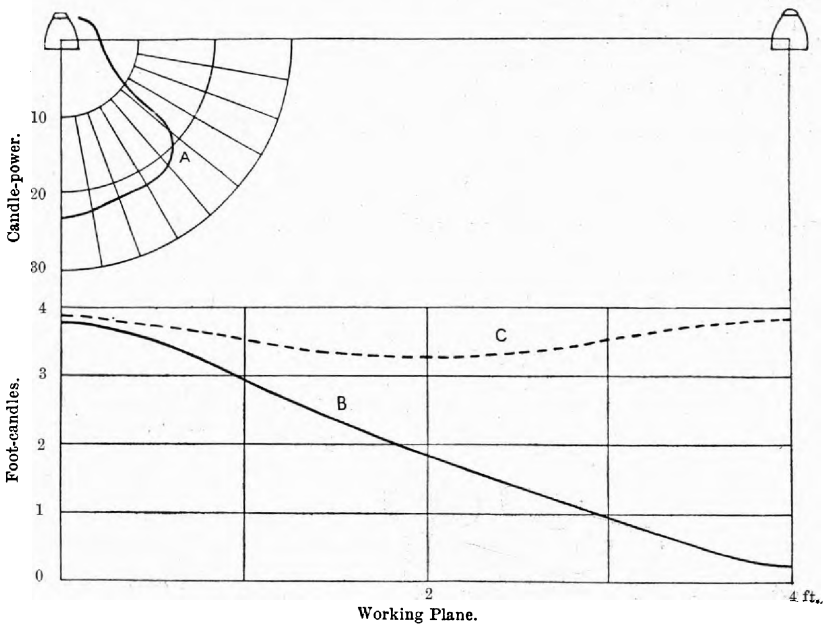
Holophane, Ltd.,

12 Carteret Street, S.W. (Stand Nos. 199 & 216.)

Shades and Reflectors.—The "Holophane" shades and reflectors continue to increase in popularity, but the makers are nevertheless constantly bringing out new designs. The "residential" patterns, recently described and illustrated in our columns, are well displayed at the stand and are being welcomed by those who desire to have in their homes the advantages of the improved light distribution which the holophane reflector affords, and yet wish to depart from the standard forms seen everywhere. Another new design, or rather an adaptation of an existing design, which will be much appreciated, is the "bank desk" unit. One of the "Stiletto" series of shades, the "extensive" pattern (No. E.60), is employed, and over it a green and white opal shade is placed, fitting closely to it. The external appearance is that customarily desired on bank desks, &c., but the advantages of the holophane reflector within are obtained. An interesting curve giving the illumination with the holophane reflector is shown above.



Holophane "Bank Desk" Fitting."



Curve A=Distribution Curve from Holophane Bank Unit.
Curve B=Illumination " " " " "
Curve C= " " " Two Holophane Bank Units.
Height of lamp above desk, 2 ft. 6 in.
Distance between successive lamps, 4 ft.

The Sunbeam Lamp Co., Ltd.,

Gateshead-on-Tyne. (Stand Nos. 56 & 58.)

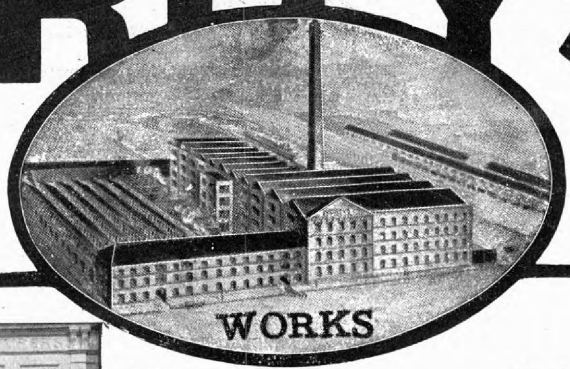
This firm is showing a continuous-filament lamp with a drawn filament, and in sizes down to 45-watt 200-volts. They are also making 32-watt 200-volt lamps with drawn filaments. Lamps of all sorts and sizes are shown, the largest

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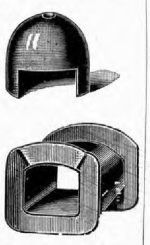
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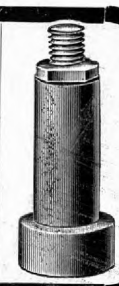
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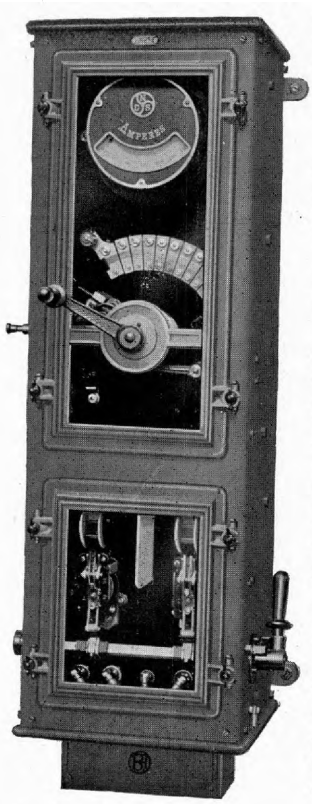


being 1,000 c.p., and there is, of course, a collection of radiator lamps, for it will be remembered that the Sunbeam Lamp Co. were the first, in conjunction with the Dowsing Radiant Heat Co., to put this class of lamp on the market. The "Lux" candle lamp fitting is shown. In this a short lamp replaces the usual bulb flame lamp, and a glass tube (the lower part of which is an imitation candle and the upper part is of plain glass and covers the candle lamp) is placed over it. Specimens of the Sunbeam stage number and cab signs are shown. In these a number of small lamps are placed in diamond-shaped compartments in a square or rectangular frame, which is covered with red glass so that the edge of the partitions come right up to the glass. A set of lamps representing the number or letter required are lighted up by means of a special controller, and show through the red glass, the remaining part of the glass in front of the unlighted partitions being left quite dark. The Sunbeam Company are also exhibiting electric cooking utensils and general supplies.

Brook, Hirst & Co., Ltd.,

NORTHGATE ELECTRICAL WORKS, CHESTER. (STAND NO. 153.)

Motor Control Apparatus.—This firm show a variety of motor panels embodying some interesting features. The illustration shows a standard constant speed wall pattern panel with starter, with solenoid pattern overload trip, renewable copper contacts, each with a subsidiary carbon roller wipe, and separate D.P. magnetic blow-out circuit-breaker with no-voltage and overload releases perfectly free to act during or after the operation of starting. The starter and circuit-breaker are so interlocked that the circuit-breaker can only be put on when the starter is off, and the starter can only be put on when the handle of the circuit-breaker is free. Several varieties of these panels are shown, some of which are fitted with an adjustable thermal time lag device actuated by a special form of compound metal spring, which is found to be particularly reliable in action. Among the panels exhibited is one of special Admiralty design with mica insulation throughout and without slate. A special form of panel is provided where frequent "inching" is required; here only one pole of the circuit-breaker is actuated by hand, the other being closed electrically by putting the starter handle on the first notch, so that the circuit is not broken on the starter contacts. Both breakers are, however, thrown out by the releases. Some of these starters are provided with mechanically interlocked shunt regulators. The largest panel shown is a multiple lever type panel, in which successive movements of the single handle close first the main D.P. circuit-breakers, then the row of starter contactors, and lastly a "final contact" circuit-breaker, to which the load is transferred. Current is broken on tripping by the circuit-breakers only, and an electrical interlock prevents the circuit being made again till all the starter contactors are off. An important feature is that a button has to be kept pressed during the starting operation to keep the circuit-breakers in, so that the attendant cannot leave the starter with the starting operation half completed. Another interesting pillar contains an automatic starter in which a set of contactors are mechanically released and allowed to engage successively under the control of a dash-pot.



Brook Hirst Standard Wall Motor Panel with Interlocked Circuit-breakers.

The Lazilite Co.,

SOUTHAMPTON HOUSE, HIGH HOLBORN. (STAND NO. 316.)

On this stand in the gallery are shown examples of an extensible fitting, on the "lazy tongs" principle, for fixing to a ceiling or wall to enable a lamp suspended from a counter-weight pendant to be placed in any position within a ten-foot circle. The construction of the fitting renders it able to sustain an 8-lb. weight when fully extended to a length of five feet. The fitting should have an extensive field of application, both for office and domestic use.

Isenthal & Co., 85 MORTIMER STREET, W. (STAND NOS. 20 & 41).—On this stand is an imposing array of Moscicki condensers, Giles valves, and other appliances, including a 35,000 surge protection equipment complete with choking coils, disconnecting liquid switches, &c. Examples of batteries of this and other forms of condenser as used in wireless telegraphy are also shown, and there is also a display of small adjustable resistances for laboratory and testing-room use, as well as field regulators for dynamo and motors.

The Efandem Co., Ltd., 83 UPPER THAMES STREET, E.C. (STAND NO 4.)—The principal exhibit on this stand is the dry battery for pocket lamps, of which we are told that 10,000 are being turned out daily from the Wolverhampton Works. Sheet metal cases for pocket lamps and torches are also on view. Another branch in which this firm specialises is a British-made bell, which is shown in several sizes. Some very complete charging sets, to be run from the lighting circuits, consisting of a rotary converter and switch-board with automatic cut-in and cut-outs, must also be mentioned.

W. Lucy & Co., Ltd., EAGLE IRONWORKS, OXFORD. (STAND No. 96.) *Street Lighting and Mains Accessories.*—On this stand are to be seen a number of typical examples of fittings and lamp-posts for street lighting and accessories for overhead distribution, including a convenient form of overhead distribution-box as used on the poles at Carmarthen. This is supplied complete and ready for connecting up from the outside, and is thoroughly weather-proof. Several designs of cable-box are shown, including a fine junction-box for large triple concentric cables. Feeder pillars, both for high and low tension systems, are exemplified, and a special method of sealing in without the use of rubber tail-ends is demonstrated. There is also on this well-arranged stand a particularly good show of cast-iron house service and other fuse-boxes.

A. Emanuel & Son, Ltd., 7 to 13, GEORGE STREET, MANCHESTER SQUARE, W. (STAND NOS. 195 & 220.) *Fittings and Accessories.*—This firm have a fine display of fittings on the some stand as the Foster Engineering Co., including some very artistic designs of pendants, standards, &c., made at their Birmingham Works. Outside lanterns, radiators, and other accessories are also shown, and particular attention should be called to the company's "Kwik-Fix" ceiling-rose entirely without back connections or screws into china.

The Rapid Magnetting Machine Co., Ltd., 18, THE CRESCENT, BIRMINGHAM. (STAND NO. 10.) *Separators.*—Several forms of magnetic separator are shown. A standard pattern machine with a revolving gunmetal drum within which are powerful radial electromagnet

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poles is shown at work, removing iron from mass and other non-magnetic turnings, &c. Another machine is specially designed for removing iron particles, nails, &c., from such material as destructor furnace clinker. This has the magnet poles arranged circumferentially and is used for treating crushed clinker used for the tramway sand-boxes by the Corporation of Birmingham, and at Glasgow for removing iron from the clinker used for making paths in parks and public gardens. Similar machines at Folkestone remove iron from material used for gritting roads. Another pattern of separator for more finely divided iron consists of an inclined shaking table with magnet poles at intervals, to which the iron adheres, while the other material passes to a spout. A special device prevents the iron falling off and remingling with the other material should the current fail, by causing the deflecting spout to be held up by a magnet, so that it drops away when the current is cut off. The company are also bringing out a machine for treating large quantities of material on a belt-conveyor in which magnet drums are used both from above and below the belt, with their poles arranged to give a very intense field.

Eastman & Warne, 241–243, Acton Vale, W. (Stand No. 236.) *Electric Irons, &c.*—This firm show a considerable range of "hot point" electric irons for industrial and domestic work as used in the works of Messrs. Eastman & Sons (dyers and cleaners). These are of substantial construction, with heating elements consisting of plenty of heavy-guage wire wound on mica or similar strips embedded in a large number of slots in the upper part of the sole. A 1,400-watt hot-plate cooker with seven degrees of heat is among the other objects shown.

Hans Renold, Ltd., Progress Works, Brook Street, Manchester. (Stand No. 250.)—On their stand in the gallery this firm have an excellent display of their well-known steel driving chains and wheels for the transmission of power, including examples of their patent silent chain suitable for speeds up to 1,300 ft. per minute, and powers up to 300 h.p. One of these chains can be viewed running through a rotoscope, by means of which visitors can see while the chain is in motion exactly how the links mesh with the wheel teeth. Roller and block chains are also shown.

The Imperial Lighting Co., 157 Blackfriars Road, S.E. Stand No. 233.)—This firm, who equipped the large outside sign over the entrance, with its 1,500 incandescent lamps, partly metal filament and partly carbon, and two 80-ampere searchlights, has been greatly handicapped in the preparation of their stand by a fire which took place at their works a few weeks ago. The company's well-known Fairyland strip is well represented, and demonstrations are being given of its waterproof qualities. The addition of a strip with miniature B.C. holders now brings the patterns made up to twelve. Among the signs is an effective arrangement employing 14-volt metal filament lamps in multiple series for outlining letters, &c. A motor-driven flasher is shown in action, and various items of stage-lighting equipment are exemplified. Above the stand is mounted a new form of large electric bell with a slowly swinging, electromagnetically actuated clapper, known as the Knoxem bell.



The Leskole Co., Ltd., Palace Works, Enfield. (Stand No. 222.) *Thermometers.*—The principal electrical exhibits of this firm include two kinds of thermometers. The distance thermometer, for temperatures up to about 900° F., relies on the variation with temperature of the resistance of small coils of pure nickel. This is compared with others not sensitive to temperature, which are arranged in an indicator to form a Wheatstone bridge with the thermometer resistance. The current is supplied by a 2-volt accumulator. The other kind is the pyrometer, in which the thermo-elements are of carbon-nickel for measuring up to 2,280° F. Platinum-iridium is used for higher temperatures up to 2,900° F. A continuous recorder is also shown.

Etchells, Congdon & Muir, Ltd., 15 Cannel Street, Manchester. (Stand Nos. 18 & 43.) *Lifts.*—This firm show a model lift to demonstrate their very simple system of push-button control. The controller is entirely self-contained, and the same pair of solenoids which control the change-over direction switch draw up the starter contact against a dash-pot. A number of accessories such as gate-locks, interconnected with the control system, self-closing doors for goods lifts, examples of the particularly simple and robust "Eureka" push-buttons, entirely without springs, and other details of lift control apparatus are shown, as well as an automatic speed governor for instantaneously engaging the safety catches on a rise in speed. A complete motor and gear for a goods lift is also shown.

Bi-Metals, Ltd., 80A Southwark Street, London, S.E. (Stand No. 324.)—An interesting exhibit on the gallery is the "Tinol" paste solder. This is a combination of finely divided tin and lead in certain proportions, and a flux. The paste is placed on the metal and heated until it runs, the flux liquifying and not dissipating until the solder is fused, so that any oxides that may be present are dissolved. Six different alloys are made up in this way, including one with a very low melting point, 120° C., consisting of tin, lead, and cadmium, which is very useful for instrument work. It is also made up in the solid form for heavier work, in which the solder is self-fluxing, having a central core made of the paste. Demonstrations with this solder are given at the stand, which is well worth a visit. "Tinol" can be had in various quantities, and several outfits are shown.

F. M. Russell & Co., Ltd., Junction Works, Willesden, N.W. (Stand No. 320.) *Time Recorders.*—Examples are shown of the Kosmoid time-recorder for works, &c., where each employee, on entering and leaving, signs his name on a paper strip upon which the time is automatically printed. In another form each man inserts a key, which prints a number on the slip. The key is inserted a different distance for in or out, or in the case of tramways, &c., for "up" and "down" journeys. The instruments are compact and portable, and suitable for outside contracting work, as well as factories, &c. A large wall pattern of recorder is also shown.

R. W. Paul, 33 Leicester Square, W.C. (Stand No. 240.) *Instruments.*—A small laboratory comprising all the latest developments in Mr. Paul's instruments is fitted up on this stand. Attention may be drawn to the Harris portable ohmmeter with a 500-volt generator with a specially open scale, and a push-button switch for dividing the reading by ten. A slide potentiometer having a double pole key, by which the balance of the standard cell can be checked without shifting the switches or slider, is also shown. The Ampall for measuring currents in copper conductors without shunts, which we described in Electrical Engineering, May 25th, page 297, is also on view. A number of resistance boxes are shown, including the precision decade resistance, with three dials, each having ten oil-cooled manganin coils, with which direct contact is made by self-adjusting laminated copper brushes. Among the A.-C. instruments mention must be made of the unipivot dynamometer wattmeter for measuring small currents and pressures.

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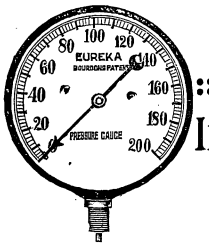
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SEND FOR CIRCULARS AND TESTIMONIALS.

Wireless telegraphy is represented by Campbell's apparatus for high-frequency measurements of inductance, capacity, and effective resistance, including the microphone hummer, tuned telephone detector, vibration galvanometer, and variable mutual inductance. Two types of pyrometers are also shown, with iron-eureka and platinum-rhodium couples, and other exhibits include galvanometers, portable ammeters and voltmeters, all with unipivots; also Fleming's high-frequency thermo-electric ammeter, the Cohen interrupter and barretter for telephonic measurements, the Irwin hot-wire oscillograph, and the Duddell-Mather standard wattmeter.

Aerators, Ltd., Upper Edmonton, N. (Stand No. 77.) *Die Finished Castings.*—On this stand are shown castings with specially high finish and accuracy, made in special alloys by the "Prana" process, in which the metal is kept under pressure in the mould until set. These castings save a considerable amount of machining, as even fine screw threads can be cast on accurately. The alloys used are exceptionally well adapted to nickel-plating, and the whole method possesses great advantages for such work as the manufacture of telephone parts. A special plaited hose-covering equally suitable as a cable covering is shown, and on the same stand is a display of CO_2 fire-extinguishers by the British Fire Appliances Co., Ltd. (Craig's Court House, S.W.).

Richard Hornsby & Sons, Ltd., 75B Queen Victoria Street, E.C. (Stand No. 9.).—On this stand can be seen running a 17 b.h.p. single cylinder horizontal gas engine with magneto ignition, driving a dynamo which supplies the lighting of the stand, and taking gas from a complete suction plant working on anthracite also on the stand. A 6½ b.h.p. oil engine on the company's well-known type, with automatic ignition, is also to be seen running, and a 3 b.h.p. single cylinder horizontal petrol engine, direct coupled to a 1½ kw. dynamo, is also shown.

Pirelli, Ltd., 45 Basinghall Street, London, E.C. (Stand Nos. 172 & 191.)—The most striking exhibit to be seen here is a 75,000-volt three-core cable shown wound on a drum with one end mounted to show the cross section. Smaller sizes of cable of every description, including multiple telephone and flexible cables, are exhibited in show cases, where some excellently mounted specimens can be seen. Rubber gloves and insulating tapes of various kinds are also on view.

The Dussek Bitumen Co., Canal Bank, Trundley's Road, Deptford, S.E. (Stand No. 242.)—This firm is showing some very fine specimens of Trinidad bitumen, which can be seen both in the crude and the refined states. The firm is also experienced in the actual laying of cables, and show a trough with the cables in position and partly filled with bitumen. Samples of joint-box compound, resin oil, bituminous paint for preserving iron and steel, and greases for lubricating and other purposes are other exhibits. All those who are interested should apply at the stand for the firm's latest pamphlets, which contain interesting information.

The Crypto Electrical Co., Bermondsey Street, London, S.E. (Stand No. 57.)—One of the principal exhibits on this stand is the A.-C. to D.-C. transformer. This is shown in two forms, a squirrel-cage motor coupled to a shunt-wound dynamo for charging accumulators or lighting cinematograph arc lamps, and a combined set, in which the two machines are mounted in the same frame. This is suitable for charging accumulators from A.-C. mains, and is very widely used. A private lighting plant with vertical petrol engine, which can be seen working, and a series of small A.-C. and D.-C. motors, all of British manufacture, are also shown.

Bullers, Ltd., 6 Laurence Pountney Hill, E.C. (Stand Nos. 118 & 141.)—Porcelain insulators of every description are to be seen at this stand. The suspension types for voltages of 100,000 has mechanical fittings, which are tested to three tons. A number of the pin-type for voltages of 2,000 to 50,000 are also prominent. The feature of this stand is no doubt the testing of these insulators. This is done under a spray of water with a 100,000-volt transformer, and a large crowd is attracted at each demonstration. A section is given to telephone and telegraph work, where a series of insulators, for use under all conditions, can be inspected. A large lattice steel mast is also erected on the stand.

A NEW LAMP SHOWCARD

A NEW and attractive showcard has just been issued by the British Thomson-Houston Co., Ltd. (83 Cannon Street, E.C.). This lamp's special feature, mechanical strength, due to the employment of drawn wire in place of the pressed composition tungsten filament, is graphically demonstrated by the



New Mazda Lamp Showcard.

centre illustration. Other attractive features of the new showcard are the three well-displayed catchwords, "The Sun's Only Rival," "Better Light—Lighter Bills—Saves 75%," and "British Made by British Labour." The black and white reproduction given here gives no idea of the brilliant colouring—the circle in the centre of the card is a vivid red, and compels attention.

Printed for the Proprietors, The Kilowatt Publishing Co., Ltd., 203-206, *Temple Chambers, Temple Avenue, London, E.C., by* Richard Clay And Sons, Ltd., *Brunswick Street, Stamford Street, S.E., and Bungay, Suffolk.*—Oct. 19, 1911.

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ELECTRICAL ENGINEERING

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ELECTRICAL ENGINEERING.

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SUMMARY

The fifth part of our special description of the Electrical Exhibition at Olympia (which closes on Saturday) forms part of this issue, containing detailed accounts of over 50 stands. Among the novelties described and illustrated are the fine electric cooking ranges and cookers of the British Prometheus Co., a new type of A.-C. meter, and a cable-sinking drum for mines. Several new forms of electric heating and cooking apparatus and details of different systems of lift control are discussed, some new sign flashers are illustrated, and illumination curves relating to a new holophane fitting are reproduced.

A submarine telephone cable laid between England and Belgium is described. The weights of copper and gutta-percha are only 160 and 150 lbs. respectively per naut of core, and speaking through this has been rendered possible by the use of loading coils and a special gutta-percha with low leakance. The cable, which has two pairs of cores, will be used for three simultaneous conversations by employing a "phantom" circuit, and an additional series of loading coils is inserted to enable this to be done. (Page 567.)

In view of the manufacturing difficulties in connection with the production of high-voltage metal filament lamps having now been largely overcome, and in consequence of increased outputs, the leading manufacturers are now able to effect substantial reductions in price. The 200–260 volt lamps in the ordinary sizes are now sold at 3s. each, and those for 100–135 volts have been reduced to 2s. 6d. (Page 567.)

A description is given of a new electrically-driven appliance for displaying posters or samples of material. (Page 569.)

At the inaugural dinner of the British Electrical and Allied Manufacturers' Association on Thursday, Mr. S. Z. de Ferranti, who occupied the chair, said that the fact that the electrical industry was not as prosperous as one would like to see it was partly due to the manufacturers themselves. He desired to see less competition purely in price, and keen competition in excellence. Mr. A. B. Anderson, to whom it had evidently been delegated to disclose the programme of the Association in general terms, made it clear that one of the endeavours of the Association would be to discourage buying abroad. He also disclaimed any intention of the Association to form a trust or cartel, and in this he was supported by Mr. Hugo Hirst. (Page 569.)

A method of sealing wires into hard, vitreous substances, and a lampholder for use with electric signs, in which the terminals are well insulated and protected from the outside metal parts, were among the specifications published by the Patent Office last week.—B. Macku has introduced a means of producing slightly damped oscillations by condenser discharges, and E. Girardeau deals with the mounting of wireless telegraph receiving and transmitting apparatus with a view to protecting the detector in the receiving circuit from the emission waves.—The purification of gases by passing them between electrodes is dealt with in another specification. (Page 570.)

Under "Telephony and Telegraphy (including Wireless)," we refer to a proposed issue of £250,000 new ordinary shares by the Marconi Co.; the present position of the National Telewriter Co.; the settlement of the dispute with regard to overhead wires at Hythe, and the possible sale of the Grindell-Matthews Wireless Telephone Syndicate. (Page 571.)

In our "Electric Traction Notes" we mention the adoption of the British Electric Traction Co.'s capital reorganisation scheme; a proposal of the L.C.C. for tramways to Cheapside; and the loss of £5,749 upon the Liverpool tramways due to the strike. (Page 572.)

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The Birmingham Electricity Committee propose to erect a new high-tension power station.—There was a net profit of £9,000 upon the Bradford Electricity Department last year, and £8,430 at Edinburgh.—Some very satisfactory results have been obtained with the new generating plant at Brownlow Hill Workhouse (Liverpool).—The Sheffield Corporation are proposing to apply for wiring powers next session.—The cost to the Winchester Corporation of acquiring the local electric supply company was £2,263. (Page 573.)

A 1,000 b.h.p. gas-engine plant is required at Accrington; storage battery at Bury; a 5,500 kw. steam turbine at Sheffield; a 250 kw. Diesel engine at Swindon, and a generating plant at Radcliffe and Stourbridge. Tramway supplies are required at Bradford and Dublin. Considerable extensions to the tramways are contemplated at Halifax. (Page 573.)

Ferranti, Ltd. made a net profit of £4,166 last year. No dividend is declared. The A.E.G. (Berlin) again declare a dividend of 14 per cent. (Page 574.)

A 60,000-kw. Power House.—The *Electrical World* (New York) reports excellent progress in the new Spokane power house, which is being erected by the Water Power Co., Spokane, Washington, at Long Lake, four miles from the Little Falls. The coffer-dam is complete, and preparations are being made for commencing a dam which will be 140 ft. high. The new plant will be equipped with four 22,500-h.p. turbines, each direct-connected to 15,000-kw. 400 volt three-phase 60-cycle G.E.C. generators. The turbines are being made by the J. P. Morris Company, Philadelphia, to operate under a head of 140 ft. The transformers that will be installed to step up the pressure to 60,000 volts will comprise either four 15,000-kw. three-phase, or twelve 5,000-kw. single-phase units. A transmission line will be built connecting the new power house with an existing station at Little Falls, and eventually a tower line will be constructed for a distance of 50 miles north of the river.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) FRIDAY, OCTOBER 20th.

Electro Harmonic Society.

8 p.m. Smoking concert at Holborn Restaurant.

FRIDAY, OCTOBER 27th.

Physical Society.

5 p.m. At Imperial Technical College. The agenda includes:—"Further Observations on the After Glow of Electric Discharge and Kindred Phenomena," by the Hon. R. J. Strutt.

A Safety Device.—We regret that the name of Mr. F. C. Morris, the writer of a letter given under the above heading on page 559 of our last issue was given incorrectly as F. C. Moins.

Engineering and Machinery Exhibition, 1912.—We are informed that considerable progress has already been made in letting space for this exhibition, which is to be held at Olympia from October 4th to 16th next year, and that comprehensive display of electrically-driven machine tools will be made.

Manchester Section of the I.E.E.—The opening meeting of the Manchester Section of the Institution of Electrical Engineers will be held at the Midland Hotel on Friday, October 27th, at 7.30 p.m., when the Chairman, Mr. W. Cramp, will deliver his Inaugural Address. A smoking concert will follow. The remaining meetings will be held as usual at the University. The programme for the session is as follows:—November 7th, "The Mechanical Design of Direct-current Turbo-generators," by R. Roberts; November 15th, Joint Meeting with the Liverpool Engineering Society at Liverpool, "The Function of the Laboratory in the Training of an Engineer," by Prof. E. W. Marchant; November 28th, "Automatic Reversible Battery Boosters," by R. Rankin; December 12th, "Heat Conductivity in Electrical Machinery," by Miles Walker and H. D. Symons; January 16th, "Recent Developments in Turbine Practice," by Karl Baumann; January 27th, Meeting with the Manchester Association of Engineers, "Electrical Furnaces," by Cecil Myers; February 13th, "Specifications," by Fred S. Sells; February 23rd, Annual Dinner; February 27th, "High Tension Porcelain Insulators," by J. Lustgarten; March 12th, "The Mechanics of Electric Train Movement," by F. W. Carter; March 26th, "The Corrugation of Rails," by Prof. A. Schwartz and R. G. Cunliffe; April 16th, "Recent Developments in the Application of Electricity in Textile Factories," by J. F. Crowley; April 30th, Annual General Meeting, Lecture by Dr. R. Thury.



CAPTAIN OF FISHING SMACK: Steady with that anchor, Bill. There be submarine cables here. I don't mind about 'em as a rule, but they say that new one be loaded, and we don't want to be blown up with their blooming electricity.

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NEW TELEPHONE CABLE BETWEEN ENGLAND AND BELGIUM

THE new telephone cable which has been laid between St. Margaret's (Kent) and La Panne, in Belgium, represents the greatest advance that has yet been made in the application of the Pupin coil system to telephony. It will be remembered that the first cable in which Pupin coils were used was the latest submarine telephone cable between England and France, a full description of which appeared in our issues of March 17th and December 22nd, 1910.

In this cable, although it was felt that the Pupin coil system as applied would bear out the predetermination of the results arrived at by calculation and previous research, yet it was deemed advisable to make the cable in such a way that even if the Pupin coils were unsuccessful, and had to be cut out, the cable would still be used in the ordinary course for telephone purposes. The Anglo-French cable was therefore made with conductors weighing 160 lbs. per naut, and gutta-percha 300 lbs. per naut, *i.e.*, similar to the other telephone cables between England and France. It will be remembered that the results of the addition of the loading coils was to improve the speaking properties of the cable enormously, and was quite up to anticipations.

In designing the Anglo-Belgian cable, therefore, it was decided that full account should be taken of the effect of the loading coils, and that the cable should be constructed throughout in accordance with the modern theory of telephonic transmission. The conductors are the same size, viz., 160 lbs. per naut, but instead of the dielectric weighing 300 lbs. per naut, it weighs only 150 lbs. A special gutta-percha is used in the Anglo-Belgian cable with a particularly small leakance, and the ratio S/K has been reduced from 120 in the Anglo-French cable to 12 in the Anglo-Belgian cable.

In addition to this advance in cable construction, there is further progress by the fact that the two circuits in the cable, instead of being used merely for two conversations, will be able to be used for three simultaneous conversations by the use of what was formerly somewhat incorrectly called duplexing, and is now usually termed a "phantom" circuit. The wires of each circuit are bridged by repeating coils, the centre of each of which is connected to form the third circuit, so that the two wires of each of the "side circuits" are used in parallel for the "phantom" circuit, as has frequently been done in the case of long-distance land lines. To enable this to be possible in the case of a loaded circuit, however, it was necessary to add an additional series of loading coils in each circuit. The two windings in the loading coil in the side circuits are wound, as in the Anglo-French cable, on one core, and are, of course, so wound that the inductive actions of the two windings assist one another. When the two conductors are used in parallel on the phantom circuit, these two windings therefore neutralise one another, and another coil is necessary with a pair of windings wound both in the same direction, instead of in contrary directions, so that they act as an inductance coil when the two wires are used in parallel for the phantom circuit, but the inductances oppose one another when the two conductors are used in the ordinary way.

The total length of the cable is 47·892 nauts, and each wire has a length of 48·366 nauts. The following are the other constants of the cable:—

Resistance per naut of conductor without coils	14·2 ohms at 15° C.
Capacity per naut (wire to wire) without coils	0·157 mfd.
Capacity per naut of phantom circuit without coils	0·314 mfd.
S/K at 800 cycles per sec. and 15° C. (S = leakance in micro-mhos, K = wire to wire capacity)	12
Inductance of the coils for the transformer circuit	0·1 henry.
Ohmic resistance of the inductive and non-inductive coils of the transformer circuit	6·6 ohms.
Effective resistance of the inductive and non-inductive coils of the transformer circuit at 800 cycles with 1 milliampere at 15° C.	11·5 ohms.
Inductance of the coils in the phantom circuit	0·05 henry.
Ohmic resistance of all coils in the phantom circuit	3·3 ohms.
Effective resistance of all the coils in the phantom circuit at 800 cycles with 1 milliampere at 15° C.	4·6 ohms.
Capacity of the coils in the transformer circuit	0·004 mfd.
Additional capacity of the coils in the phantom circuit, less than	0·0001 mfd.

"βl" for 50 Nautical Miles (measured).

$2\pi n$	3,000	4,000	5,000	6,000	7,000
Transformer circuit	0·863	0·872	0·893	0·920	0·977
Phantom circuit	—	0·877	0·904	0·928	—

On testing the cable after laying, the speaking properties were equivalent to 7½ miles of "standard" cable.* This test may be considered fairly accurate, as 10 miles of "standard" cable was added at each end to eliminate terminal losses.

The actual construction of the cable, and the method of inserting the armouring and loading coils follows exactly that employed in the Anglo-French cable. Loading coils are inserted one naut apart, and the additional loading coil for the "phantom" circuit is inserted at the same place. In construction, this additional loading coil is similar to the others, except that one of the windings is reversed, and it merely increases the length of the bulge by eight inches. In spite of the smaller amount of dielectric, the total diameter of the cable is the same, and the same number and size of armouring wires are employed, the difference in diameter being made up by the additional jute under the armouring. Teredo tape is employed, as in all channel submarine cables nowadays.

The laying of the cable was completed on August 30th, but it has not yet been taken into use, as the land lines at the two ends are not yet complete. A very interesting point, which was rather welcomed by the Post Office engineers than otherwise, was that after laying, a fault was observed. This was localised, and was found to be an ordinary jointer's fault between the coils and the core, close to the St. Margaret's end. This afforded the Post Office engineers an opportunity of ascertaining whether it was as easy to repair a cable of this character as an ordinary submarine cable. The cable was lifted at the fault, and no difficulty at all was found in effecting the repair in the ordinary way, after which the cable was tested and found to be perfect. The fault was localised by an ordinary Varley loop test.

For the information in this article we are indebted to Major W. A. J. O'Meara, R.E., C.M.G., Engineer-in-Chief to the General Post Office, and to Messrs. Siemens Bros. & Co., who were the makers of the cable.

New Publications.—In the list of new publications in our last issue we gave the price of "Electrical Mining Installations," by P. W. Freudemacher, as 1s. net instead of 2s. net.

Dissolution of National Electric Lamp Co. (U.S.).—The United States District Court, Toledo, has decided that the combination of the National Electric Lamp Co. and 35 subsidiary companies is illegal, and has ordered the dissolution of the company. The efforts of this company were directed to the maintaining of the prices of electrical apparatus, and it is this which is declared illegal.

Rugby Engineering Society.—1911–12 session commenced on Thursday, Oct. 12th. The following Papers will be read during the session, the meetings being held at the Benn Buildings, High Street, Rugby:—Oct. 12th, "Multiple-effect Evaporation," by E. R. Briggs. Nov. 16th, "Gyrostats," by R. C. Clinker. Dec. 14th, "Machine Shop Practice," by P. V. Vernon. Jan. 11th, 1912, "Air Compressor Efficiency," by B. M. Woodhouse. Feb. 15th, "Workshop Economics," by J. Picken. March 21st, "High-speed Electrical Machinery," by F. H. Clough.

* Standard cable is that having a wire to wire capacity of each pair of wires of 0·054 microfarads per statute mile, a loop resistance of 88 ohms per statute mile, and an average insulation resistance of not less than 200 megohms per statute mile wire to wire.

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REDUCTION IN THE PRICES OF METAL FILAMENT LAMPS

IMPORTANT announcements are being made by the leading makers of reductions in the prices of metal filament lamps, especially those for the higher voltages. In the case of Osram lamps, the list price of the 200–260-volt 32, 40 and 55-watt lamps has been reduced to 3s. (instead of 3s. 9d. and 4s.), and the 100–135-volts 17, 25, 32 and 55-watt sizes are now sold at 2s. 6d. The price of the new 20-watt 200–260-volt lamp is also very moderate, being 3s. 3d. These low prices are in no way due to competitive cutting, for indeed they form a concerted move on the part of the principal firms, who have a patent understanding amongst one another, but are solely the outcome of the vast manufacturing improvements, which have caused the former difficulties in the manufacture of very thin filaments to disappear. There is no doubt that, combined with the introduction of a really convenient sized 200-volt metal filament lamp for small units, a great impulse will be given to electric lighting in general, and that yet another step has been taken in the superceding of gas.

Messrs. Drake & Gorham, who hold very large stocks of Osram lamps, enabling them to give prompt delivery, announce similar reductions.

Siemens Brothers Dynamo Works have also been enabled, owing to their increasing rate of output, to announce reductions in the prices of Tantalum lamps from 200–250 volts, which will, as from Monday last, stand at 3s. Corresponding reductions have also been made as regards the same firm's 55-watt drawn tungsten "Onewatt" lamp, which will henceforth be sold at 2s. 6d. for 100–130 volts, and 3s. 3d. for 200–250 volts. (The above prices refer to standard bulbs. Special bulbs are 3d. extra both for Tantalum and Onewatt lamps.) The discounts remain as before, and we are asked to state that lists with the new prices can be supplied overprinted with contractors' names and addresses.

The British Thomson-Houston Co. are likewise able to lower the prices of their British-made Mazda lamps with wire-drawn filaments, which are now sold at 2s. 6d. each for the 100–125-volt 17, 25, 30, 40 and 60-watt sizes, and at 3s. for the 200–260-volt 30, 40 and 60-watt sizes.

Similar reductions in the prices of Mazda lamps are being made by G. M. Boddy & Co. (8 Leadenhall Street, E.C.).

The Edison & Swan United Electric Light Co., Ltd., are also bringing the prices of their Royal Ediswan metal lamps in line with those given above, viz., 100–130 volts 17–55 watts, 2s. 6d., and 200–260 volts, 32–63 watts, 3s. They also make the important announcement that they are introducing a 100–130-volt 12-watt lamp at 2s. 8d., and a 200–260-volt 24-watt lamp at 3s. 3d.

The British Westinghouse "Auriga" lamps are also being sold at the reduced price of 2s. 6d. for the 100–135-volt 20–63-watt sizes, and 3s. for the 200–260-volt 32–63-watt sizes.

The Electrical Company's "Aegma" lamps are subject to similar reductions, the sizes affected being 25, 32 and 50 c.p. for 200–260 volts, which are reduced to 3s., and 16, 25, 32 and 50 c.p. 100–130 volts to 2s. 6d. This reduction applies to lamps purchased since September 16th.

Brimsdown Lamp Works announce similar reductions, the 17–57-watt 100–135-volt lamps now selling at 2s. 6d., and the 32–55-watt 200–260-volt lamps at 3s.; and Simplex Conduits, Ltd., are selling at similar prices.

The Sunbeam Lamp Co. are bringing their prices both for high and low voltage lamps in line with those given above. Reductions in price are also being made by the "Z" Electric Lamp Manufacturing Co., who at the same time announce the introduction of a high-voltage 16-c.p. lamp. Cryselco, Limited, are reducing their 25 to 50-c.p. high-voltage lamps to 3s.

Krupka & Jacoby announce reduced prices for Graetzin lamps, which are now sold in the following sizes:—100–135 volts, 16–50 c.p., 2s. 6d.; 200–260 volts, 25–50 c.p., 3s. (round bulbs 3d. extra).

CATALOGUES AND PAMPHLETS, &c., RECEIVED

CATALOGUES FOR SOUTH AFRICA.—We have received from the A.E.G. Electrical Co. of South Africa, Ltd. (Caxton House, Westminster), several publications of the Foreign Department of the Allgemeine Elektricitäts-Gesellschaft, of Berlin, relating to metallic filament lamp fittings, balance or differential protective systems, meters, and a description of the Adamello power scheme.

HAIR DRYERS.—A card from Simplex Conduits, Ltd., calls attention to the Simplex electric hair dryer, consisting of a small motor-driven fan delivering electrically-heated air, and weighing no more than 2 lbs.

HIGH AND LOW TENSION SWITCHGEAR.—Messrs. Messrs. Vedovelli, Priestley & Co. (Paris), whose London agents are Laing, Wharton, Ltd. (7 Newport Street, W.C.), have sent us a copy of a comprehensive catalogue containing particulars of switchgear &c., of their manufacture, including knife and other low tension switches and fuses, H.T. oil switches, overhead horn break switches, isolating switches, link suspension insulators, circuit breakers, remote control switches, lightning protection apparatus, &c.

ELECTRICITY IN DAILY LIFE.—A new booklet entitled "The Magic Wand of Science," designed to place before the public the possibilities of electricity for household purposes, is being issued by the General Electric Co., who are prepared to supply it in small quantities to any central station who will undertake to distribute copies among the consumers. The booklet is excellently produced, copiously illustrated, and deals thoroughly with the uses of small motors for driving household appliances, sewing machines, &c., electric heating, cooking, and ironing, vacuum cleaners, fans, &c.

METAL FILAMENT LAMPS.—An effective form of advertisement of the General Electric Co.'s new 200-260-volt. 16-c.p. (20 watts) Osram lamp with continuous drawn tungsten filament is a card the exact size of the lamp with an illustration of the lamp on the front, and price and particulars on the back.

FITTINGS AND HEATING APPARATUS.—Two attractive booklets, entitled respectively "The Electric Light Fixture" and "The Aston Electric Working Appliances," from Veritys (31 King Street, Covent Garden), deal with the fittings in the styles of various periods, and the new forms of heating and cooking apparatus referred to in our special article last week on their new London showrooms.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ONEWATT LAMPS.—We have received from Siemens Bros. Dynamo Works, Ltd. (Incandescent Lamp and Fittings Department, Tyssen Street, Dalston), a framed copy of a clever, humorous sketch illustrating the manufacture of the onewatt lamp. Various stages are pleasantly suggested, but the scene we like best is "drawing" the filament by a tug-of-war between two traction engines.

MACHINERY.—Lists from the Metallic Seamless Tube Co., Ltd. (Wiggin Street, Birmingham), give the prices, weights, and full particulars of motor generators, rotary transformers, and converters, D.-C. motors and dynamos, and two- and three-phase induction motors with 4, 6, 8, 10, or 12 poles.

SWITCHGEAR.—The same firm also send a leaflet relating to starters, starting panels, and shunt regulators for D.-C. machines.

LANTERNS AND FITTINGS.—A new catalogue from the Wardle Engineering Co., Ltd. (196 Deansgate, Manchester), shows a number of new designs of lanterns and fittings for street, shop, and works lighting. Several types are shown suitable for use under all conditions. Details and prices are also given, so that it should be found very useful for future reference.

HEATING APPARATUS.—The same company also send details of the Bastian Quatzalite heaters, which are being used on the s.s. *Olympic* and *Medina*, and a list of quartz heating and cookery apparatus described in our exhibition article, Part III., October 5th, 1911, pp. 44 and 47.

LIGHT TRANSFORMING REFLECTOR.—A leaflet from the Westinghouse Cooper Hewitt Co., Ltd. (151-2 Great Saffron Hill, Holborn Circus, E.C.), refers to the mercury vapour lamp fitted with this reflector, which we described in Part IV. of our exhibition supplement, October 12th, p. 64.

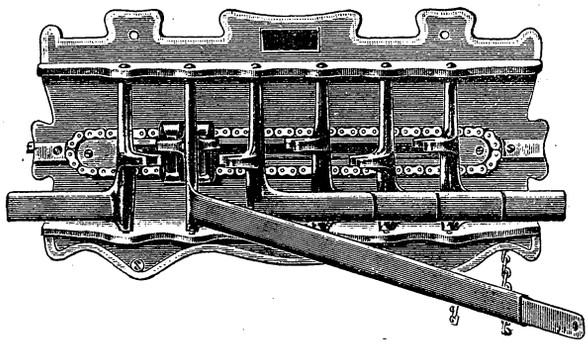
DRIVING CHAINS.—A pamphlet from Hans Renold, Ltd. (Progress Works, Manchester), discusses the application of well-known Renold chain to governors and valve gear driving. It combines the advantages of belt and gear drive, it does not slip, and encircles more than a third of the circumference of the pinion, so that the movement is practically continuous and free from shocks.

LAMPS AND ACCESSORIES.—A new pocket list issued by the Edison & Swan United Electric Light Co., Ltd. (Queen Street, E.C.), contains in a most convenient form full particulars of the "Royal Ediswan" metal (tungsten) filament lamps from 9 to 600 c.p., for voltages from 25 to 600, as well as the carbon lamps on which the firm's reputation was built up. Numerous patterns of lampholders, adaptors, ceiling roses, sockets, plugs, fuses, and switches are also listed, including the well-known "Phlatta" switch, and larger pattern wood blocks, conduits, and casing are also dealt with, as well as flexible, simple fittings and shades, while other sections are devoted to switchboard and portable instruments, fans, bells, and telephones. A further small but effective brochure deals in a more general way with the excellence of the Royal Ediswan lamp.

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A MOVING SHOP WINDOW DISPLAY APPARATUS

A VERY ingenious and effective piece of apparatus has been brought out by Messrs. Laing, Wharton, Ltd. (7 Great Newport Street, W.C.), under the name of the "auto-exposer," for the continuous display of lengths of fabrics, carpets, wall-papers, or posters by turning them over like the pages of a book one at a time. One of these appliances is at work at the London and Provincial Supply authorities at Olympia, showing off the effective posters of the Electric Supply Publicity Committee. The apparatus is made in several sizes, the largest of which is capable of handling carpets and rugs up to 7 ft. by 10 ft. The illustration gives an idea of the working. The apparatus is driven by



MECHANISM OF "AUTO-EXPOSER."

a small motor, of 1/30 h.p. in the size exhibited. The motor drives a chain running up to the "exposer" through a reducing gear. The frame of the exposer carries pivoted arms, the backs of which are provided with three teeth, which engage with two teeth on a travelling slide. The slide travels along a channel, and is driven by an endless chain within the frame. One pin of the chain is sufficiently long to engage in a slot in the slide; the pin rides in the top of the slot when moving in one direction, and passes down to the bottom of the slot when rounding the pulley at the end, taking the slide back with it so that the arms are moved back again in the reverse order.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION

THE inaugural dinner of the British Electrical and Allied Manufacturers' Association (Incorporated) was held at the Hotel Cecil on Thursday night. Mr. S. Z. Ferranti (President of the Institution of Electrical Engineers) was in the chair, and there were over two hundred people present.

In proposing the toast of the Association, Mr. FERRANTI said that, generally speaking, the electrical industry in this country was not as prosperous as one would like it to be. One of the reasons attributed to this had been the divergent interests in the electrical engineering industry in this country, but he did not agree with that view. The prosperity of the country depended on the prosperity of its manufacturers, and it was impossible for the manufacturers to make progress unless they were sufficiently prosperous to be in a position to make continued investigation and research with a view to improvements—this was vital to the buyer as well as to the seller. The condition of affairs, however, had been partly due to the manufacturers themselves, and he was glad to see that so many were now meeting together, for they should compete as good friends. Competition was excellent, and if it were not for competition we should become fossilised and do no good. There was, however, too much competition purely in price, instead of there being merely reasonable competition in price and keen competition in excellence.

Mr. F. H. NALDER, replying as Chairman of the Council of the British Electrical and Allied Manufacturers' Association, referred in general terms to the reorganisation of the Association. He urged the members not to grudge the increased subscription in view of the benefits which they would derive, and reminded them that the subscriptions of the Council themselves had risen from forty guineas to about six or seven hundred. In conclusion, he quoted a sentence from a letter of one of the applicants for the position of Secretary, "The tendency of modern industrialism is to temper competition by conference."

Mr. A. BRUCE ANDERSON, who in the course of his speech congratulated the Association on having secured the services of Mr. D. N. Dunlop as Secretary, proposed the toast of "The Industry." The British Empire, he said, lived very largely by its manufacturing industries. Although he saw no reason for placing the electrical industry second to any other industry, he saw no reason for placing it first. He was fully alive to the fact that if it were not for the older industries the members of the electrical industry would not be where they are, but he was also perfectly certain that if they did not work together they would never achieve the greatest of their possibilities. The great majority of those present had to buy at least as much as they had to sell—in the case of some manufacturers, alas, at about the same price. In the minds of some people, however, the idea of a manufacturers' association implied all the evils of trusts and combines and cartels; and these gentlemen, in their affright, declared that, in order to frustrate such evil designs, they would buy outside the Manufacturers' Association, and even outside that greater association of their fellow-countrymen, and would buy abroad. The power to buy abroad might be a necessary weapon in the hand of the buyer for fear the home manufacturer should become arrogant, but that was a contingency so remote in this country that he did not think they need stop to discuss it. The process of buying in a market where one could not sell was one which could not go on indefinitely. "The question no doubt arises in your minds," Mr. Anderson continued, "what is the Manufacturers' Association going to do about it? Well, perhaps I may be permitted to add in very general terms a few words to that which Mr. Nalder has said on this subject. So far as buying abroad goes, we are going to ask you not to do it, or, if you will do it, we are going to ask you to do it as little as possible, and if the conditions are such that you find yourselves compelled to do it, whether you will or not, we are going to say, do so with a shamed face and a sore heart, and set to work to alter the conditions." To send work abroad for goods which might be made at home by men who were standing idle was a shameful thing, and they ought to find out the reason for it, whatever it might be. In order that such matters might be put before them effectually, the British Electrical and Allied Manufacturers' Association had been created. The intentions of the Association had been well summed up in the sentence quoted by Mr. Nalder. They were going to hold "conversations"—they had been moving gunboats about for a considerable time, and as no one had been very much frightened, they had decided to converse together. They had created an Association and an organisation for carrying out the desires of the manufacturers as a whole, as soon as they had found out what desires were practicable, and it would be agreed that there were scores of questions, entirely aside from the question of price to the user, which could only be handled by such an Association in such a way as to benefit the manufacturer. Whatever was done to strengthen the manufacturers of this country must strengthen the industry as a whole and the country as a whole, because that strength would be used to fight for work in the big market of the world, which meant employing more people at home. It was only right and proper that the electrical industry should be amongst the first to recognise that idividualism, however magnificent, could not ultimately triumph against combination.

Mr. JAMES SWINBURNE (Past President of the Institution of Electrical Engineers), replying on behalf of the industry, referred to the difficulties placed in the way of new undertakings by Parliamentary Committees. He also referred to the education of the British workman himself. Apparently the British workman had the impression that there was a certain amount of work in the world to do, after which there would be none left, so that it would be expedient to do it as slowly as possible. As an example of one of the details which could be improved by a combination of manufacturers, he mentioned the lack of uniformity of catalogues, and explained his difficulty in devising a filing system which would make any catalogue easily accessible.

The next toast was "The Guests," proposed by Mr. HUGO HIRST (Vice-President of the British Electrical and Allied Manufacturers' Association). He said that as electrical manufacturers they were accustomed to efficiencies of about 95 per cent., but if the efforts of the Association had only an efficiency of 50 per cent., they were well worth making. He emphasised Mr. Anderson's point that the Association was nothing in the nature of a trust or cartel, but he advocated the regulation of selling prices, leaving sufficient margin for middlemen's and selling agents' profit.

Major W. J. O'MEARA, C.M.G. (Engineer-in-Chief to the General Post Office) and Captain R. MUIRHEAD COLLINS, C.M.G. (Representative of the Commonwealth of Australia in Great Britain) replied.

The Chairman's health was proposed by Mr. B. LONGBOTTOM (Vice-President of the Council of the British Electrical and Allied Manufacturers' Association), and Mr. Ferranti briefly responded.

Electrical Works Driving.—The following advertisement from a Yorkshire paper speaks for itself:—"For sale, eight horse . . . gas engine (run up to 14 horse), good as new, used at *Advertiser* office, Horsforth, up to last week-end. Only parting with it on account of machinery at new premises being run by electricity; will sell at great sacrifice."

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Oct. 12, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

30,194/10. **Purification of Gases.** J. Y. Johnson (*Badische Anilin & Soda Fabrik*). The gases containing impurities are passed between two electrodes connected to an H.-T. supply. One of these is formed to give a brush discharge, which charges the suspended impurities and causes them to settle on the other electrode. The discharge electrode takes the form of a carbon plate with a sharpened edge, and is so arranged relatively to the collecting electrode, that the field all round the edge is uniform, and the separation of the impurities takes place regularly. The wall of the vessel, through which the gases pass, may form the collecting electrode. To separate solid impurities the direction of the flow of gas is suddenly changed to assist the impurities to settle down. Three figures.

1,880/11. **Sealing Wires into Hard Vitreous Substances.** G. B. Burnside. The wire is placed through a small aperture in the glass or other vitreous substance, and heated by a blow-pipe flame until perfect cohesion between the two takes place. The seal is then removed from the flame, and when at a dull red heat, it is cooled by gradually increasing immersions, of about two or three seconds' duration, in some sperm or similar oil or in wax. For currents above 15 amperes, round tubular conductors, plugged with a conducting material, are employed. This form is very useful for mercury vapour lamps or rectifiers, as the tubular shell is made of a substance that does not form an amalgam, and thus protects the copper from the mercury. Seven figures.

3,950/11. **Lampholder.** G. Weissmann. This is intended for use with electric signs. A cube of insulating material with ring-shaped extensions has a central boring and two slots, one above the other, at right angles to the bore. Two conducting strips to form the terminals are fitted into the slots, the lower strip being continuous, and the upper strip having a threaded hole. This corresponds to the bore, and takes the threaded part of the lamp cap, which is screwed in until it makes contact with the lower strip. This gives a very tight holder, as after inserting the strips the joints can be cemented. The strips are also well insulated from the other plates. These are provided with holes, through which the cube extensions pass, so that the holder is firmly secured. Seventeen figures.

8,524/11. **Electric Oscillations.** B. Macku. This invention relates to the production of slightly damped oscillations by means of condenser discharges. Two resonant circuits of slightly different frequencies are arranged in parallel across a spark gap connected to a H.-T. current. At the first discharge across the gap, both condensers discharge simultaneously, but at the second discharge the first condenser begins to discharge before the other has finished charging, so that some of the energy of the first condenser flows into the second and the current across the gap is reduced. The greater the difference of phase, the smaller the current becomes until it is so small that the spark is cooled and extinguished. The energy still continues to oscillate, but flows round the circuits provided, as in a single circuit. One figure.

11,999/11. **Mounting Receiving and Transmitting Apparatus.** E. Girardeau. This relates to a wireless telegraph station with the above apparatus, in which the antenna is connected to earth through a gap device, across which the primary of the receiving circuit is connected, the secondary being connected to a detector. The object of the invention is to protect the detector from the emission waves, so that a more sensitive one can be used. The gap referred to is placed close to the spark gap in the emission circuit, so that when the spark is operative it automatically lowers the explosive potential in the gap device, and consequently reduces the strain on the detector. Instead of using the spark gap directly, a vacuum or neon tube may be employed, so that the ultra-violet rays from the tube during the operation of the emission system reduces the potential of the gap device. Two figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) 607/11; Körting and Mathiesen Akt.-Ges. [Rain-proof ventilator for] 10,886/11; Ges. für Maschinen und Metall Industrie, 15,730/11.

Dynamos, Motors, and Transformers: Cabot [Electric conversion] 27,696/10; Rauschburg and Perlusz [Portable transformer for medical purposes] 1,951/11; Maes [Generator] 5,457/11; Anschutz and Co. [Motors] 5,866/11; Brown, Boveri et Cie [Variable frequency commutator machine] 7,061/11.

Electric Ignition: Maher, 7,108/11.

Switchgear, Fuses, and Fittings: Venner and Griesbach [Switches] 17,658/10; Alexanderson [Motor control] 8,149/11; Lowen (*Killing*) [Globe and shade holders for lamps] 12,572/11.

Telephony, Telegraphy, and Signalling: Cortland [Signalling systems] 22,085/10; Siemens Bros. & Co. and Ferreira [Railway signalling] 26,647/10, and [Electro-magnetic relays] 24,003/10; Sterling Telephone & Electric Co. and Burney [Intercommunication systems] 26,854/10; Gledall [Device for receiving and transmitting] 3,630/11; Vahey [Railway signalling apparatus] 6,630/11; Goldschmidt [Apparatus for intensifying weak alternating currents] 8,978/11; Siemens Bros. & Co. (*Siemens & Halske Akt.-Ges.*) [Telegraph instrument] 15,130/11.

Electrochemistry and Electrometallurgy: Cowper-Coles [Electro-deposition of iron] 28,226/10; Ludecke and Imperial Lamp Works (Brimsdown), Ltd. [Furnaces for treating metal filaments] 8,996/11.

Incandescent Lamps: "Z" Electric Lamp Manufacturing Co. and Hoge, 23,332/10; O'Brien and Catts [Lamps and reflectors] 25,404/10; Polack [Locking lamps in holders, &c.] 28,138/10.

Miscellaneous: Rorke and Rorke [Electro-magnetic valve control] 22,397/10; Pucillo [Aluminium treatment] 22,684/10; Siemens Bros. Dynamo Works, Ltd. (*Siemens Schuckertwerke Ges.*) [Driving ring-spinning and doubling machines] 23,641/10; Johnson (*Badische Anilin & Soda Fabrik*) [Electrical purification of gases] 142/11; Von Leiben, Reisz and Strauss [Relay for undulatory currents] 1,482/11; Henri Helbronner and Von Recklington [Sterilizing apparatus] 6,178/11; Cremer [Miner's Safety Lamps] 8,632/11; Evans (*Allgemeine Electricitäts Ges.*) [Welding machine] 12,585/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Switchgear: Elektromotoren-Werke Hermann Gradenwitz [Remote-control systems for electric driving] 10,551/11; Canfield [Controllers] 20,534/11; Ferguson [Regulator for machines] 20,586/11; Schiodt [Protective device for machines] 20,636/11.

Miscellaneous: Ritter [Apparatus for winding armatures] 20,997/11.

Expiring and Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: W. J. Davy, 14,809/06.

Distributing Systems, and Cables and Wires: E. Lycett [Cable couplings] 14,617/04; T. and L. Torda [Distribution] 14,935/07.

Dynamos, Motors and Transformers: Brown, Boveri et Cie [Regulation for constant charging current] 12,097/04; C. A. Parsons and A. Flint [Armatures] 13,107/05; A. Lloyd [Motor-generator for medical work] 14,780/06; Siemens Bros. Dynamo Works [Preventing distortion of field and sparking at brushes] 14,838/07; J. E. Noeggerath [Armatures, homopolar type] 14,876/07.

Meters: W. B. Thorpe [Coin-freed meter] 14,831/07.

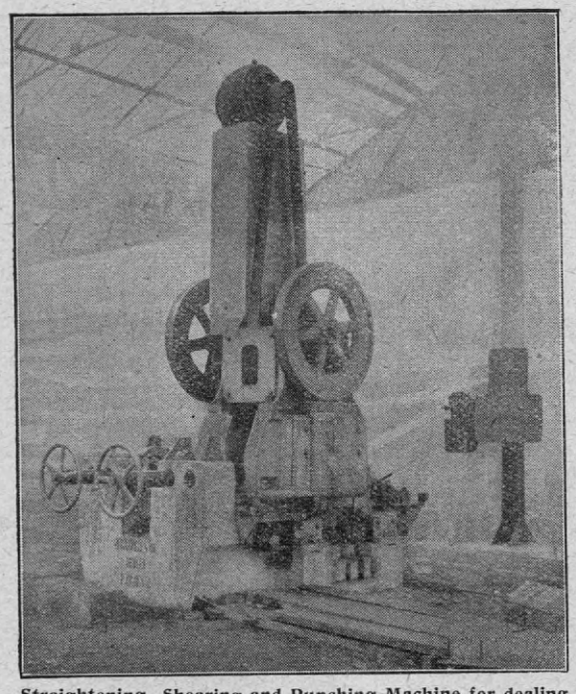
Switchgear and Fuses: F. W. Le Tall (*Cooper-Hewitt Electric Co., New York*) [Cut-outs] 14,173/03. G. B. Bowell and Pearson Fire Alarm, Ltd. [Fuse] 14,605/03; G. C. Fricker [Selecting switch for advertising mechanism] 14,590/06; A. Eckstein, A. C. Heap and D. B. Mellis [Solenoid switch] 14,567/07; Veritys, Ltd., and A. E. Gott [Switches and cut-outs] 14,797/07.

Telephony, Telegraphy and Signalling: C. M. Jacobs and A. H. Nicholson [Switch for selective signalling apparatus] 14,375/03; W. Reid [Railway signals] 14,495/06; A. J. Boult (*Zorge Safety Railway Equipment Co.*) [Railway signals] 14,518-9/07.

Miscellaneous: H. Walder [Speed indicators] 14,335/06; F. Schübbe [Electro-magnetic piano players] 14,637/07; C. W. Taylor [Medical battery] 14,638/07; S. J. Ross [Coils for electro-magnets, &c.] 15,012/07.

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SILVERTOWN MOTORS



Straightening, Shearing and Punching Machine for dealing with Angle Bars, driven by 8 H.P. Silvertown Motor, in Shipbuilding Yard.

OPEN PROTECTED, ENCLOSED VENTILATED, AND TOTALLY ENCLOSED TYPES.

EVERY MACHINE is GUARANTEED TO DEVELOP ITS RATED HORSE POWER

Price List on Application.

The India Rubber, Gutta Percha and Telegraph Works Co., Ltd.,

Head Offices:
106, CANNON ST., LONDON, E.C.

Works:
SILVERTOWN, LONDON, E.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

A special article on another page gives details with regard to the new submarine telephone cable laid between England and Belgium, which shows that this country is maintaining its position as pioneer in submarine cable work. The cable depends absolutely on the use of loading coils for speech to be possible through it, and it will be seen that the weight of gutta-percha on each core is only 150 lbs. per naut., with 160 lbs. copper. In this connection our readers will also doubtless be interested in the cartoon on page 566.

The second ordinary general meeting of the National Telewriter Co. was held on Monday, when the Chairman, Mr. E. Edwards, said that since the date of the last meeting, the number of their subscribers had steadily increased. Permission had been received from the General Post Office to instal telewriters at the offices of the principal cable companies to enable them to receive cablegrams direct from their clients. A small exchange had been established in the West End, and the Contract Department has been reopened under the supervision of an experienced telephone contract officer. The company have secured the services of Mr. H. Laws-Webb as Consulting Engineer. Orders have been received from Australia, Italy, Austria, and other countries, and an important firm of electrical engineers in Berlin have been appointed agents for Germany. It appears that serious difficulties were encountered with some of the technical details of the English machine, with the result that the company have thought it wise to negotiate with the American Company for the supply of instruments, which have been found to give greater satisfaction.

A meeting of the Marconi's Wireless Telegraph Co. is to be held on October 25th in connection with the creation of 250,000 new ordinary £1 shares. It is announced that the company have secured the control and direct management of the Russian Company of Wireless Telephony and Telegraphy of St. Petersburg, and that Mr. A. Simpson, of the London Marconi Co., has been appointed managing director, and will proceed to St. Petersburg to assume control. By manufacturing in Russia the Russian Company secures the bulk of the Russian Government business.

The October issue of the *Marconigraph* contains a description of a 5-k.w. wireless station in the Falkland Islands, an order for which has been placed by the Crown Agents for the Colonies with Marconi's Wireless Telegraph Co., Ltd. The station will be situated at Port Stanley, on East Falkland, and will have a working range of 400 nautical miles and a considerably longer maximum range. It will be arranged to tune in transmission to waves of 300 and 600 metres, and to any waves between 600 and 1,200 metres, and in reception to any waves between 100 and 2,500 metres. Two sectional steel masts, with wooden top-masts, each 220 feet in height, will be provided to support a two-part aerial of the "T" type. A 15-h.p. oil engine will drive an alternator and exciter, and the disc discharger will be mounted on an extension of the alternator shaft. In conjunction with the oil-cooled transformers, suitable oil-cooled iron-core primary low-frequency inductances will be provided, and provision will be made against injurious induced effects from the high frequency circuit by air-core protecting chokes. The condenser battery will consist of eight independent whole glass plate condensers. The disc-discharger will produce a musical note, and will consist of a steel disc, with transverse copper studs rotating between adjustable revolving electrodes. The high-frequency inductance will be continuously adjustable over the full range of inductance required for varying wave length between the stops of the condenser combination so as to provide for the waves specified. The transmitting jigger will be of the independent primary and secondary circuit type, contained in teak cases, the secondary being adjusted laterally with respect to the primary for varying the coupling between the circuits. The receiver will consist of the one part of a double magnetic detector and multiple tuner providing for the reception of all waves between 100 and 2,500 metres, the multiple tuner being calibrated to permit the instrument to be set to any pre-arranged wave length to be received, and provided with a change switch to permit of instantaneous change of the circuit from a highly syntonised tuned condition to an untuned condition specially devised for picking up incoming waves of widely different wave length when standing by. The receiving circuit will be arranged so that it may

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be permanently connected to the aerial through the insulated plate of the earth arrester terminal, thus permitting the operator to be interrupted in the transmission of a message in the event of erroneous reception by a corresponding station. The receiver will consist for the other part of a valve receiver of generally similar construction to the above combination, except that the valve detector and the wave length in reception will be from 1,600 to 4,000 metres.

Messrs. Siemens Bros. & Co., Ltd., who possess the British rights of the Telefunken system of wireless telegraphy, have decided to institute proceedings against the Marconi Co. for alleged infringement of patents.

According to the *Elektrotechnische Zeitschrift*, important commercial interests in Germany recently approached the German Post Office on the matter of direct telephonic communication between England and Germany. The secretary, in his reply, stated that the present knowledge of long-distance submarine telephony did not render possible the working of a direct cable between Germany and England. The length of such a cable would be about 280 miles, as compared with 55 miles between England and Belgium. The secretary added, however, that an attempt would be made to provide such communication *viâ* the new England-Belgium cable.

An application was made to Mr. Justice Parker in the Chancery Division on Friday in connection with the prolongation of the Strowger automatic telephone patent, which was referred to in our last issue. The Automatic Telephone Co., Ltd., applied for an extension of time in which to deliver particulars. Mr. T. Terrell, K.C., stated that the action had been put down for November 20th. Mr. Justice Parker granted the extension of time asked for, but stated that the date fixed for the hearing must remain. The patent expires in January next year.

Sir William Bull, M.P., presided at the first ordinary general meeting of the Grindell-Matthews Wireless Telephone Syndicate on Friday. He mentioned that a large amount of experimental work has been carried out in the little creek of Pilning on the Severn, and called attention to the fact that whilst the general body of shareholders did not seem disposed to put more money into the concern, a finance company has agreed to provide further capital to complete the experiments. This finance company has an option to purchase the syndicate for £150,000, provided that certain experiments are satisfactorily completed. If this option is exercised, the ordinary shareholders will get £7 10s. for each of their £1 shares. The depôt at Pilning is now being removed to London, where larger instruments are being prepared for long distance work.

An interim dividend at the rate of 3 per cent. per annum free of tax has been declared by the Anglo-Portuguese Telephone Co.

According to the *Financial News*, negotiations are in progress for the formation of an English Company for the installation of a telephone system in Constantinople, the concession for which was secured some time ago, by Mr. H. Laws Webb on behalf of an international group. The plans are to be submitted to the Government for approval within six months of October 17th, 1911. The first plant will consist of 10,000 lines with scope for increasing to 18,000. There will be 75 public call offices, for which the charge will be 4d. per call. Private users will be upon the message rate system, and there is to be an unlimited subscription rate for dwelling-houses. Twenty months is spoken of as the time for the completion of the first portion of the system, the capital outlay upon which will be about £250,000.

With reference to the note published in our last issue concerning the dispute between the Hythe Council and the National Telephone Co., the Postmaster-General has informed the Council that at the end of the year he will have the offending poles removed. It is therefore anticipated that the Council will withdraw their demand to the company for the immediate removal of the poles.

Communication with Rabat is again normal, but telegrams for Mogador are still subject to delay.—Telegrams to Turkey in code or cypher are prohibited.—The Indo-European Telegraph Company suffered an interruption of lines between Kertch and Soukhoumkale for a short while, but the cable between Tripoli and Malta was again working on the 10th inst. In this connection it is interesting to note that an Italian vessel has been engaged in the laying of a new direct cable between Sicily and Tripoli, and this should relieve congestion when it is working, which should be in a few days.—The Indo-European Company's lines were in trouble between Djoulfa and Tabriz on the 13th inst., but were again put through on the 17th inst.—In case of misconception, it would be well to explain that telegrams in code may pass Turkish lines in transit, but must not be deliverable in that country.—It is only natural that the Chinese troubles should bring telegraphic restrictions in their train, and so we find that telegrams to Hankow can now only be accepted at sender's risk.—Private telegrams must be written in plain English.

ELECTRIC TRACTION NOTES

The capital reorganisation scheme of the British Electric Traction Co. was sanctioned at meetings on Tuesday. At the commencement of the proceedings the Chairman, Mr. E. Garcke, stated that the proxies which had been lodged indicated that the Board had the full confidence of the shareholders, and he understood that in view of the large support which the directors had, the amendment for the appointment of a shareholders' Committee would not be moved. This being so, the directors were willing, after having the scheme for the sub-division and rearrangement of the capital passed, subject to adjustment of details, to agree to an adjournment for a fortnight to allow time to discuss the situation with the representatives of dissentient shareholders. This course was adopted. As explained in our issue for August 3rd, under the scheme the preference shareholders obtain an advantage in priority of capital and waive part of their rights to future distribution of profits, the ordinary shareholders have their prospect of dividend improved and waive part of their right as to capital.

A joint report has been presented by the Highways and Improvements Committees of the L.C.C. with respect to tramways in connection with the new St. Paul's bridge. It is proposed to construct a double line of conduit tramways from the south side of the bridge over the bridge, and terminate at Cheapside. The tramways between Cheapside and the south side of Cannon Street are to be constructed in a subway, and the whole is to be leased to the City Corporation for a term of 60 years. The Committees recommend that the Council shall contribute £350,000, or one-half of the net cost, whichever is the less, towards the widening of St. Paul's Churchyard in connection with this scheme.

There was a credit balance of £28,854 on the working of the Cape electric tramways for the year to June 30th. After providing for debenture interest and redemption of debentures, reserve is credited with £8,000, and the directors recommend a 2½ per cent. dividend free of tax on the ordinary shares, and carry forward £8,574.

It is estimated that the total loss of revenue upon the Liverpool Tramways during the strike in the summer amounted to £5,749. In spite of this, however, the total receipts for the first nine months of the year constitute a record. The number of passengers carried increased by 2,266,686, and the receipts by £13,616.

The Stockport Corporation Tramways Committee have decided to recommend the Council to seek powers for running trolley omnibuses from the Market Place to Marples. Owing to the narrowness of the roads on this route, frequent representations for tramways have had to be ignored.

It was stated at the last meeting of the Burton-on-Trent Corporation that the tramway receipts during the six months ended September 30th show an increase of £600, whilst the energy consumption was the lowest reached since the beginning of the undertaking.

Subscriptions are invited until to-morrow (Friday) by the Paisley and District Tramways Co. for 80,000 4 per cent. mortgage debentures at 96.

The Perth Corporation have decided to separate the management of the tramways from that of the electricity undertaking. Mr. J. Lambert, at present electrical engineer and tramways manager, will in future only have charge of the overhead and other electrical equipment of the tramway system and the supply of current, for which services he will be paid a salary of £50 per annum by the Tramways Department. Mr. W. G. Snell, at present traffic superintendent, has been appointed interim manager for a period of three months at a salary of £130 per annum. In making a recommendation to this effect, the Electricity and Tramways Committees specially pointed out that it was not intended as any reflection upon Mr. Lambert, but they felt he was not able to give the necessary attention to the proper development of the electricity undertaking at present.

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LOCAL NOTES

Birmingham: *Proposed New Power Station.*—The Electricity Committee have decided to purchase 17 acres of land for the purposes of another generating station. It is anticipated that the capacity of the Summer Lane power station will only be equal to the requirements of the department until 1915. It is expected that the new high-tension power station will cost about £250,000.

Bradford: *Electricity Accounts.*—The annual report of the Electricity Committee to March 31st last shows a net profit of nearly £9,000.

Edinburgh: *Electric Light Accounts.*—There was a net revenue of £69,440 on the working of the electricity undertaking for the year to May 15th last. After meeting interest and sinking fund charges, there is a balance of £8,430. The total number of units sold was 16,228,906, against 15,309,493 in the previous twelve months.

Holmfirth: *Electric Lighting.*—The Council recently submitted the question as to whether a supply of electricity should be undertaken to a poll of ratepayers. The result was that 1,276 votes were received in favour of the scheme, 580 were against, and 204 neutral.

Liverpool: *Workhouse Lighting.*—When the proposal for lighting the Brownlow Hill workhouse was first made some time ago there was a long discussion as to whether it would be more economical to instal special generating plant or take the current from the Corporation mains. The advocates of the former course, who eventually carried the day, are feeling very satisfied with themselves at the results of the first year's working. The total cost, including £700 for interest and repayment of loans, has only amounted to £1,698, compared with £3,291 which would have been charged by the Corporation for the same supply.

Penzance: *Electricity Supply.*—The scheme of the Penzance and District Electric Supply Co. for laying cables in connection with the supply of electricity has been approved by the Council.

Sheffield: *Municipal Wiring.*—In an omnibus Bill which the Corporation propose to promote in the next session of Parliament are clauses authorising them to provide, let for hire, and fix, wire, &c., the premises of electric light consumers. Objection was taken to this clause at the last meeting of the Corporation, but the Chairman of the Electricity Committee asked that the matter should not be discussed then, as legal proceedings were pending, and anything said would be used against the Corporation. The objections were thereupon withdrawn on the understanding that the matter should be discussed at a later stage.

Winchester: *Electric Light Undertaking.*—The Electricity Committee report that the costs of obtaining the Act of Parliament sanctioning the transfer of the Winchester electric light and power undertaking to the Corporation amounted to £2,263. The purchase price was £97,000.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Accrington.—Tenders are invited by October 28th for a 1,000-B.H.P. gas engine plant, together with a 750-kw. generator. Particulars from Borough Electrical Engineer.

Bury (Lancs.).—The storage battery, which has at present a capacity of 350 ampere-hours, is to be increased to 1,000 ampere-hours.

London: *L.C.C.*—The Highways Committee recommend the erection of a new sub-station at Vauxhall, and an expenditure of about £33,300 in connection with it.

Sheffield.—The Electric Light Committee invite tenders for a 5,500 kw. steam turbine with condensing plant, pumps, pipe-work, &c.; also an alternator and exciter. Particulars from General Manager and tenders by November 13th.

Swindon.—The Electrical Engineer has estimated the cost of a 250 kw. Diesel engine, switchgear, &c., at £5,600, and the Corporation have decided to apply to the Local Government Board for the necessary loan.

Radcliffe.—Tenders are invited for two 300-kw. rotary converters and transformers and extra high-tension switchgear (see an advertisement on another page).

Stourbridge.—Tenders are invited for an electricity generating plant, wiring, lamps, for the Stourbridge and Halesowen Hospital. Architect, Mr. H. E. Folkes, Waterloo Buildings, Stourbridge.

Wednesbury.—A Local Government Board inquiry was held last week concerning an application for a loan of £4,997 for extensions at the electricity works. There was no opposition.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Fulham.—Proposed new music-hall at 444 and 446 Fulham Road, Messrs. Matcham & Co.

Glasgow.—Picture theatre, 72 Renfrew Street. Glasgow Picture House Co.

Reconstruction of saw mills and offices recently destroyed by fire in Kinning Park. Architects, Messrs. H. & D. Barclay.

London.—New offices for the Board of Agriculture and Fisheries. Architect, H. A. Collins, H.M. Office of Works, London.

Neath.—New infirmary.

Paddington.—Cinematograph theatre at 140 Maida Vale.

Paisley.—Public refrigerator. Town Council.

Rhondda.—Alterations and additions to girls' and infants' schools. Architect, Mr. J. Rees, Hillside Cottage, Pentre.

Stoke Newington.—Cinematograph theatre at 538 and 540, Kingsland Road, N.

Tewkesbury.—Isolation hospital, &c. Architect, Mr. J. Villar, 5 Essex Place, Cheltenham.

Wrexham.—School to accommodate 400 children. Architect, W. G. Wiles, 42A High Street.

MISCELLANEOUS

Bradford.—The Tramways Department invited tenders for a twelve months' supply of miscellaneous stores, including lamp fittings, traction lamps, insulating material, insulated bolts, &c. Particulars from Tramway Offices, and tenders by November 11th.

Dewsbury.—It is proposed to extend the tramways from Market Place to the eastern border of Batley. A second scheme involves the laying of some lines inside the Batley boundary as a continuation of this extension, and there seems every prospect of the two Councils agreeing.

Dublin.—The Dublin United Tramways Co. invite tenders for general stores, including car fittings, electric supplies, &c. Particulars from Secretary, and tenders by November 6th.

Halifax.—The Tramways Committee have sanctioned an extensive scheme of track-doubling at an estimated cost of £10,000.

Portsmouth.—It is proposed to extend the tramways from Gosport to Lee-on-Solent.

TENDERS RECEIVED AND ACCEPTED

Aldershot.—The tender of the Diesel Engine Co., for a 200 h.p. engine made by Messrs. Carels, coupled to a Bruce Peebles dynamo, at £2,298, has been accepted.

Belfast.—The tender of Messrs. Craig & Paton has been accepted for the electric wiring of the new abattoir at £505.

Bury (Lancs).—The tender of the Switchgear Co., Ltd., for supplying two regulating switches for the battery has been accepted.

Dundee.—The tender of Messrs. Lowdon Bros., of Dundee, for the electric lighting and power distribution system in the new engineering laboratories of the University, has been accepted.

Norwich.—The Electricity Committee recommend the acceptance of the tender of Messrs. G. G. Stowers & Son, of Norwich, for new buildings at the electricity works at £2,960.

Stoke-on-Trent.—The following tenders have been accepted:—300 ampere-hour battery, D. P. Battery Co., £91; motor generator, three-phase to D.-C., Bruce Peebles & Co., £225; electric feed pump, British Westinghouse Co., £180; three-phase transformers, British Westinghouse Co., £91.

OSRAM-LAMPS

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APPOINTMENTS AND PERSONAL NOTES

Mr. Ashton Bremner is opening an office as consulting engineer at 27 Paradise Street, Birmingham. He has been called in to advise the Wakefield Corporation upon their destructor plant, and has been invited by the Walsall Electricity Committee to report on the condition of their generating and distributing plant, to which he has been acting electrical engineer for the last six months.

Mr. Alfred H. Gibbings is opening up an engineering and electrical contracting business at Buenos Aires (Congallo 564) under a partnership agreement with Messrs. Scott & Hume, late Alejandro Hume, Scott & Hume, railway contractors, &c. The firm has already secured agencies for a number of well-known British firms.

Mr. J. W. Meares is leaving to-day for India on the P. & O. steamer *Morea*. All communications should, therefore, now be sent to him at the Electrical Advisor's Office, Calcutta.

The salary of Mr. J. Allan, Secretary of the Dublin electric light undertaking, is to be increased by four annual increments of £50, making £600 per annum.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £57 to £57 5s. (last week, £56 15s. to £57).

Checkogram, Ltd.—We are informed that Checkogram (1908), Ltd. (150 Oxford Street), are extending their business to include electrical installation work, including telephones, and invite catalogues from manufacturers.

Western Electric Co., Ltd.—The company have opened a branch office in Glasgow, under the charge of Mr. M. Breingan. Telegraphic address, Microphone, Glasgow; telephone, Central 1999.

Submersible and J.-L. Motors, Ltd.—Submersible Motors, Ltd. (23 St. Swithin's Lane, E.C.), have taken over the business and works at Southall of the J.-L. Manufacturing Co., Ltd., and the name of the company will be altered to that given above. Mr. T. L. Reed-Cooper, Managing Director of the J.-L. Co., will be Managing Director of the new company, and the manufacture of both the Macdonald submersible motor and the J.-L. laminated field motor will be continued.

Benjamin Reflectors.—We understand from the Benjamin Electric, Ltd. (117 Victoria Street, E.C.), that at the Canadian National Exhibition at Toronto no less than 1,795 of the type of reflector illustrated in Electrical Engineering, January 12th, page 16, were used.

G.E.C. Athletic Club.—The General Electric Co.'s Athletic Club invite applications for football clubs in the electrical trade (non-league), London and district, to enter for the Davis Challenge Cup. Full particulars from the Secretaries, Messrs. H. Chard and J. Peters, 67 Queen Victoria Street, E.C. The cup has been presented by Mr. S. Davis, of 30 & 31 St. Swithin's Lane, E.C.

B.T.-H. Leeds Office.—The British Thomson-Houston Company, Ltd., are removing their Leeds Office from Greek Street Chambers to Standard Buildings, City Square, and the telephone number will be the same as previously, namely, 3244 Central.

The Silent Electric Clock Co.—Owing to increase of business, the Silent Electric Clock Co. (192 Goswell Road, E.C.) have found it necessary for the second time within twelve months to enlarge their premises.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Drake & Gorham.—The annual general meeting was held on Wednesday last week, Mr. Bernard Drake presiding. He said there had been considerable increase in the turnover of all sections of the business. Severe competition still continued, however, and it was difficult to get people to appreciate that if they accepted lower tenders they would not necessarily be getting the same quality of material and workmanship. He had been told that Messrs. Drake & Gorham had the reputation for doing very good work, but that they were expensive. Nevertheless, the policy would be to maintain at all costs the high standard of excellence. It had been found necessary to take an additional warehouse and offices in Felix Street, from which the wholesale business would be conducted in future.

Ferranti.—The trading profit for the year to June 30th was £49,074, and after meeting interest, repairs and renewals, bad debts, &c., there was a balance of £22,044. After meeting prior lien debentures and mortgage interest, and allocating £10,000 to depreciation, the balance of £4,166 was carried forward.

Allgemeine Elektricitäts Gesellschaft.—The report for the past twelve months shows a net profit of 14 per cent., the same as in the previous year. The capital, which now stands at 130 million marks, has increased by 30 million marks. The orders in hand are said to be considerably more than at this time last year. The Oerlikon Machine Works, Zurich, declare a dividend of 4 per cent. It is expected that electrical working on the Lotschberg Railway, the order for which the company has secured, will be commenced in 1913. The agreement with the Siemens-Schuckert Works, Berlin, providing for joint action with regard to railway electrification in Switzerland, has been terminated.

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ELECTRICAL ENGINEERING

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SUMMARY

There was further criticism on the Marylebone Electricity Department at the meeting of the Council last Thursday. The Chairman of the Electric Supply Committee replied at length to the various charges made against the department, showing that the undertaking is in a sound financial condition, and eventually the accounts for the year to June 30th were passed by a large majority. (Page 577.)

We regret to announce the death of Mr. John Conacher, for some years general manager of the Metropolitan Electric Supply Co. (Page 577.)

A letter from Siemens Brothers & Co. refers to the relative position of the Telefunken patents, of which they are proprietors in this country, and the Marconi patents, and announces their intention of proceeding against the Marconi company for infringement. (Page 578.)

We had the opportunity of inspecting a large Willans-Diesel engine coupled to a Siemens' alternator at Messrs. Willans & Robinson's works on Monday. (Page 579.)

A new design of H.T. feeder on motor panel in iron plate cubicle is described and illustrated. (Page 580.)

In our sixth and last notice of the Olympia Electrical Exhibition, which closed last Saturday, we describe some interesting motor control gear, a fuse on a new principle, electrical mechanism for chime ringing, and other novelties. (Page 583.)

Three Patents in connection with incandescent lamps were published last week. One provides means for mounting the filament supporting wires, another an arrangement for fixing a shade and at the same time locking the lamp in its holder, and a third relates to a furnace for treating raw metallic filaments, which takes the form of a cylinder produced by the dissociation of tungsten and molybdenum chlorides into their component parts. Another specification protects a portable transformer for medical purposes, from which a low-tension current as well as a faradised current can be obtained. An electrolytic process for producing very pure iron is also covered by S. O. Cowper-Coles. Opposition has been entered to the grant of a patent to T. G. Smith and F. J. Platt which relates to an ignition plug. (Page 584.)

Some interesting cases of breakdowns of electrical machinery are recorded in the annual report of the chief engineer to a large insurance company. (Page 585.)

We describe an experimental installation just erected at Billericay for the application of electricity in horticulture. A new type of influence machine is employed. (Page 585.)

A new combined shade carrier and lamp-locking device is described. (Page 585.)

Some notes are given on a theatre lighting installation employing metal filament lamps. (Page 585.)

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In our "Electric Traction Notes" we refer to the fatal accident on the Stalybridge tramways, the difficulty experienced by the National Electric Construction Co. to raise the necessary capital for the Oxford tramways, and the refusal of the Corporation to modify the existing agreement, and a proposal by the Brighton and Hove Corporations to introduce the trolley-omnibus system. (Page 586.)

We make the important announcement under "Telephony and Telegraphy (Including Wireless)" that the dispute between the Marconi's Wireless Telegraph Co., Ltd., and the Lodge-Muirhead Syndicate, Ltd., as to patents, has been ended. Sir Oliver Lodge will, in future, act as scientific adviser to the Marconi Co.—The Marconi Co. have issued a writ against Messrs. Siemens Bros. & Co., Ltd.—The dispute between the Hythe Council and the National Telephone Co. is still unsettled.—The conference of municipal authorities, which was to have been held this month regarding the telephone system of the country, has been postponed.—Successful experiments have been made in telephoning between London and Geneva and Basel, *viâ* the loaded Anglo-French cable, and the public will shortly be able to telephone between these three towns.—Major O'Meara, in an address delivered to the Institution of Post Office Electrical Engineers last week, referred to the injury done by "quack" engineers. He also read a Paper on multiple telegraphy, in which he reviewed and compared the various systems and gave interesting indications as to the tendency of the policy of the Post Office in this direction. (Page 587.)

The Bethnal Green Council have retained Mr. J. F. C. Snell to advise them with regard to a supply of electricity.—Messrs. Handcock & Dykes have prepared a report for the Douglas Council recommending an electric lighting scheme.—The Grimsby Electricity Committee have decided to transfer £1,000 to relief of rates.—Street lighting experiments with electricity and gas are being carried out in Dawlish.—The Metropolitan Electric Supply Co. are giving a bulk supply in Brentford. (Page 588.)

Mains extensions are to be carried out in Battersea at an estimated cost of £588; the Hammersmith Council have been granted a loan of £15,000; the Blackpool Electrical Engineer recommends new generating plant, &c., at a cost of £12,000; and a complete electricity generating equipment is required at Lethbridge, Canada.—An electric lighting, heating, and power installation is required at the Edinburgh College of Art, and a street fire-alarm system at Sidcup. (Page 588.)

The accounts of the Edison & Swan United Electric Light Co. for the year to June 30th show a net profit of £19,013. No dividend is recommended.—Callender's Cable and Construction Co. recommend an interim dividend at the rate of 10 per cent. per annum. (Page 590.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) FRIDAY, OCTOBER 27th.

Physical Society.

5 p.m. At Imperial Technical College. The agenda includes:—"Further Observations on the After Glow of Electric Discharge and Kindred Phenomena," by the Hon. R. J. Strutt.

The "Generators."

6.45 for 7.15 p.m. Dinner at Imperial Restaurant, Regent Street.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. Inaugural address by Chairman, Mr. W. Cramp, at Midland Hotel.

TUESDAY, OCTOBER 31st.

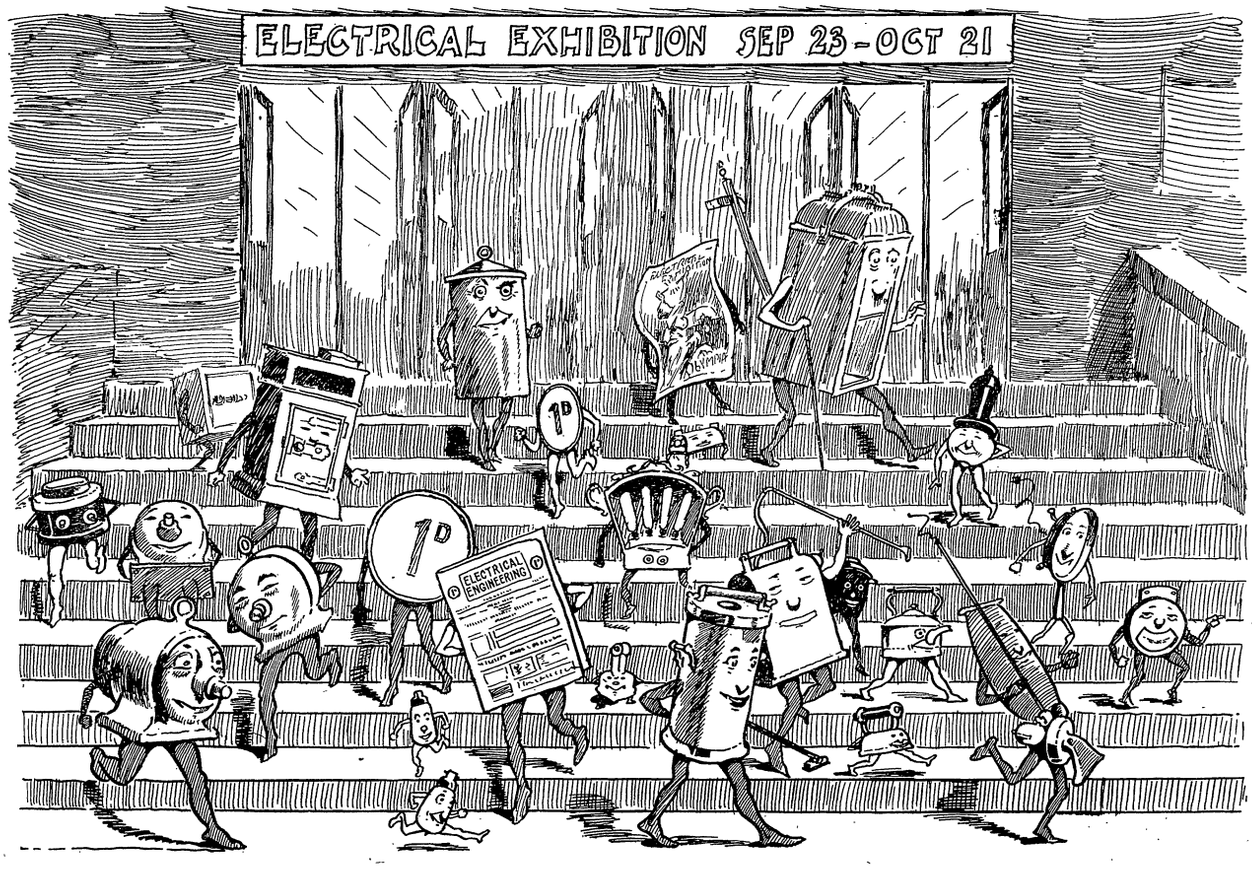
Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At Municipal School of Technology. Address by Mr. J. F. C. Snell.

SATURDAY, NOVEMBER 4th.

Junior Institution of Engineers.

7 p.m. Reception by the President, Sir J. J. Thomson, F.R.S., and Lady Thomson.



The Electrical Exhibition at Olympia closed last Saturday.

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IN order to bring them into line with other leading makes the prices of "Leanda" (Metal Filament) Lamps have been reduced, the 200/260 Volt, 25, 32 and 50 Candle-power being now listed at 3/-. The discounts and rebates, which are exceptionally liberal, remain the same as before. The high quality is fully maintained, and they are universally recognised by those who are competent to judge as being the best. That this is so is proved by the ever-increasing sales.

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THE MARYLEBONE SALES DEPARTMENT

AT the meeting of the Marylebone Council on Thursday, October 19th, the accounts of the electricity department for the year to March 31st, 1911, were adopted. These show a surplus of £12,088 15s. compared with £8,481 in the previous twelve months. The accounts were partly discussed last July, and only one or two speakers besides the Chairman of the Electricity Committee took part in the debate on Thursday. One of the chief points made was that a member of the Electricity Supply Committee has received electrical apparatus on loan, free of charge. Colonel Hopkins, Chairman of the Electric Supply Committee explained this to the Council. It appears that in order to be better able to push electric heating and cooking apparatus, the officials of the Electric Supply Department thought it would be well to obtain some independent tests. Consequently Dr. Bokenham, a member of the Electric Supply Committee, undertook to have some apparatus installed in his house and keep careful records, reporting the results to the Committee from time to time. Naturally, the apparatus was loaned free of charge, and although much had been made of the fact, the explanation was a very simple one.

Colonel Hopkins replied at some length to various criticisms upon the accounts, and complained bitterly of the methods adopted by a certain local paper and also a London morning paper in regard to the undertaking, charging them with publishing every accusation that could possibly be made against it, and giving none of the facts in its favour, nor even publishing any figures of the accounts. After having explained one or two other charges of alleged taking away of custom from local contractors, Colonel Hopkins complained of a statement made by Councillor Duncan Watson to the representative of the *Standard* that over 2,000 consumers were paying at the rate of 8d. a unit. In the Council, he said, Councillor Duncan Watson said that this was "over 6d.," which was rather different. The facts were that 2,000 consumers were paying over 6d., but of these only 573 paid 8d.; the average price paid by these 2,000 consumers was 6½d. per unit, and as they were very unprofitable consumers, using only a few units per quarter, he did not think they had much cause for complaint. Charges had been made, he continued, that the undertaking was not paying off its capital debts quickly enough. As a matter of fact, in spite of their £2,000,000 of goodwill which had to be paid off, they were repaying their loans at rates equal to any other municipal undertaking in London. So far as he could see, there was absolutely nothing to be said against the financial position, and he was disappointed that not one word had fallen from any member of the Council in praise of the good work which the officials of the Electric Supply Department had accomplished in the most adverse circumstances. The percentage of working expenses to total revenue was the lowest of any undertaking, either municipal or company, in London, and only one place in the country, viz., Stalybridge, had a higher number of units sold per head of population to Marylebone. The Marylebone figure was 87.

OBITUARY

JOHN CONACHER.

WE regret to announce the death of Mr. John Conacher, on Wednesday last week, at the age of 66. Whilst it is particularly in the railway world that Mr. Conacher was best known, yet he was a very familiar figure in London electric supply circles. He held the position of General Manager of the Metropolitan Electric Supply Co. for several years, during which time the company made great progress. He took a leading part in the opposition of the London electric supply companies to the bulk supply schemes promoted by Mr. C. H. Merz and the London County Council, and was responsible for getting through Parliament the Metropolitan Electric Supply Company's bulk supply Bill. This gave the company a large area in West Middlesex, which is now being developed. In 1907 he resigned his position with the Metropolitan Electric Supply Co., and proceeded to South Africa for the purpose of preparing a report upon the conditions and possibilities of the railways there. In 1909 he was elected Chairman of the Cambrian Railways, and was on the board of several other railway companies.

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CORRESPONDENCE

WIRELESS TELEGRAPH PATENTS

To the Editor of Electrical Engineering.

Sir,—Some time ago we received a circular from Marconi's Wireless Telegraph Co., Ltd., which we believe has been widely distributed, sending us a summary of the action and of the Judgment delivered by Mr. Justice Parker in respect of their British Patent No. 7,777 of 1900.

The circular states :—

"We desire to draw your attention to the fact that the system protected by this said British patent is the only known system of wireless telegraphy capable of dealing with practical modern requirements, and every wireless telegraphic installation, if it have any practical value, is an infringement of the Marconi patent."

We beg to state that there is, as a matter of fact, a well-known system which has been proved in many installations all over the world to be capable of dealing with practical modern requirements, and which at the same time in no way infringes the Marconi patent (No. 7,777 of 1900), whether the said patent be valid or not.

The system we refer to is the "Singing Spark System," known on the Continent as the "Telefunken System," of which we hold the exclusive rights in this country.

Counsel's opinion has been taken on the question whether this system infringes patent No. 7,777 of 1900, and is as follows :—

Re The Telefunken Co. and Marconi's Patent No. 7,777/00.

OPINION.

"We have carefully considered the arrangements of the Telefunken System of Wireless Telegraphy, known as the "Singing Quenched Spark" System, in relation to Marconi's Patent No. 7,777/00. We are of opinion that the Telefunken arrangements do not in any way infringe the Marconi Patent. In giving this opinion we have paid special attention to the Judgment of Mr. Justice Parker in the recent case of Marconi *v.* the British Radio Telegraph Co. The reasoning upon which that Judgment was founded appears to support the opinion at which we arrive in this case."

Temple, 38/8/11.

W. R. Bousfield.
George H. Hume.

In view of this, we are prepared fully to indemnify our customers against any action for infringement in respect of wireless telegraph installations supplied by us.

Moreover, as already announced in the *Financial Times* of October 16th, we have decided to commence an action against the Marconi Company for infringement of certain Telefunken patents of which we are the assignees.

Yours faithfully,

Caxton House, Westminster, London, S.W., October 19, 1911.

Siemens Bros. & Co., Limited,
W. Wheeler,
Secretary.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ELECTRICAL SUPPLIES.—We have received from Drake & Gorham, Ltd., a copy of their new 1911–12 general catalogue, which is very comprehensive and at the same time most conveniently arranged in eleven sections, of which the first deals with incandescent lamps, including Osram, Philips, Mazda, Tantalum, and Onewatt lamps, as well as carbon lamps, radiator lamps, &c. In the next section the Butt, Excello, and several other arc lamps are listed, and following this we have cables and wires and a long section on switchboards, switchgear, and lighting accessories, including a considerable amount manufactured at Drake & Gorham's own works. The electric heating and cooking section is very complete, and embraces a full range of the Bastian quartz apparatus, as well as appliances on the Archer, Economic, Zoroaster, Royce, and Drakel systems. Succeeding sections are devoted to bells and telephones, auto-transformers, insulators, fans, vacuum cleaners, and fittings. The last-mentioned section occupies over 100 pages, and a very large selection of fittings are illustrated, including many specially designed for holophane glass ware; watertight and exterior fittings are also dealt with as well as shop window reflectors and illuminated signs. The new Holophane-Benjamin steel reflectors in a number of forms are also listed.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

CABLES AND SUPPLIES.—The Western Electric Co., Ltd. (North Woolwich, London, E.) have issued an illustrated handbook of over 400 pages, which will be found to be of the greatest utility by all mains engineers. The first part contains particulars of almost every type and size of electric light and power cable and wire, and also gives some useful data and illustrations concerning dry-core telephone and telegraph cable. The second part is equally valuable. Commencing with illustrations of junction and end boxes, it next gives instructions for laying and jointing, and also for overhead work. There is also a chapter on loading coils for telephone cables. The last part of the book gives the Institution of Electrical Engineers wiring rules in full, the Board of Trade regulations under the Electric Lighting Acts, the Board of Trade rules for low and medium pressure overhead wires, the Phœnix Fire Office wiring and lightning conductor rules, and the recommended special rules (issued by the Home Office Committee) for electrical installations in mines. Useful reference and conversion tables are also appended.

INSTRUMENTS.—The Globe Electric Co., Ltd. (11 Farringdon Avenue, London, E.C.) has issued a list of instruments including the "Globe-Nadir" universal testing set. A metal filament lamp testing apparatus, with which 2,400 filaments can be tested per day by one operator, is described. A patented spring clip is provided to take any thickness of filament without injury. Particulars are also given of galvanometers, pyrometers, moving coil ammeters, and voltmeters, and a combined set, with two moving systems, one of which can be used for both current and voltage measurements.

FITTINGS.—A neat little booklet of conveniently small size, from the Benjamin Electric, Ltd., deals with their well-known wireless clusters and other fittings for various kinds of lighting, giving useful explanatory notes as to their uses.

INSTALLATION MATERIALS.—An abridged price list from the A. E. G. Electric Co., Ltd. (133-135 Oxford Street, W.) deals in a very exhaustive manner with a complete equipment for electric light and power installations. As an introduction attention is given to the firm's turbo dynamos, pumps, and compressors, dynamos and motors of all types, D.C. or A.C., switchboards, transformers, and H.T. apparatus, machine tools, furnaces, welding machines, and electric drives for printing works, textile factories, paper mills, breweries, cement and brick works. The list is well arranged, the technical terms in the list are explained, and an index, which is very essential for this 126 page booklet, completes a most useful general catalogue.

MOTORS.—A stock list of D.-C. motors is to hand from the Electrical Co., Ltd. (122–124 Charing Cross Road, W.C.).

JOINTING MATERIALS.—A new list of jointing materials in the same standard form as their other lists has been issued by W. T. Henley's Telegraph Works Co., Ltd. (Blomfield Street, London Wall, E.C.). This deals with numerous kinds of insulating and fire-resisting tapes, compounds, tools, &c. Among the tapes is the special unvulcanised Vulcan tape, which can be quickly vulcanised in place by a blow lamp. Another important item is a non-inflammable rubber solution, and attention should also be called to a safety spirit lamp, so constructed as to prevent the possibility of the flame reaching the spirit through the vent hole.

VACUUM CLEANERS.—The Electrical Co., Ltd., send us a card illustrating in an effective way a simple form of electrically-driven small vacuum cleaner, in which the motor centrifugal pump and dust chamber are in a light case, which stands on the ground while the usual flexible hose is used.

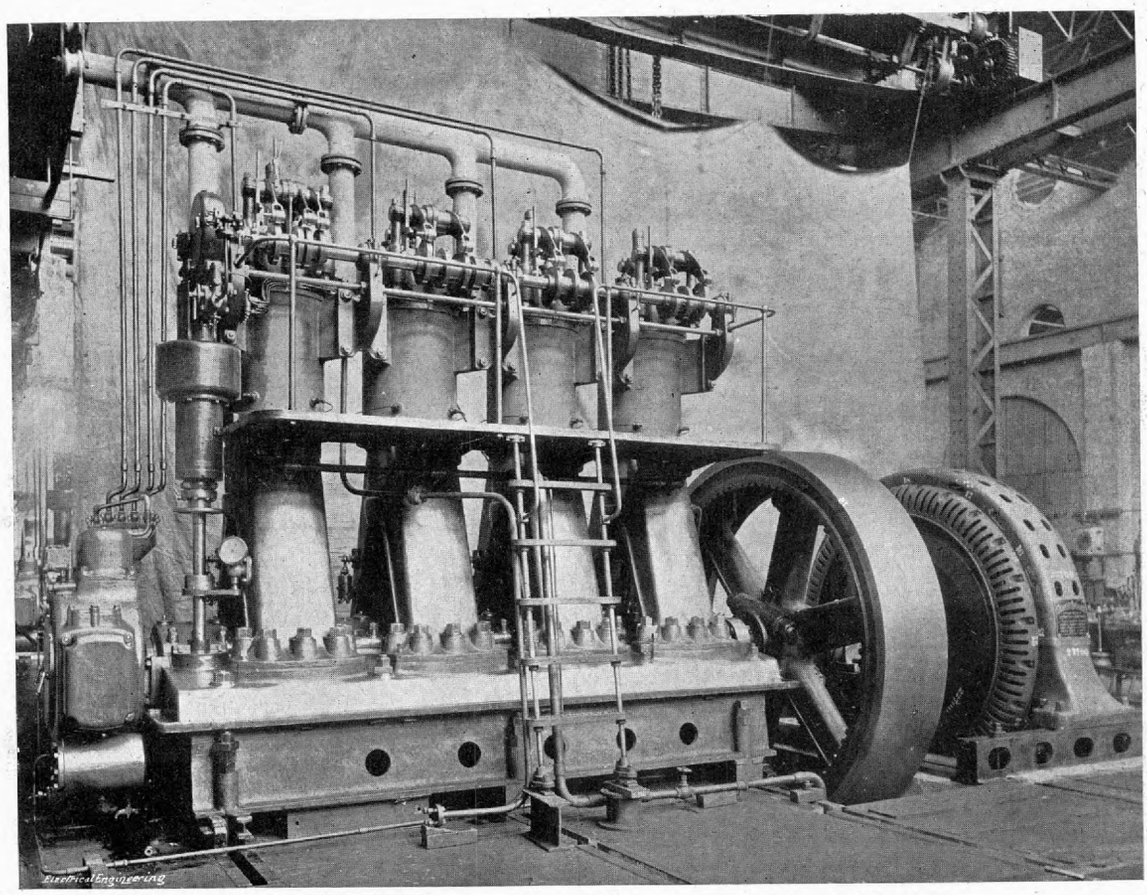
TELEGRAPH APPARATUS.—We have received a fine new catalogue of Morse telegraph apparatus from Siemens Brothers & Co., Ltd. (Caxton House, Westminster), which is remarkably complete, and is copiously illustrated from photographs of the actual instruments made at the Woolwich works. Both Post Office and Siemens standard apparatus is included. The scheme on which the catalogue has been arranged is that the component parts of which telegraph station sets are made up are listed at the commencement, beginning with inkers, and continuing with keys, sounders, galvanoscopes, relays, &c., to switches. After that we come to station sets. The first section deals with single current, which in turn is divided into simplex and duplex; the next with double current, which is also divided into simplex and duplex, and then follows the quadruplex system. The catalogue concludes with a few pages of accessories, diagrams of connections of station sets, and a comprehensive code and index. A pamphlet of instructions for using Morse station sets accompanies the list.

Electric Driving of Cotton Mills.—The first meeting of the Joint Committee of the Textile Institute and the Manchester Section of the Institution of Electrical Engineers, which was appointed in August to conduct an investigation into the electric driving of textile mills (Electrical Engineering, August 3rd, 1911) was held at the Textile Institute, Manchester, on Friday. In the report prepared by a sub-committee, it was recommended that the committee should appoint a secretary and two honorary secretaries, one of each of the latter representing the two institutions. This report was adopted, and it is understood that the first step in the investigation will be the collection of statistical information regarding the various kinds of motor power used in the United Kingdom, United States, Canada, and most of the continental countries. After this has been completed, the further course of action on the part of the committee will be decided. A special sub-committee has been formed to conduct investigations outside the United Kingdom.

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A LARGE WILLANS-DIESEL ENGINE

THROUGH the courtesy of Messrs. Willans & Robinson, Ltd. (Victoria Works, Rugby), we were enabled to inspect at their works last Monday a fine example of one of their large Diesel engines running on full load prior to delivery. The engine in question is one of two which have been built to the order of the Alianza Co., Ltd., of London, for lighting and power purposes at their nitrate works at Bellavista in the Argentine Republic, to the specifications of Messrs. Strain & Robertson, consulting engineers, Glasgow. The engines are each coupled directly to an alternator manufactured by Siemens Brothers' Dynamo Works, Ltd., to the order of the same company under a separate contract. A view of one of the sets is given in the illustration.



WILLANS-DIESEL ENGINE WITH SIEMENS ALTERNATOR FOR SOUTH AMERICA.

The engine is of the four-cylinder vertical semi-enclosed four-cycle standard Diesel type, with cylinders 15 in. bore by 22 in. stroke. The standard normal output of this size of engine is 335 b.h.p. when running at 220 r.p.m. with an overload capacity of 10 per cent. for two hours, but conditions of alternator frequency in this particular case imposed a speed of 187 r.p.m., at which speed the engines are arranged to develop 280 b.h.p. continuously or 325 b.h.p. for two hours at sea-level. They will, however, be installed at an altitude of about 3,200 ft., where they will be called upon to give 200 b.h.p. continuously and 230 b.h.p. as an overload for two hours.

The Siemens alternators to which they are coupled are of the rotating field type rated at 175 k.v.a., or 140 kw. (460 amperes) at 220 volts, three-phase, 50 cycles, with a 25 per cent. overload capacity. Each has its own direct-coupled eight-pole exciter, giving 35·5 amperes at 110 volts. The two sets are designed to run in parallel, and a 10-ton flywheel has been provided, in addition to the very large flywheel effect already contained in the rotor. The speed variation is guaranteed within one part in 250. Official tests have been made of the sets, including twenty-four-hour runs at full load, followed by two hours at 15 per cent. overload and one hour at three-quarter-, half-, and quarter-loads (at sea-level); governing and paralleling tests were also carried out to the satisfaction of the consulting engineers.

The guaranteed fuel consumptions, subject to a margin of 5 per cent. for the newness of the engines, are given below, in lbs. per b.h.p.-hour.

Full load	0·44	¼ load	0·72
¾ load	0·46	15 % overload ...	0·52
½ load	0·52		

An idea of the size of the sets may be given by the following figures:—

Total overall length	28 ft. 9 in.
Total overall width	11 ft. 6 in.
Total approximate height	11 ft. 0 in.
Approximate net weight	57 tons.

The two sets are identical with a further pair recently shipped to South America under separate orders from the Rosario Nitrate Co. for their works in Peru, also to the specifications of Messrs. Strain & Robertson.

The engines conform in practically all particulars with what is now regarded as standard two-stroke moderate-speed Diesel practice, and form one of a range of sizes standardised by Messrs. Willans & Robinson from 50 to 640 h.p., with from one to four cylinders. The design throughout is simple and straightforward, particularly as regards the valve gear. As seen in the illustration, an overhead cam-shaft is used with one simple rocking lever to each valve. The cams themselves are of cast-iron with a chilled surface, upon which bears a case-hardened roller, ensuring exceptionally good wearing quality. The air inlet and the exhaust valves are of the ordinary mushroom pattern in the cylinder heads, but

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the most distinctive feature of the Diesel engine is the fuel admission valve. The oil, as is well known, is supplied by a pump in the correct quantity to each cylinder, and is actually driven into the cylinder by an air blast controlled by a needle valve, which carries the oil through a "pulveriser" consisting of a series of perforated plates with their holes staggered, and finally injects it into the compression space of the cylinder in a fine mist from the specially shaped "flame plate." Owing to the high compression, complete combustion ensues as the oil enters, without the necessity for any ignition apparatus whatever, giving a steady initial pressure rather than a sudden explosion. In these engines a single fuel pump is used with a distributing valve to the various cylinders, and the governing is effected entirely by regulating the time of opening of the fuel pump inlet valve, thus grading the amount of fuel delivered in proportion to the load. The actual fuel injection or air blast valve does not vary in its time of opening, but simply blows into the cylinder the amount of oil supplied to it. The exact point in the stroke at which the fuel valve opens is of some importance, and this can be set to a nicety by the tip of the cam being made as a separate piece, whose position can be adjusted relatively to the rest of the cam. Starting gear is fitted to one cylinder only, and a simple method of mounting the cam lever spindles eccentrically permits of the starting or running valves being put into action alternatively. In none of the sizes are water-cooled valves used: in the very largest, however, two air inlets and two exhaust valves are employed. A three-crank engine of this pattern, giving 450 h.p., was on the test bed at the time of our visit.

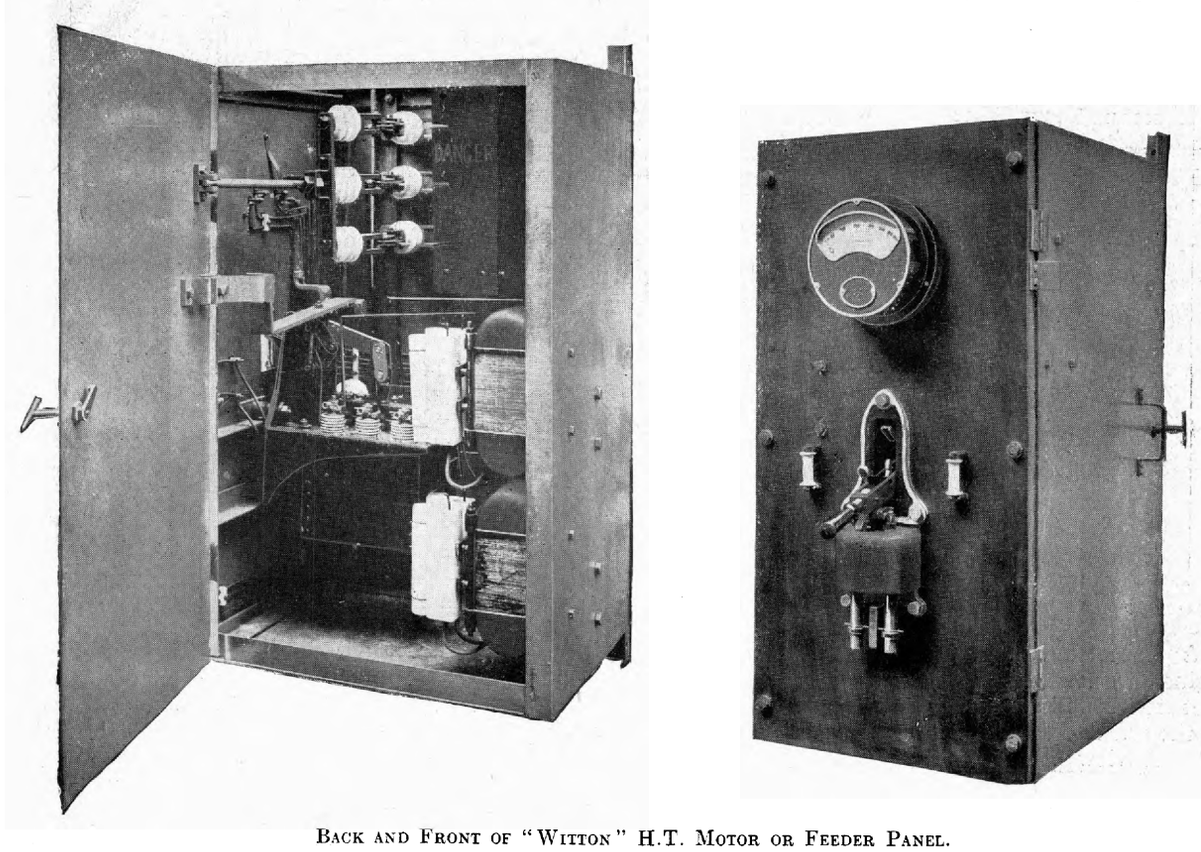
The compressed air required for fuel injection and starting is supplied from three reservoirs or "bottles," one smaller one normally for the injection, one larger one for starting, and a third large one as a spare. These are kept constantly charged at a pressure above 60 atmospheres by a Reavell water-cooled compressor direct-coupled to the engine. Lubrication of the main bearings, which are of ample length between each crank, is effected by rings; the crank pins are lubricated by gravity feed, while the pistons are supplied by positive timed forced feed.

A stroll round the works revealed a number of interesting details as to the manufacturing methods which enable such fine work as that invariably associated with the name of Willans & Robinson to be put into these engines, parts of a very large number of which were going through. Particularly interesting were the details of the pulveriser through which the fuel is sprayed into the cylinder, the special machine for grinding in valves, and the method of making piston rings of an even thickness to give constant pressure all round. Considerable numbers of steam turbines were also in progress, and it was interesting to see that all these are now provided with impulse high pressure and reaction low pressure stages. The foundry, too, was one of the busiest parts of the works, not only with large engine turbine, pump and condenser parts, but also with complicated cylinder castings for automobile engines, which Willans & Robinson supply to a large number of motor-car builders, with most ingenious devices for arranging and ventilating the cores.

H.T. MOTOR OR FEEDER PANELS

THE accompanying illustrations show a pattern of H.T. panel which has been developed by the General Electric Co. for controlling three-phase high-tension motors or feeders, and is made at their Witton works. It takes the form of an iron cubicle suitable for fixing to the wall, and fitted with three single-pole isolating links, one three-pole automatic switch, the necessary current and potential transformers for operating the trip coils or oil-switch, &c., and an ammeter or wattmeter on the front of the cubicle above the oil-switch operating handle.

The special feature about this cubicle is the arrangement of interlocking the various pieces of apparatus with the door designed to render it absolutely fool-proof. The isolating links are interlocked with the doors of the cubicle in such a way that the action of opening the door also opens the links, and the door is further interlocked with the oil-switch so that it cannot be opened until the switch is in the "off" position. Also, the oil-switch cannot be closed until the door of the cubicle is closed. It will thus be seen that it is impossible to either make or break the circuit by means of the isolating links. Careful attention has also been paid to efficiently isolating the line sides of the isolating links by means of insulating barriers, so that it is impossible to touch any live parts when the door of the cubicle is open, consequently adjusting and cleaning of the various apparatus can be done in absolute safety.



BACK AND FRONT OF "WITTON" H.T. MOTOR OR FEEDER PANEL.

The Northampton Institute.—The new scheme for the management of the Northampton Polytechnic Institute, rendered necessary by the dissolution of the City Polytechnic in 1907, has now been sealed by the Charity Commissioners. Under their new powers, the governors have offered the appointment of President to H.R.H. the Duke of Connaught, who has accepted the office.

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THE ELECTRICAL EXHIBITION OF 1911

(Sixth Notice.)

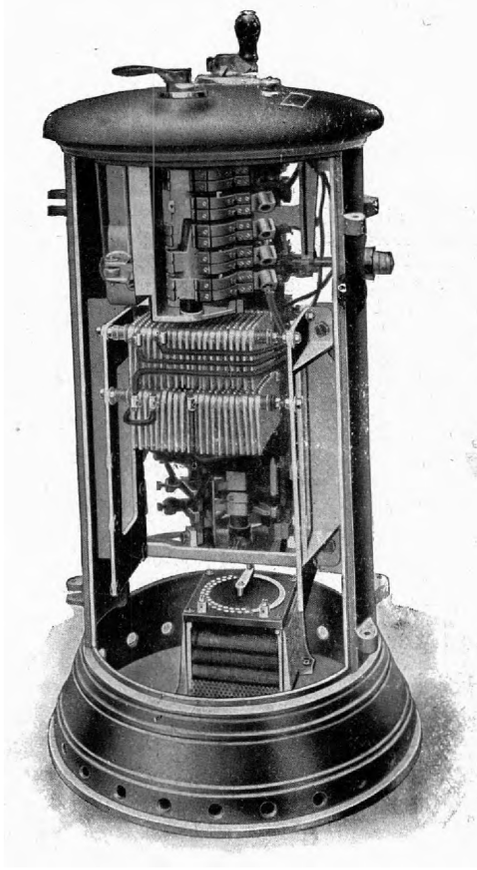
THE Electrical Exhibition at Olympia closed on Saturday last, after being open for four weeks. We conclude our notice of some of the more interesting exhibits.

Electric & Ordnance Accessories Co., Ltd. (Vickers, Ltd.),

Aston, Birmingham.

This firm showed a new line of A.-C. induction motors, ranging from ¼ to 15 h.p. The rotors of the sizes from 5 h.p. upwards have slip-rings. In these one end of the three-phase winding of the rotor is earthed to the frame, so that only two leads need be brought through the spindle, and the whole motor is at earth potential when it is short-circuited on reaching running speed. The motors have a solid belt-tightening bedplate, and show evidence of good design and workmanship.

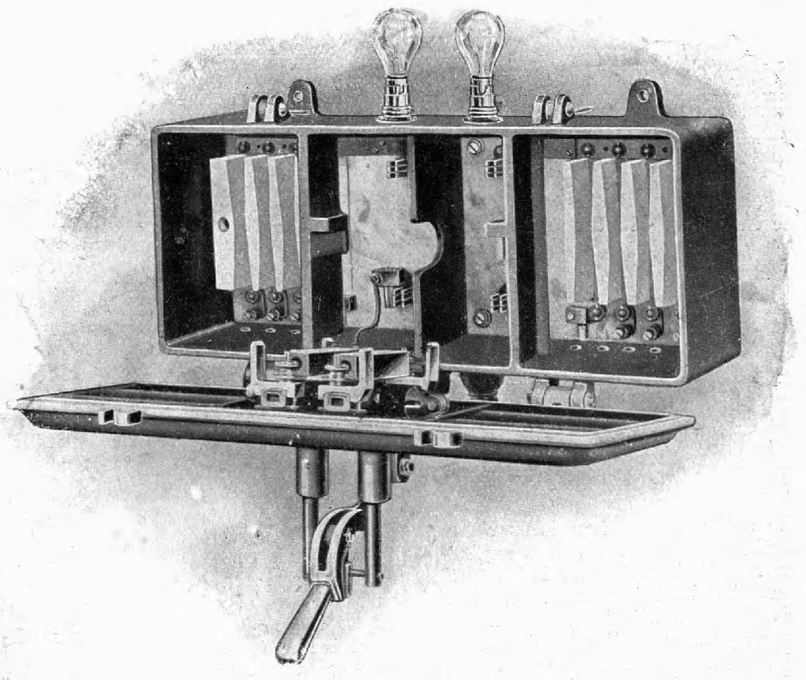
Another interesting exhibit on this stand was a control pillar for shunt-wound workshop motors. It is a new design intended as a substitute for the ordinary motor control panel. We illustrate the pillar open, to show the starting resistance, reversing barrel, reversing handle, and regulator. In addition to the starting handle at the top, there is a knob which has to be kept pressed down while switching on, and if this knob is released before the handle reaches the running position, the circuit-breaker opens. A magnetic blow-out coil is provided, and as this covers every step of the starting switch, spark wear should be reduced to a minimum, and there are shields between every set of fingers. The starting resistance is in the lower part of the pillar, so that the whole gear is self-contained. The circuit-breaker (which breaks on both poles) is so interlocked with the main barrel that, when it is open, the handle has to be brought to the off position before the motor can be re-started. In addition, an emergency stop push-button enables the motor to be stopped at any position of the starting handle; as well as releasing the no-voltage coil, it also operates the circuit-breaker mechanically in the event of the latter sticking, due to the contacts being slightly welded or the spring being broken, so that the stopping is absolutely instantaneous. A reversing switch was also fitted in the pillar shown at the exhibition and illustrated here; it is worked by a separate lever interlocked with the starting barrel and preventing the connections being reversed unless the starting handle is on "off." On opening the door of the pillar, a catch operates the emergency stop, and everything is made dead except the two main fingers.



Control Pillar Open.

Another new type of switch shown was a knife pattern with quick make as well as quick break. On switching on, a helical spring is extended, which takes control of the contact bar after the handle has passed a certain point, and brings the bar in between the fixed contacts with a snap, and an ingenious arrangement (described in our Patent Record on July 27th last) is provided for locking it in position. On the stand was also a new ironclad crane panel, the construction of which is made clear by our second illustration.

On the gallery the company gave cooking demonstrations with their "Eclipse" cooking apparatus. The characteristic feature of the Eclipse ovens, &c., is that the coils (which are made up of wire wound on flat strips of mica) are used at a dull red heat, and that they are fixed in clips on each side of the oven and exposed so that replacements are extremely easy and can be carried out by the consumer himself. In front of the heating elements are cast-iron protecting guards, or "gates," on hinges, which can be swung out for cleaning and for examining the elements. These guards also serve for carrying the shelves. In the case of hot-plates, &c., where the coils are not exposed, they are protected by mica and tin-plate. A practical form of kitchen switch-panel with indicating lamps to show which apparatus were switched on was also exhibited.



Ironclad Crane Panel.

Parmiter, Hope & Sugden,

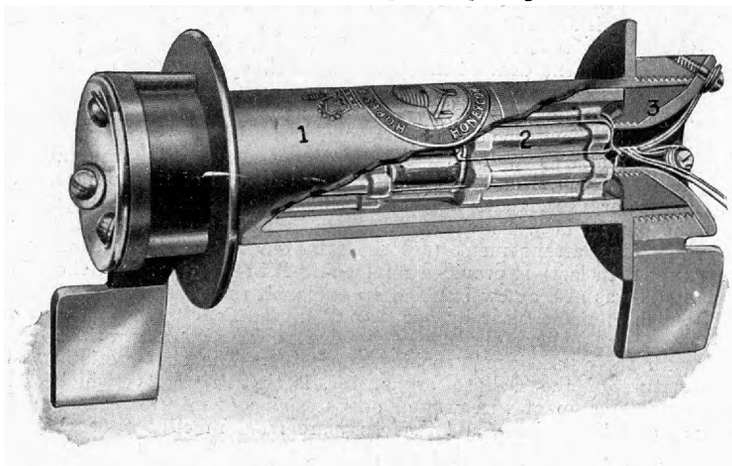
Hulme, Manchester.

The exhibit which attracted most attention at this stand was Hope's "Bi-metal" fuse wire, demonstrations of which were being constantly given. It consists of a copper wire covered with a thick layer of tin alloy. The latter melts off first before the fuse blows, so that there is no spluttering of tin, and, while not being liable to oxidisation and ageing, the fuse blows as cleanly as ordinary copper fuses. In addition, the construction enables it to carry even 90 per cent. of its fusing current practically indefinitely, and it will stand momentary overloads without blowing.

The same firm showed their new "honeycomb" fuse, designed to withstand heavy short-circuits. Our illustrations show the construction. The outer body consists of a red fibre tube, 1, lined with a fire-resisting compound. The

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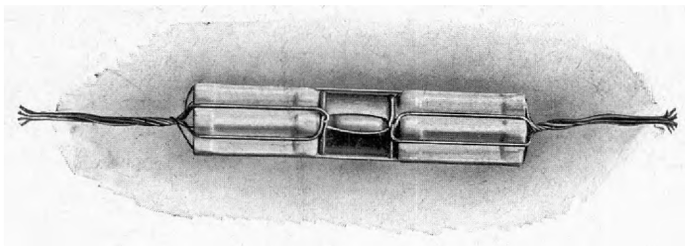
ends of the fibre are screwed to receive contact ends, and the end caps or baffle plates, 3, are of gun-metal lined with hard fibre. Inside is a cylindrical china body, on the outer surface of which there are a number of cells, 2, in which the fuse wires are placed, whilst through the centre of this body there is a hole with a tapered opening at either end.



The "Honeycomb" Fuse.

This central chamber serves as an expansion chamber. Round the centre portion of the outer surface of the honeycomb cylinder a tin "time element band" is fixed, which is connected to the terminals by copper strands. In addition a number of small copper strands, varying in number from three to six, according to the size of the fuse, run right through from terminal to terminal.

A "honeycomb" carrier is shown below, wired ready to place in position in the outer casing.



The action of the fuse is as follows: Running on a small load the copper "through strands" carry the bulk of the current as their resistance is lower than that of the tin band, but as the load increases, the temperature of the copper "through strands" rises, and the resistance of these strands becomes greater until a portion of the current is shunted and carried by the central tin band. When the load exceeds the maximum continuous rating of the fuse, the temperature rises until the latter is melted. All the load is then thrown on the copper "through strands," which immediately fuse. It will be seen, therefore, that on ordinary overload conditions the break takes place on the copper through strands only, and consequently a comparatively small mass of metal only is volatilised. On a heavy short circuit, however, the "fusible tin band" is as a rule left unfused, the connecting copper strands fusing instead. Mr. S. L. Pearce, City Electrical Engineer, Manchester, has tested a 700-ampere fuse by shorting it across the 440-volt terminals of the huge Dickinson Street battery, and it broke circuit satisfactorily without splashing or even damaging the fuse terminals.

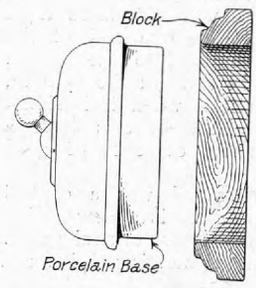
O. C. Hawkes, Ltd.,

69 & 70 Aldersgate Street, E.C.

The point which this firm are emphasising is the construction both of their electric stoves and electric cookers, so that the heating elements can easily be replaced. They are encouraging contractors to keep stocks of the apparatus without coils and a separate and larger stock of coils, so that they can make up a heater for any desired pressure at practically a moment's notice. The coils of the sitting-room stoves are mostly wound on fireclay bobbins, but the heating elements for the ovens, wound on strips of mica and glowing at a red heat, are also employed in some types of radiators and convectors. Among other exhibits was a very cheap and light type of kitchen oven with heating elements on the top and bottom only; the top elements serve as well to heat a hot-plate, which can also be employed for a grill. The firm's combined stove and cooker—used as the latter in combination with a "Dutch oven"—was described in our columns some time ago (October 13th, 1910), and this was also exhibited. Several specimens of signs were exhibited, among which the most effective had incised gilt letters with a narrow slit at the back enabling it to be employed with lamps behind for illuminating at night.

J. H. Tucker & Co.,

King's Road, Hay Mills, Birmingham.



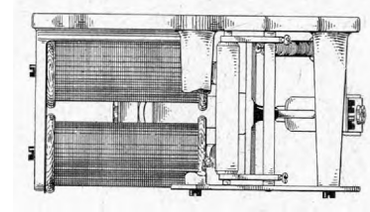
Semi-recessed Switch. Half Size.

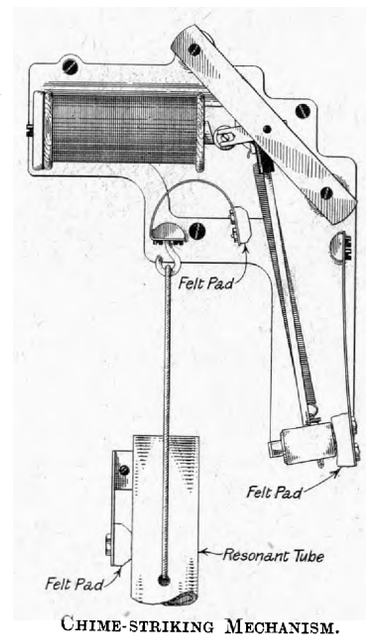
The semi-recessed switch, which we illustrate, is not quite new, but may not be known to all our readers. It is a compromise between a flush switch and an ordinary one, as it can be employed with ordinary concealed wiring without the additional cutting away necessitated by the flush switch. As seen, the projection is very slight. The firm also exhibited switches of heavier type, some well-designed distribution boards, and interest was evinced in a show-board on which were the 38 parts of an ordinary tumbler switch unassembled. Few people realise the enormous number of parts involved in the making of a switch which sells for a few pence.

Gent & Co., Ltd.,

Faraday Works, Leicester.

One of the neatest things on this stand was a set of chimes for connection to an electric clock system. The "chime transmitter" movement is actuated by impulses from a master clock in the ordinary way, and a cam is raised to a different height during every quarter-hour and





Chime-striking Mechanism.

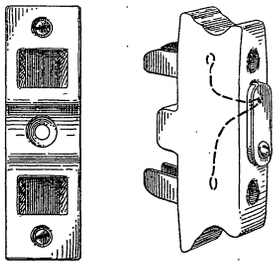
then released. In returning to its normal position, it makes a series of contacts which actuate the electromagnetic striking gear above each of the resonant tubes forming the chime. We illustrate the striking gear. The armature roller is attracted along the face of the magnet, and the hammer attached to it strikes the tube. As is seen, means are taken to make the action quite silent, and the tone is beautifully clear and is free from extraneous noises.

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Dorman and Smith,

Ordsall Electrical Works, Salford, Manchester.

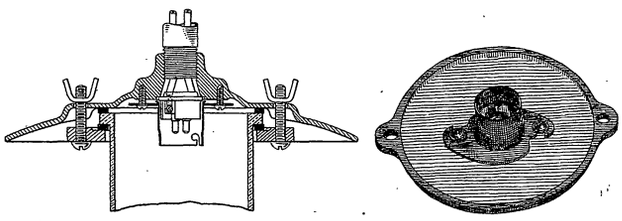
This firm had only a small exhibit, on the same stand as the Phœnix Dynamo and Motor Co. A large photograph of the main switchgear on board the *Olympic* and *Titanic* excited much interest. We illustrate a new fuse just brought out by



Fuse to Comply with Home Office Requirements. (*Half-size.*)

the firm to meet Home Office requirements. It is seen that the contacts are thoroughly protected, and that, instead of the fuse-holder being simply tubular, the wire makes a detour (indicated by a dotted line in the drawing) through the thickness of the handle. By loosening the screw at the top of the holder and turning back the asbestos-lined brass flap, the bend in the fuse wire can be examined to see if the wire has blown, without removing the fuse-carrier.

Another useful fitting is the cast-iron mill fitting shown in the second illustration. A special type of lamp-holder is



Mill Fitting Designed for Easy Wiring.

employed, and the method of fixing indicated enables the usual lamp-holder nipple to be dispensed with, so that the wires have a wide and straight run through into the lamp-holder insulator.

Globe Electric Co., Ltd., and **The Armorduct Manufacturing Co., Ltd.** (6 & 11 Farringdon Avenue, London, E.C.).—The Globe Electric exhibited a new electromagnetic hammer, just placed on the market. The power is furnished by a series motor, and is transmitted through spur gearing to a connecting rod, which links the motor to a moving sleeve. A solenoid, with a uni-directional current, surrounds the sleeve and plunger, which is a piece of hardened tool steel, and supplies a magnetic connection between them. This produces a cushioning effect, as the magnet does not move with the plunger, but simply acts as a flexible clutch to prevent the blow having any ill effects on the mechanism. The tool is operated by a switch in the handle, so that the pressure of the operator's hand on the tool also closes the circuit. The machine is equally suitable for drilling, caulking, or chipping. It weighs 25 lbs., is 13 in. long, and has a 1½-in. stroke, which can drill a 1-in. hole to a depth of 3½ in. in hard stone in one minute. The current required is 1 ampere at 220 volts. The firm also exhibited the "Glob-o-Lite" glass bead signs, arc lamps, both for ordinary and photographic work, and some measuring instruments. The Armorduct Company exhibited wires and cables, conduit fittings, and other accessories, metal filament lamps, heating and cooking appliances, fans, electrically operated tools, and the "Magic" suction feeder, described under a separate heading.

Magic Appliances, Ltd. (6 Farringdon Avenue, London, E.C.).—At this stand demonstrations were given with a self-contained electric suction cleaner mounted on rubber-tyred wheels fitted with ball-bearings. In addition to being wheeled about bodily for carpet cleaning, the apparatus can be used stationary with a flexible vacuum hose, with which the usual accessories are supplied. A hose can also be attached to the outlet for blowing. The suction is obtained from a motor-driven disc-turbine fan, and the dust is received in a bag. The case is made of aluminium, and the whole weighs about 9½ lbs.

The National Machine Recorder Co. (Marquette Building, Chicago, U.S.A.).—An example of the advanced ideas prevalent in America in connection with factory organisation was shown in the shape of a recorder to be placed in a works office, and connected electrically to every machine, so as to produce a record of the time each machine has been working. A chart is mounted on a drum, which revolves by clock-work, and is large enough to take the records of fifty markers. Each of these has an "on" and "off" position controlled by electromagnets, which are connected by wire to a switch on the machine. As soon as a machine is started a switch is closed, but the recorder is not in circuit until the machine is actually working, when the action of the material passing through the machine closes another switch. For all wire-working and screw machines a wire is run through this switch, and in the case of lathes, planers, milling machines, &c., the cutting tool actuates the switch. When this is closed the corresponding magnet deflects the pencils to the production position on the chart. It is held in this position until the material stops passing through the machine, when the switch is opened, and the pencils fall back to the idle position. This idle time is automatically added up by means of an attachment, which has a separate wheel for each machine. For variable-speed machines time switches are provided worked by the recorder clock. They show whether the operator is working his machines at the maximum efficiency, because all time taken in excess of the limit allowed for a job is recorded on the chart.

The Morgan Crucible Co., Ltd. (Battersea Works, London, S.W.).—The well-known "Morganite" brush was well represented at this stand, as well as the high-grade "Battersea" carbon brush, suitable for use under the severest conditions. A feature of this brush is the method of fixing the flexible: a hole about ½ in. deep is drilled in the brush, and the end of the flexible, which is splayed out, is inserted, and held in position by compressed pure metallic powder, thus ensuring good contact. The firm is also making Morganite gland rings for steam turbines, specially suitable for withstanding heat and moisture without disintegrating. A new departure of the firm is a tilting furnace, a model of which was shown. The Brazil patent carbon powder resistance for use with lightning arresters was another exhibit (see Electrical Engineering, Vol. V., page 1039, December 9th, 1908).

J. Hopkinson & Co., Ltd. (Huddersfield).—A fine display was given of this firm's well-known valves for all purposes including the Hopkinson-Ferranti steam stop valve. A full set of boiler mountings is also shown on a model Lancashire boiler front.

C. W. Goodchild & Partner (30–32 Farringdon Road, E.C.).—Machine tools manufactured by Ludwig Loewe & Co., for whom this firm are agents, were shown, as well as small tools, gauges, &c., and examples of D.W.F. ball-bearings. Attention should be directed particularly to an automatic pin and stud machine shown at work.

Chicago Rawhide Co., Ltd. (Hythe Road, Willesden, N.W.).—Examples were shown at this stand in the gallery of Chicago rawhide belting, which is prepared by a special process, retaining the pliable nature of the hide as well as its softness. Belt laces, packing, rawhide pinions and blanks, and other leather articles are also shown.

Reunion of Cromptonians.—One hundred past and present Cromptonians dined together at the Trocadero Restaurant on Saturday, October 14th last, under the chairmanship of Col. R. E. B. Crompton. Mr. W. A. Chamen acted as vice-chairman, and Col. Crompton was supported among others by Mr. James Swinburne, a former works manager at the arc works, and by Mr. A. P. Lundberg, Col. Crompton's original assistant at the works. Mr. Chamen, in proposing the toast of "Cromptonians," pointed out that there were no less than 25 Old Crompton men occupying at the present time the position of chief engineer to electric lighting and power undertakings, and, further, that names of men such as James Swinburne, Gisbert Kapp, A. P. Lundberg, Sam Mavor, J. F. C. Snell, J. W. Kempster, A. Bergtheil, and others, bore record of the importance which the old firm had played in the building up of the electric industry. Col. Crompton, in reply, expressed his pleasure in seeing around him so many of those who were associated with him in his earlier days. The dinner was organised by a committee consisting of Messrs. W. A. Chamen, S. Dobson, E. J. Fox, H. Leaf, C. Peel, A. H. Pott, and W. L. Pakenham. Many still associated with the company were present, among others Lt.-Col. Clibborn and Mr. B. Gibson, directors, and Messrs. E. Reeves and A. H. Hodgson, joint managers.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Oct. 19, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

23,332/10. **Incandescent Lamps.** The "Z" Electric Lamp Manufacturing Co., Ltd., and F. Hoge. A method of mounting that part of the central rod of a lamp to which the filament supporting wires are attached is covered by this patent. A glass bead is slipped over the central stem near the bottom, and in it the supporting wires are embedded. The leading-in wires are connected, by twisting and welding, one to each of two of the supporting wires. These are double, the other part being attached to the filament, so that the bead, which is loose, is held in position on the stem, and the leading-in wires form a resilient support for it. The manufacture of the bead is also protected by this patent. Four figures.

28,138/10. **Lamp Shade and Locking Device.** W. G. Polack. A combined arrangement, in which both the lamp and its shade are fixed, consists in resting the shade on the shoulder at the neck of the lamp, and fixing it there by means of a metal collar, over which a ring is screwed down, causing the collar to press on the top of the shade. The collar and ring may be combined. Three figures.

28,226/10. **Production of Iron.** S. O. Cowper-Coles. This is an electrolytic process, in which the cathodes consist of thin sheets of electrolytic iron, and the anodes of bars of pig iron of any kind. The electrolyte can be sulphuric or hydrochloric acids, or a mixture of both, or a ferrous ammonium sulphate. Any thickness of iron may be deposited on the cathode, which can be removed from the cell and the iron taken off. It can then be further treated, such as converting it into steel. To prevent the anodes becoming coated with carbon, graphite or other impurities, brushes are mounted on a spindle, and attached to the cathode. These revolve and keep the anode surfaces free. Two figures.

1,951/11. **Portable Transformer.** Dr. P. Ranschburg and D. Perlusz. An apparatus adapted to be used from a lamp socket on any ordinary lighting circuit, for supplying current for medical purposes. The main current passes through a fixed resistance, such as a glow lamp, and an adjustable resistance, which are in series, and a low-tension current can be taken from terminals provided. In parallel with the regulating resistance, the primary and interrupter of an induction apparatus are connected, the secondary being taken to another pair of terminals at which a corresponding faradised current is available. The induction apparatus can be cut out by means of a switch in the primary circuit, and the core is also adjustable. Instead of the lamp, a fixed resistance can be used, in the form of platinum wire embedded in porcelain and interrupted at one point, where two contacts are provided. This resistance is such, that if a loop of a cauterising surgical instrument be placed between the contacts, it will be brought to incandescence by the current flowing. Five figures.

8,996/11. **Electric Furnace.** G. Lüdecke and The Imperial Lamp Works (Brimsdown), Ltd. This relates to an apparatus for decarbonising and sintering raw metallic filaments. The inner well of a carbon cylinder or other refractory metal, whose conductivity is lower than tungsten, is coated with a deposit formed by evaporating the chlorides or oxy-chlorides of tungsten and molybdenum within the cylinder. In a preferred form the cylinder is evacuated and brought to incandescence and tungsten hexa-chloride is evaporated within, the high temperature causing a uniform and dense coating of tungsten to form on the interior. An inner cylinder of tungsten and an outer of carbon may be produced, the latter forming a part of the resistance. The cylinder is held between cast-iron rings, which are connected to conductor terminals. One figure.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Names in italics indicate communicators of inventions from abroad.

Arc Lamps: Blondel, 27,989/10.

Distributing Systems: Strasser [Distribution system, equalising arrangements] 168/11.

Dynamos, Motors, and Transformers: Holbech [Dynamos] 15,587/10; Girardelli [Motors for transmitting angular movements] 22,714/10; Parker-Haigh [Single-phase motors] 26,984/10; Beeton and Morgan Crucible Co. [Carbon brushes] 27,162/10; Leitner [Dynamo connection] 709/11; Brown, Boveri et Cie. [Compounding dynamos] 4,256/11.

Electrometallurgy and Electrochemistry: Cowper-Coles [Electro-deposition of iron] 28,592/10; Reid [Furnaces] 1,609/11.

Heating: Schneider [Thermostats] 11,548/11.

Incandescent Lamps: W. C. Heraeus Ges. and Trenzen [Metal filaments] 1,544/11.

Switchgear, Fuses, and Fittings: Royce [Connectors] 23,445/10; Romeu [Automatic multi-fuse cut-out] 28,840/10, Hirst and Chapman [Cut-outs] 1914/11; Pintsch's Patent Lighting Co. and Vidal [Switches] 9,005/11.

Telephony, Telegraphy, and Signalling: Urban [Transcribing telegraphic characters] 22,697/10; Fleming [Wireless telegraphy transmitting apparatus] 23,242/10; Automatic Electric Block Signalling Co. and Brousson [Automatic signalling] 1,048/11; Siemens Bros. & Co. (*Siemens & Halske Akt.-Ges.*) [Semi and automatic exchange calling circuits] 14,144/11.

Miscellaneous: Henri, Helbronner and Von Reckling-hausen [Sterilising liquids] 23,077/10 and 4,895/11; Brush Electrical Engineering Co. and Salisbury [Vapour electrical apparatus] 28,991/10; Davy Bros., Ltd., and Holmes [Overload relief apparatus for cranes] 30,215/10; H. Aron Elektricitäts Zahlerfabrik Ges. [Operation of electric clock installations] 7,862/11; Giles [Indicating an earth on a line] 9,745/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Miscellaneous: Veifa-Werke Vereinigte Elektrotechnische Institute Frankfurt-Aschaffenburg Ges. and Dessauer [Regulating device for induction coils] 21,333/11.

Opposition to Grant of Patent

1,028/11. **Ignition Plugs.** T. G. Smith and F. J. Platt. Opposition has been entered to the grant of this patent, in which the fixed terminal is made in the form of a hollow tube, provided with a glass window for inspection purposes. It was abstracted in Electrical Engineering, August 31st, p. 490.

Expiring and Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: J. W. Nasmith (*T. L. Carbone*) [For 3-phase current] 15,107/06.

Distributing Systems, and Insulating Materials: P. F. Corkhill [Distribution] 13,964A/05; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Insulation for laminations, &c.] 15,171/07; J. S. Peck [A-C. distribution] 15,335/07.

Dynamos, Motors and Transformers: M. Latour [Self-exciting A-C. dynamos] 13,402/01; W. E. Burnand [A-C. machines] 14,770/03; L. R. Auvert and A. F. E. Ferrand [Converter] 13,585/06; V. A. Fynn [A-C. machines] 15,151/07; G. C. Dymond (*E. Eisemann & Co.*) [Armatures of magneto machines] 15,594/07.

Electric Ignition: M. Kemp-Welch, Olantye and P. Lyle, 15,412/06.

Heating and Cooking: W. S. Adlard [Electric heater] 15,079/07.

Instruments and Meters: British Thomson-Houston Co. and F. Holden [Instrument for magnetic measurements] 15,113/02; W. Hamilton and Ferranti, Ltd. [Induction motor meter] 13,696/05.

Switchgear: R. Amberton and E. Schattner [Controller regulator] 15,366/07; J. N. Maskelyne [Lamp switch operated by door] 15,522/07.

Telephony and Telegraphy: Siemens Bros. & Co. (*Siemens & Halske Akt.-Ges.*) [Telephone systems] 13,586/05; W. K. L. Dickson [Combined telegraph and telephone system] 15,169/07; L. H. Walter [Electro-magnetic wave detector] 15,412/07; P. M. Justice (*Sub-Target Gun Co.*) [Ships' telegraphs] 15,532/07.

Traction: Siemens Bros. & Co. (*Siemens & Halske Akt.-Ges.*) [Railway points and signals] 13,980/99.

Miscellaneous: Siemens Bros. & Co. (*Siemens & Halske Akt.-Ges*) [Condensers] 13,682/05; A. C. Stray [Clocks] 15,100/07 and 15,100A/07.

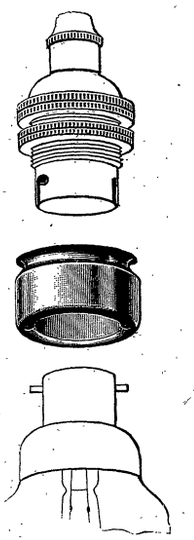
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DYNAMO AND MOTOR BREAKDOWNS

THE annual report of Mr. Michael Longridge, Chief Engineer to the British Engine, Boiler, and Electrical Insurance Co., contains, in addition to a quantity of information regarding accidents to steam and gas plant, &c., some interesting particulars relating to dynamo and motor breakdowns. In some statistical tables it is shown that 85·5 per cent. of the breakdowns with which the company was concerned were those to D.-C. machines, the remaining 14·5 per cent. being alternating. In the case of dynamos 43 per cent., and in the case of motors 33 per cent., of the cases were due to armature or rotor breakdowns, and 25 and 26 per cent. respectively originated in commutators or slip-rings. 24 per cent. of the total number are ascribed directly to dirt and neglect. Some typical examples are described in detail. Among these are failures due to excessive wear of white-metal bearings causing contact between rotor and stator, and in this connection the company record satisfactory experience with ball bearings as avoiding possibility of minor accidents. In another case field coils were damaged by excessive soaking with oil, and an instance of field-coil winding breaking through insufficient protection where lead in from the terminals is recorded. Excessive sparking due to unequal wear of the copper and mica of commutators is also referred to. In two cases trouble was experienced in induction motors with the slip-ring leads where they pass through tunnels in the shaft, and in a D.-C. motor short circuits were caused by absence of proper covering over the cast-iron drums under the end connections. In another case the presspahn troughs in the armature slots were too short and left a sharp edge which cut the insulation. Loose connections produced sufficient heat to set fire to insulation in a motor with proper terminal boxes, and another cause of trouble referred to was broken commutator connections. A very curious case is also mentioned where the company's inspector was consulted as to the cause of the repeated blowing of a fuse in circuit with a variable speed motor driving a heavy planer. This would blow just as the machine was being switched off, and the cause was eventually found to lie in the attendant switching off by moving back the combined stator and speed regulator instead of pulling out the main D.P. switch, thereby cutting resistance out of the field and causing the motor, backed up by the inertia of the heavy machine, to become a generator and to send back a heavy wave of current into the line before pulling up. Another interesting case is that of a generator which continually went to earth owing to a black oil deposit attributed indirectly to the effect of the fumes from a suction gas plant, partly in that these were continually corroding the copper of the commutator, with the result that it was rubbed with emery paper much too often, allowing an excessive amount of copper dust to find its way into the armature, and partly by the action of the fumes on oil creeping into the machine.

ELECTRICITY IN HORTICULTURE

FROM time to time we have noted the experiments that have been made in the application of electricity to horticulture by erecting wires charged at a high potential above fields containing crops or in greenhouses. Originally electrostatic influence machines were employed for the purpose, but these, as is well known, require very careful attention, are apt to fail to excite, and are also of a rather unsatisfactory construction mechanically. Induction coils and Lodge valves were substituted, and good results were obtained, but the cost of the equipment is fairly high. We learn that Mr. S. Clark has devised a new type of influence machine for the purpose, a demonstration of which was held at the Highfield Nurseries, Downham, Billericay, on the 11th inst. It has six plates, 26 in. diameter, mounted on ball bearings, and the spindle does not pass through the plates. The air is dried by the exhaust from the engine before passing into the case of the machine, and in like manner the dust is extracted from the air to render the machine indifferent to atmospheric conditions. The plates have no sectors, the electrodes are sliding and removable for cleaning purposes, and the terminals are arranged so as not to accumulate dust. The engine has been placed in a separate house to the electrical machine; the two houses are a foot apart, and the driving belt is protected by a movable pent roof. The building is heated by hot water pipes. The machine house is placed about 18 in. from the greenhouse, end on. A glass dormer covers the exposed 18 in. of insulated wire, which passes through a 20 in. square glass varnished pane, out of the machine house and through a similar pane of glass, into the greenhouse, where it joins on to the main overhead wires, three in number, stretched down the length of the greenhouse. The wires are suspended from the roof by glass insulators (dipped into paraffin wax), and kept taut by weights on pulleys at each end of the greenhouse. The greenhouse is 200 ft. × 24 ft. 6 in. centres, and was specially designed for the purpose by Messrs. H. L. Rowdon and Son; all ventilating rods and gears are on the outside of the roof, and all stove-pipes as far distant from the overhead wires as possible. The wires are hung 7 ft. from the ground. Fifty feet of the greenhouse is partitioned off for seedlings, and it is so arranged that the current can be applied to this part alone or to the whole 200 ft. The machine working normally produces 600,000 volts, and the glass insulators have been tested up to 800,000 volts. No horticultural experiments have taken place yet, but rough vacuum tube tests have been made, and it has been found that tubes are lighted up by a wire stretched 4 ft. away from the overhead wires. The influence machine is being sold at £36, and the maker estimates that it can be worked for 48 hours for the cost of 3s. Messrs. Highfield Nurseries, Ltd., are sole agents for the influence machine, and offer to exhibit their installation to any interested in this development in horticulture. The installation is under the direct supervision of Mr. J. R. Milne, who has been for many years privately interested in the subject, and to whom we are indebted for the notes from which the above article has been written.



A NEW SHADE CARRIER AND LAMP-LOCKING DEVICE

WE illustrate here a simple and convenient lamp-locking device combined with shade-carrier, which has been put on the market by C. H. Jeffcoat (148 Addison Gardens, W.). The locking collar is first placed on the lamp cap and the shade is placed over both. The lamp is then put into the holder in the ordinary way, and the shade-ring is screwed down over it, so that the lamp cannot be pushed in to disengage without slacking back the shade-ring. This arrangement does not require any special form of lampholder, nor any tools for unlocking, and renders the shade much more easy of removal than when supported by the shade-ring in the ordinary way.

THEATRE LIGHTING BY METAL FILAMENT LAMPS

THE Prince of Wales' Theatre, Birmingham, has recently been reconstructed and redecorated, and the opportunity has been taken to modernise the electric lighting arrangements by the adoption of the British Thomson-Houston Co.'s new drawn-wire Mazda lamps, of which some 1,500 are employed, with substantial gain in economy of current consumption. Specially successful measures have been taken to avoid glare in the arrangement of the lamps, many of which are frosted, and some very fine decorative fittings have been installed. The foyer is provided with five three-light electroliers, and two-light brackets, finished in dull gold, with the lamps shaded by fringes of crimson beads. The staircase, leading to the grand saloon and dress circle, is lighted by four three-light electroliers and side brackets of similar style. The grand saloon itself is provided with five handsome electroliers in dull gold, the largest fitted with ten lights, and the remaining four with three lights each. The dress circle, upper circle, and corridors are lighted by means of ceiling fittings and wall brackets. All the dressing rooms and offices are lighted entirely with Mazda lamps.

From the centre of the auditorium ceiling depends an imposing electrolier, holding some fifty lamps. This is supplemented by four lesser electroliers accommodating six lights each. All these fixtures are finished in dull gold, and equipped with Mazda lamps. The whole of the incandescent stage lighting is by Mazda lamps, work for which a tough filament is specially necessary. In the footlights there are some 104 of these, 52 clear, 26 red, and 26 blue lamps. In addition, there are six rows of batten lights, each batten containing a similar number of lamps and assortment of colours. The switching of these lights is so arranged that all or any part of each batten may be thrown in circuit at any desired time to produce the requisite colour effects.

On account of the different characteristics of metal and carbon lamps, specially designed dimmers have been put in. The stage is further illuminated as required with hanging battens of lamps, and with portable swivel standards holding "bunch" lights.

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ELECTRIC TRACTION NOTES

According to the *Financial News*, the experiment of the German State Railway Administration with the electric railway service between Dessau and Bitterfeld having proved satisfactory, electric traction will now be adapted to the Bitterfeld-Leipzig-Halle and Dessau-Magdeburg lines, each line being of a length of 150 kilometres. The electrification of the Berlin city and district railway will take place in the near future, all preliminaries having been successfully concluded. The Allgemeine Electricitäts Gesellschaft of Berlin is to carry out the work, and for this purpose, as well as for the construction of the Berliner North-South underground, the company is considering a new loan.

At a meeting, last Friday, of the Metropolitan Association of Electric Tramway Managers, Mr. A. H. Stanley (Managing Director, London Electric Railways and London United Tramways) and Mr. T. B. Goodyer (Tramways Manager, Croydon) were elected Chairman and Honorary Secretary respectively, and Messrs. Z. A. Knapp (General Manager, London United Tramways) and S. Dudman (Manager, Dartford Light Railways) were elected members of the Association.

As the result of the recent report regarding the use of trolley omnibuses, the Tramways Committee of the Edinburgh Town Council have appointed a Sub-committee consisting of the Lord Provost, the Convener of the Tramway Committee, and another councillor to consider the scheme, and to confer on the subject with the Tramway Co. and the Leith Town Council. It is stated that the Tramways Committee are prepared to recommend the Town Council to apply for Parliamentary powers to run trolley omnibuses over three experimental routes.

Subscriptions are being invited by the Fife Tramway Light and Power Co. for 51,195 ordinary shares of £1 each at par.

It is stated that the extension of the Central London Railway from the Bank to Liverpool Street will be opened in June.

The difficulty of raising capital for the Oxford tramways has not yet been overcome by the National Electric Construction Co. A few years ago the consent of the Corporation was obtained to a modification of the original electric tramway scheme by which there would be a much larger proportion of overhead trolley and a correspondingly smaller amount of conduit traction over the central portion of the city. Now the company have informed the Corporation that there are grave difficulties in the way of obtaining the £180,000 capital required, and, in fact, that it cannot be raised under the conditions of the present agreement. In other words, the company is not able to proceed with any scheme which involves the laying of the expensive conduit system. A special meeting of the Corporation has been held to consider the position and it was decided by 46 votes to 6 to decline to accept any modification of the existing agreement.

The Anglo-Argentine Tramways Co. is issuing £1,500,000 of 5 per cent. debenture stock at 97½.

The accounts of the Auckland Electric Tramways, Ltd., for the year to June 30th show a net surplus of £43,574. Of this, £15,000 has been placed to reserve, and a 7 per cent. dividend recommended on the ordinary shares, against 6 per cent. last year, carrying forward £7,147.

A terrible tramway accident took place on Friday morning upon the Stalybridge, Mossley, Hyde, and Dukinfield Joint Board's tramway system, resulting in the death of five persons and injury to six others, one of whom has subsequently died. The car got out of control on a very steep road, which, after a clear run of half-a-mile, takes a sharp turn to the left and crosses a railway bridge. At this point the car was going at too great a speed to take the curve, with the result that it crashed into the wall of the railway bridge and toppled over on to the railway lines, 30 feet below. The accident occurred at about 5 o'clock in the morning. A Board of Trade inquiry was opened on Monday and adjourned after a short sitting.

A deadlock has occurred between the Watford District Council and the Metropolitan Electric Tramways, Ltd., with regard to the construction of tramways in the High Street. The Council insist upon certain widenings being carried out, but the company are against the latter on account of the heavy capital cost, and in this contention they have the support of the County Council, which is the tramway authority. The Urban District Council say that to build the tramways without the widenings would be "nothing short of a public calamity."

The Merthyr Tydfil Council have appointed a Committee to approach the local tramways company with a view to acquiring the undertaking. The Borough Engineer has also been instructed to make inquiries with regard to the trolley omnibus system in Bradford and Leeds, with a view to the adoption of the system between Merthyr and some of the outlying districts.

There was a loss of £1,599 upon the Sunderland and District Electric Tramways Co. working for the past year. This makes the total debit balance £16,202. A scheme for the reorganisation of the company is in preparation.

The General Purposes Committee of the Brighton Corporation recommend the Corporation to apply for powers to instal trolley omnibuses. There has been a conference with the Hove Corporation, but the latter body are recommended by a sub-committee to provide a separate Bill for Hove.

An action of some importance to tramway undertakings will come on for hearing in the Sheriff's Court this week. The Greenock and Port Glasgow Tramways Co. are suing a firm of engineers and also a firm of contractors for compensation for damage alleged to have been caused to their tramway track in Main Street, Greenock, by the haulage of large boilers and heavy machinery over the roadway. The tramway company seek to have the conveyance of such loads over their tramway tracks prohibited. It is expected that the hearing of the action will last five days.

We refer in our "Local Notes" to a report upon electric lighting at Douglas (I.o.M.) by Messrs. Handcock & Dykes. In reference to the conversion of the tramways to electric traction, they recommend the Council to take no action until the electric supply scheme has been carried out.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The "loaded" telephone cable between England and France (described in Electrical Engineering of March 17th and December 22nd, 1910) has been employed for interesting tests made during the past few days, in which speech trials were made between London, Geneva, and Basel by English and Continental telephone experts. Earlier trials had demonstrated that telephonic facilities would, in future, be possible between towns so far separated as Aberdeen and Paris, a distance of 800 miles. In the present trials connections were established between London and Geneva (560 miles), *viâ* Paris and Lyons, and between London and Basel *viâ* Paris and Belfort, and in each instance satisfactory commercial conversation was obtained. We are officially informed that the results of the test calls are such that a telephonic service between subscribers in inner London and in Geneva and Basel will be inaugurated when the necessary arrangements between the two Administrations are completed.

Wireless telegraph regulations issued by the Australian Government provide for general licences at a cost of five shillings each for ships registered in Australia, and one guinea for experimental licences. No ship's wireless apparatus may be worked without permission while the ship is in any harbour or any territory of the Commonwealth. Any apparatus, including experimental, may be taken possession of and used in the King's service, and a censorship may also be exercised over messages sent from any apparatus, and it is provided that reasonable compensation will be paid for any damage done in the exercise of these powers.

It is announced that the Marconi's Wireless Telegraph Co., Ltd., and the Lodge-Muirhead Syndicate, Ltd., have arrived at a settlement of their difference with regard to patents, which will put an end to the threatened litigation between the two companies. The Marconi Wireless Telegraph Co., Ltd., are to take over all the Lodge-Muirhead patents and Sir Oliver Lodge will, in future, be associated with the Marconi Co., and act as scientific adviser. We are officially informed that the Marconi Co. have actually issued a writ against Messrs. Siemens Bros. & Co., Ltd., for infringement of their patents. Messrs. Siemens Bros. & Co. are, of course, owners of the British patents of the Telefunken system. A letter from Messrs. Siemens Bros. & Co., Ltd., in reference to this appears in our correspondence columns.

The question of the payment of local rates by the Government after the acquisition of the National Telephone Company's undertaking was discussed at the autumn meeting of the Association of Municipal Corporations in London on Saturday. The Town Clerk of Sheffield, who seconded a motion requesting the Government to continue these local rates or pay an equivalent contribution, said that any change in the present system would mean a loss of £4,000 a year to Sheffield. The Earl of Derby (a former Postmaster-

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General) said he had a fellow feeling with the Postmaster-General in this matter, for on one side there were the Corporations asking for some assessments, and on the other the general public demanding cheaper subscriptions. The resolution was carried, and a deputation is to be appointed to wait upon the Postmaster-General.

It is reported in the *Electrical Review and Western Electrician, Chicago*, that the Saskatchewan Government is taking over the telephone system of Saskatoon, Canada, which it will convert to an automatic system.

It is stated that the Spanish Government have decided to carry on inland wireless telegraphy, as a part of the general telegraph business of the country.

The dispute between the Hythe Council and the National Telephone Co. concerning overhead wires, referred to in our issues for October 12th and 19th, is not yet settled. It appears that the Postmaster-General, in informing the Council that they would place the wires underground after they had taken over the National Telephone Company's system, recommend the Council to give the company notice to remove the poles on December 27th. The company object to this treatment, and expressed their intention of removing the wires forthwith. Up to 9 a.m. yesterday, however, no subscribers had yet been disconnected.

Recent information concerning telegraphs and cables appears to centre chiefly around the arena of war. Thus the Italian Administration only accepts telegrams for Tripoli in plain language at sender's risk. Brief telegrams in code, not exceeding 25 words, are accepted in exceptional cases if transmitted *viâ* Italy, and the codes are produced, one to be available in Tripoli and one in Rome.—The wireless coast station at Karlskrona in Sweden will be temporarily closed as from the 1st November.—The Indo-European Telegraph Company had its lines down between Tiflis and Tabriz for a short while on the 23rd inst.—The Chinese Administration does not accept telegrams for the interior of China, excepting at sender's risk. Communication with Hankow is, of course, down.—It is not possible at present to obtain definite information concerning the new cable being laid by the Italian Government between Sicily and Tripoli.

At the first meeting of the new session of the Institution of Post Office Engineers last week, Major W. A. J. O'Meara, C.M.G., Engineer-in-Chief to the Post Office, delivered a short address. He extended on behalf of the Institution a cordial welcome to members of the National Telephone Company's engineering staff who might desire to join the Institution at the end of the year, and equally cordially invited offers of papers from them. He next referred to Sir William Ramsay's indictment of British methods in technical education, as expressed in his presidential address to the British Association. He endorsed Sir William's opinion that a fallacious idea prevails that the functions of an engineer correspond to those of a foreman; he believed that a great amount of injury was being done by "quack" engineers, and considered that there should be some system of registration before a young man was admitted to practise as an engineer. He admitted that there was a difference of opinion as to the value to be placed on a scientific degree, and suggested that, in substitution for the present requirements for a degree, some means should be found for marking down a man's qualifications in such a way as to indicate his ability to apply his theoretical knowledge effectively in an organisation in which human beings, and not the materials used, constitute the factor of prime importance. In the meantime, however, he thought that the degree must be accepted as an indication of certain scholastic attainments, and that the employer himself must assess the value of the personal and practical qualities of each aspirant engineer.

Major O'Meara then read an English translation of the French Paper on Multiple Telegraphy, which he had read before the International Congress of Applied Electricity in Turin last month. The Paper reviewed no less than eleven systems of multiple telegraphy. The author first summarised the recent improvements in the Morse quadruplex, and then dealt with the Mercadier system, which although used to some extent abroad, had not been adopted here, owing to its occasioning serious disturbances in neighbouring telephone circuits (described by some telephone users as resembling the singing of a number of birds). The disturbing effect on telephone circuits has also prevented the Phonopore system from being adopted by the British Telegraph Administration. The Picard system is used in France to operate Hughes apparatus in the ordinary way on one channel, and to operate a second Hughes channel by rapidly alternating currents. In Great Britain, however, the Hughes system is confined to a few long underground cables on which it is worked duplex, or for international circuits which would not be suitable for carrying the second channel. The Delany system was next dealt with. As is well known, this system worked successfully for many years on several circuits in England, but it had to be abandoned because of the more or less imperfect character of the signals, which increased as it became necessary gradually to increase the length of the underground sections in the important trunk lines. An improvement in the Delany system due to S. A. Pollock also worked very well indeed for a time, but was eventually discontinued on account of the difficulty in maintaining a sufficiently accurate balance (for the speed required) on aerial lines in the variable climate of England, and because the other lines working between the two towns where this apparatus was fixed were not suitable for the high duplex speed necessary, on account of the long sections of gutta-percha-covered wire included in them. After briefly mentioning the Meyer system, Major O'Meara dealt at some length with the Baudot system, of which apparently he is much in favour.

This is largely used in France. On the London-Paris-Zurich-Marseilles circuit London works two channels to Marseilles and two channels to Zurich, while Paris also works two channels to Zurich, and there have been fewer stoppages between London and Zurich since this arrangement was installed than when a simplex Hughes was being worked between these two towns. The Paris-Algiers communication works over one wire from Paris to Marseilles, and three submarine cables, each about 800 km. long, between Paris and Algiers. Four channels are worked between Paris and Algiers (three in one direction, and one in the other as required), while Marseilles works two channels with Algiers, one in each direction. The author expressed his surprise that the Baudot invention, which is actually about thirty years old, had taken so long a time in finding appreciation outside the country of the inventor. Its use is, however, now rapidly spreading; Russia has installed seventy-five sets during the last five years, and British India thirty sets during the same period. In Great Britain, however, traffic conditions have been somewhat different owing to the very cheap newspaper tariff rate. The Wheatstone automatic still holds the field for this class of work, but the use of the Baudot is likely to be extended for ordinary messages. Twelve quadruple sets have already been installed, and provision has been made for installing the equivalent of at least ten more during the next twelve months. A sextuple duplex is proposed between London and Birmingham, and if this is successful, as it is expected it will be, the Baudot system will be proved to be the most expeditious machine printing telegraph system for dealing with large volumes of traffic.

The Donald Murray multiplex is an advance on the Baudot in point of speed, and aims at a great saving in labour from the adoption of page printing. It remains to be seen, however, said Major O'Meara, whether on aerial lines subject to occasional interruptions any real advantage will accrue from reception in this form. An experimental installation of a double duplex has been erected, giving four channels working at a total speed of 160 works per minute (80 in each direction).

The Munier method of arranging the Hughes instrument for multiple working, and the Rowland system, which was given an extended trial in America, but ultimately abandoned, were finally commented on.

In his concluding remarks Major O'Meara compared the utility of multiple systems with that of high-speed Wheatstone automatic. He pointed out that except for newspaper work there was a disadvantage in transmitting a continuous system of signals by the Wheatstone automatic, as repetitions or verifications occasioned considerable delay, while with a multiplex the message is dealt with immediately it is received, and corrections, &c., can be given immediately they are asked for. He admitted that opinions are still divided on the subject of reception on tape, as compared with reception in page form, but thought it probable that future developments in printing telegraphs must follow the lead of the Baudot principle, on account of the great saving of line time and the simplicity in mechanical details.

Glasgow Students' Section of the Institution of Electrical Engineers.—At the opening meeting on Friday last, Mr. W. W. Lackie, Chief Electrical Engineer to the Glasgow Corporation, delivered his inaugural address as chairman, dealing with the training of engineers. He favoured the system in which the student went direct from school to college and finished his technical training before serving any part of the apprenticeship, and considered that this arrangement has many advantages over the workshop training being taken along with evening classes during the winter months, or day classes being taken in the winter and workshop training in the summer.

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LOCAL NOTES

Birmingham: *New Power Station.*—The Corporation have authorised the raising of £500,000 in connection with the new power station.

Brentford: *Electric Supply.*—The Brentford Electric Supply Co. have entered into an agreement with the Metropolitan Electric Supply Co., Ltd., for a bulk supply, and are now in a position to deal with all applications for a supply of electricity in the Brentford district. A large number of important contracts have already been secured. The Metropolitan Electric Supply Co.'s local office and show room is at 3 The Broadway, Hanwell, W.

Brighton: *Meter Rents.*—Mr. J. Christie, Borough Electrical Engineer, has again submitted to the Electricity Committee his views in favour of the abolition of meter rents. It is estimated that the immediate loss of revenue would amount to about £1,200 per annum, but the Committee, who in August recommended the Council to adopt this course, except in the case of consumers upon the maximum demand system, now ask that this recommendation be rescinded.

Extension of Supply Area.—The Corporation propose to apply next session for authority to supply electricity in Portslade, Southwick, and Shoreham.

Bury: *New Power Station.*—There is to be a formal opening of the new Chamber Hall power station in a few weeks time.

Dawlish: *Street Lighting.*—A competitive experiment with street lighting is being carried out by the Council, a number of electric and gas lamps having been erected in the main thoroughfare.

Doncaster: *Electric Supply.*—A deputation from the Corporation attended at a recent meeting of the Wheatley Urban District Council, and discussed the question of a supply of electricity being given from the Doncaster mains.

Douglas (Isle of Man): *An Electricity Scheme.*—Messrs. Handcock & Dykes have prepared an electric lighting scheme for the Corporation. The estimated cost is put at £20,889, or £24,789 with certain additional items for extra mains, services, &c., in order to provide for the development of the undertaking.

Dublin: *Electrical Exhibition.*—The Electricity Supply Committee have organised an Electrical Exhibition of apparatus and fittings relating to the use of electricity for lighting, heating, cooking, and power purposes, which will be held at the Mansion House from the 30th October to the 4th November. The Exhibition will be confined exclusively to manufacturers, and the exhibitors have agreed that no goods shall be sold in any section. Several gentlemen have accepted the invitation of the Committee to deliver short addresses in the evenings. On Monday, October 30th, Mr. Richard Cronin, Chief Locomotive Engineer of the Dublin and South-Eastern Railway, will lecture on "Electricity in Home Decoration"; on Wednesday, Dr. Maurice Hayes, on "Electricity in Medicine and Surgery"; on Thursday, Mr. Ramsay MacNab on "Electricity and Insurance"; on Friday, Mr. R. Borlase Matthews, on "Electric Cooking and Power in the Home"; and on Saturday, Mr. Borlase Matthews on "The Comforts of Electric Lighting and Heating."

Great Harwood: *Electric Supply.*—The electric supply scheme prepared by Mr. J. W. Speight has advanced a stage further. A Committee has been appointed to deal with the matter, and two Councillors are to visit Penrith for the purpose of making observations, where a similar scheme to that proposed is in operation.

Grimsby: *Electric Supply Profits.*—The sum of £1,000 is to be handed from the profits of the electricity undertaking to relief of rates.

Hull: *Electrical Trades Union.*—It has been decided to form a branch of the Electrical Trades Union in Hull.

London: *L.C.C.: Greenwich Turbo-Generators.*—The maintenance period of twelve months in connection with the two 5,000 kw. Zoelly steam turbo-generators, supplied by the British Westinghouse Co., has now expired, and although the whole of the spare parts and sundry material ordered as extras have not yet been delivered, the Highways Committee recommend the Council to pay to the British Westinghouse Co. part of the retention money due under the contract. The remainder is to be paid when all the spare parts, &c., have been delivered.

Bethnal Green: Electricity Supply.—The Borough Council have decided to engage Mr. J. F. C. Snell at a fee of 200 guineas to prepare a scheme for the supply of electricity.

Selby: *Electric Lighting.*—The Council have expressed their intention of opposing an application by a company for an electric lighting provisional order.

Swanage: *Electric Supply.*—The Swanage Electric Supply Co. have obtained an extension of time within which to put their electric lighting order into force. The Board of Trade have intimated to the company that if substantial progress is not made by June next year, the order will be revoked without further notice.

Uruguay: *Electric Power Supply.*—It is stated that the Government are putting forward proposals for increasing the use of electric power throughout the country.

Wharfedale: *Electric Supply.*—The Council have decided to oppose an application by the Ilkley District Council for an electric lighting provisional order.

Wimbledon: *Supply in Maldens and Coombe.*—Last week witnessed the inauguration of electric supply in Maldens and Coombe by the Wimbledon Council. The supply has been installed within twenty-five days of obtaining the provisional order. The work includes the laying of 7,000 yards of extra high-tension cable, 2,000 yards of high-tension cable, and 3,000 yards of low-tension cable.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Blackpool.—The Electrical Engineer and Tramway Manager has submitted a report with regard to extensions at the electricity works. He recommends application being made to the Local Government Board for £12,000. The new plant includes an additional generating set.

Bradford.—The Electricity Committee propose to lay new cables along Cleckheaton Road, together with a transformer chamber, at an estimated cost of £1,935.

Canada.—The *Board of Trade Journal* states that the Lethbrige Municipality invite tenders for the supply and erection of boilers, economisers, turbo-generator, condenser, and sub-station equipment. Tenders to G. W. Robinson, Secretary and Treasurer, Lethbridge, Alberta, by November 24th.

Donaghadee.—The Town Council have decided to proceed with an electric supply scheme, for which a provisional order has already been granted.

Erith.—The Council have decided to apply to the Local Government Board for sanction to borrow £7,671 for expenditure upon the electricity undertaking during the next three years.

Grimsby.—Additional generating plant is to be installed at a cost of £900.

London: *Battersea.*—Mains extensions in connection with the requirements of the London & South Western Railway Co. are to be carried out at an estimated cost of £588.

Hammersmith.—The Finance Committee of the London County Council recommend a loan of £15,000, repayable in eight years, chiefly for mains extensions in connection with the conversion of all street lamps to electric lighting.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Bradford.—Spindle works in Mount Street. Architect, T. Riley, Lidget Green.

Croydon.—Ten houses, Silverleigh Road. Drake Bros., Shirley.—Five houses, Elmgrove Road. R. C. Palmer, Sherwood Road.

Dublin.—Cycle factory at Pleasants Street. Architect, T. J. Cullen, 25 Suffolk Street.

Edinburgh.—New training college at St. John Street.—Administration block at the Royal Scottish Museum. Drawings, &c., may be seen at H.M. Office of Works, 2 Parliament Street, Edinburgh.

Tenders are invited for an electric lighting, heating and power installation at the College of Art for the Corporation. Particulars from the City Electrical Engineer.

London.—It is stated that a new concert hall, at an estimated cost of £85,000, is to be erected on a site close to Piccadilly Circus.

Manchester.—Laundry at Withington Workhouse. Architect, F. H. Overmann, 48 King Street.

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Rochester.—New post office. H.M. Office of Works, London.

Romford.—The Board of Guardians are considering the question of electrically lighting the workhouse.

Sidcup.—Tenders are invited for a street fire alarm system. Particulars from the Engineer and Surveyor, Council Offices.

MISCELLANEOUS

Bermuda.—The *Board of Trade Journal* states that it is proposed to construct an electric tramway in Bermuda. Either a local company or the Government will carry out the work.

Eccles.—A Local Government Board inquiry was held last week concerning a loan of £666 for street lighting.

Italy.—Tenders are invited by October 30th for the supply of electric lamps and fittings. Particulars from Generale dei Servizi Amministrativi, Ministero della Marina, Rome.

Montevideo.—The *Board of Trade Journal* states that the Port Authorities require 13 electric cranes. Further particulars at 73 Basinghall Street, where a list of agents established in Montevideo can be obtained, as local representation is necessary.

Rawtenstall.—Application is to be made for sanction to borrow £3,059 for tramway electrical equipment, and £1,608 for rolling stock.

TENDERS RECEIVED AND ACCEPTED

Accrington.—The tender of Messrs. Ferranti, Ltd., for switchgear in connection with the high-tension supply to Globe Works at £143 has been accepted. The tender of the British Westinghouse Co., Ltd., for a 300-k.v.a. three-phase transformer at £180 has also been accepted.

Belfast.—The tender for switchboard extensions of Mr. Bertram Thomas, at £154, has been accepted.

Blackburn.—The tender of Mr. F. L. Yates has been accepted for the electric lighting of the sub-police station.

London: *L.C.C.*—The following tenders have been received for the electric lighting of the Great College Street School:—Saville & Walton, £340; G. Weston & Sons, Ltd., £395; T. H. Smerdon, £412; Johnson & Phillips, Ltd., £455; Tredegar & Co., £465; Williams & Bach, £484; Waring & Withers, £496 13s.; E. Lawrence & Sons, Ltd., £528; The Fleet Electrical Co., £566 17s. The tender of Messrs. G. Weston & Sons has been accepted. In connection with this contract, the Education Committee had previously accepted, during the vacation, a tender by Messrs. Saville & Walton at £340. They report that this firm, after delivering the material and having their men on the job, withdrew them, stating that they did not intend to proceed with the contract. In consequence it is recommended that the name of this firm be entered on the list of persons and firms from whom the Council will not accept tenders.

The tender of Messrs. Pinching & Walton has been accepted for the electric wiring and fitting of the new testing ground at the chief fire brigade station at £55. An offer by the same firm to carry out the wiring and fitting of the East and North-east blocks at the chief fire brigade station at £235 has also been accepted.

The Highways Committee have accepted the tender of the Electrical Co., Ltd., for the supply of meters for use at the central car-repairing depôt at £389 12s.

The British Westinghouse Electric and Manufacturing Co., Ltd., has sent us a list of orders recently received. Among the more important are the following:—War Office, for Gibraltar: one 20, one 15, one 12, three 10, and two 7 h.p. motors; Gold Coast Machinery & Trading Co., Ltd.: two 70, and three 15 h.p., 200 volt, two-phase, 50 per. A.C. motors and control gear; Huddersfield Corporation: transformers and switchgear; Baroda State Railway: transformers and switchgear; Rhymney Iron Co.: transformers; Greenock Corporation: two 500 kw. rotaries, transformers, switchgear, &c.; Staveley C. and I. Co.: one 400 kva. transformer and six type "S" pillars; Bury Corporation: transformers; Bradford Corporation: transformers; Tennant & Barrs: one electric winder; Stothert & Pitt for Bristol Docks: equipment for nine two-ton electric cranes for Avonmouth, nine 40, nine 12, nine 6 h.p. 500 volts motors, control gear and spares; Rochdale Tramways: eleven brake equipments; Brush Co., for Rochdale Tramways: twenty-four controllers; Babcock & Wilcox: one 400 kw. rotary converter and switchgear; East Indian Railway: one 325 kw. A.C. generator, exciter, switchgear, &c.; Noyes Bros., Sydney, for Dunedin: six car equipments.

OSRAM·LAMPS

APPOINTMENTS AND PERSONAL NOTES

Visitors to the Electrical Exhibition will have noticed a very handsome electrically-driven grandfather's clock on the stand of Messrs. Drake & Gorham, and we understand that many of the admirers had marked out places in their halls where they could place such an article. We are glad to be able to congratulate Mr. Fowler, of Chelsea, on the acquisition of this prize.

Mr. C. C. Fowler, Assistant Manager of the Brighton Electricity Department, has resigned his position on having received an appointment in India. Mr. Fowler, who has been nineteen years with the Corporation, has been permitted by the Committee to terminate his appointment on November 7th, instead of giving three months' notice, and that he be granted leave of absence until Christmas, his resignation taking effect from that date. It is not without interest to recall that early this month the Brighton Corporation refused to adopt a recommendation of the Electricity Committee to increase Mr. Fowler's salary from £350 to £400 per annum.

In consequence of the death of Mr. S. R. Clarke, Mains Assistant in the Battersea Electricity Department, the Electricity Committee recommend that Mr. W. T. Magrath, at present draughtsman, be appointed Mains Assistant on probation until December next. A draughtsman for temporary work is to be advertised for at a wage of 35s. per week.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £57 15s. to £58 5s. (last week, £57 to £57 5s.).

Plania Carbons.—The Electrical Co., Ltd. (122-124 Charing Cross Road, W.C.), have now the sole agency for the United Kingdom for these carbons, formerly held by H. G. Mayer & Co. Large stocks are kept, and Mr. W. G. Mayer has joined the firm to take over the management of this department.

Sunshine Flame Arc Lamps.—The Electrical Co., Ltd. (122-124 Charing Cross Road), ask us to publish the following:—"The rumour has got abroad that direct-current Sunshine Flame Arc Lamps have infringed patents, and cannot be sold. This is not the case. An arrangement has been entered into with the owners of the master patent, and Sunshine Flame Arc Lamps are now sold under royalty, and do not infringe any patents. The list prices will remain the same as formerly. Forms of indemnity will be given whenever required. Alternating-current Sunshine Lamps are not affected by patents in any way.

B.T.-H. New London Offices.—In order to deal with their increasing business in Mazda lamps, the British Thomson-Houston Co., Ltd., have opened new premises at 77 Upper Thames Street, London, E.C., as a sales and advertising department. The telephone number is 5561 Bank.

Canadian Agency.—A Lancashire firm of stage electrical accessories manufacturers is desirous of getting into touch with Canadian firms. Further particulars from 17 Victoria Street, S.W.

Bastian Heaters at the Exhibition.—We are pleased to hear that the Bastian Electric Heating Syndicate, Ltd., had a very great rush of business during the Exhibition period for their A and F type heaters. The record "catch" was 219 heaters in one day. Every effort is being made to increase the firm's output in order to give as prompt delivery as possible.

Turin Exhibition Awards.—Among the awards accorded to British exhibitors at the Turin Exhibition, 1911, are the following:—Synchronome Co., Ltd., *Diploma of Honour;* Babcock and Wilcox, Ltd., Campbell Gas Engine Co., Ltd., National Gas Engine Co., Ltd., and Hans Renold, Ltd., *Grand Prix* for steam plant, &c. The Westinghouse Electric and Manufacturing Co., Ltd., A Reyrolle & Co., Ltd., and Morgan Crucible Co., *Grand Prix;* Muirhead & Co., *Diploma of Honour;* Crypto Electrical Co., Lancashire Dynamo & Motor Co., Ltd., Ozonair, Ltd., and Venner Time Switches, Ltd., *Gold Medal* for electrical generating and distributing plant. Heath & Son, Ltd., *Gold Medal,* and Venner Time Switches, Ltd., *Silver Medal,* for electric lighting. Cambridge Scientific Instrument Co., *Hors Concours,*

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and Marconi's Wireless Telegraph Co., Ltd., *Grand Prix*, for telegraphy. Cambridge Scientific Instrument Co., *Hors Concours*. Nalder Bros. & Thompson, Ltd., R. W. Paul, *Grand Prix*, and The Reason Manufacturing Co., Ltd., *Gold Medal* for electrical measuring instruments. Ozonair, Ltd., also received *Grand Prix* and *Diplomas of Honour* in a number of other sections.

Reductions in Prices of Metal Filament Lamps.—In the article on this subject on page 568 of last week's ELECTRICAL ENGINEERING, the reduced price of the 200–250-volt 55-watt drawn tungsten "onewatt" lamps was given as 3s. 3d. This price should have referred to the round bulb pattern, the reduced price for the pear-shaped bulb being 3s.

Meter Approved.—The Board of Trade have approved of the Alva single-phase meter, type C.A., deposited by Messrs. Gillespie & Beales, Amberley House, Norfolk Street, Strand, W.C.

The Bremer Arc Lamp Patents.—In the Court of Appeal on Tuesday, it was asked that the appeal of the Electrical Co., Ltd., against the judgment of Mr. Justice Swinfen Eady, who held that the "Sunshine" lamp infringed the Bremer patent, might stand over. It was explained that there were good prospects of the parties coming to an agreement. We reported the case in ELECTRICAL ENGINEERING, May 4th, p. 235, and June 22nd, p. 348.

Scottish Local Section of the I.E.E.—The 1911–12 session of the Scottish Local Section of the Institution of Electrical Engineers begins on Nov. 14th, and meetings will be held as usual on the second Tuesday in every month until May. The Annual Dinner will be held at the "Grosvenor," Gordon Street, on Tuesday, Dec. 12th, and applications for tickets should be made to Mr. J. Sayers, Honorary Secretary, 190 West George Street, Glasgow.

The Institution of Electrical Engineers.—The opening meeting of the coming session of the Institution of Electrical Engineers will be held on Thursday, November 9th, at 8 p.m. Contrary to the usual custom there will be no Presidential Address, Mr. S. Z. de Ferranti occupying the Presidential Chair for the second year in succession, and after the presentation of premiums and awards for last session, the following Paper will be read and discussed:—"Modern High Voltage Power Transformers in practice, with special reference to a 'T' Three Unit System," by W. T. Taylor.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

General Electric Co. of Madrid.—This company has been obliged to make arrangements with its creditors, and bond-holders are invited to put themselves into communication with the French Corporation of Foreign Bond-Holders, 5 Rue Gaillon, Paris, with a view to the formation of a bond-holders' defence committee. The position of the company is attributed to the competition of new undertakings.

Northampton Electric Light & Power Co.—The directors recently offered to the shareholders 13,346 £1 shares at a premium of 1s. In response to this invitation, applications have been received for a total of 23,138 shares.

British Thomson-Houston Co.—At the annual meeting last week, it was stated that whilst the various departments of the company are as full of work as they can be, and the value of the orders from March 3rd to date very largely in excess of those for the corresponding period of the previous year, the percentage of profit still remains low, competition being as keen as ever. Owing to the increasing business with Mazda lamps, new London premises in Upper Thames Street have been opened.

Ferranti.—Mr. A. W. Tait, who presided at the annual meeting on Friday, said that the development of the business was not being confined to any one department. Present indications were that the accounts of the current year would be quite as good as those just presented. The company has now exhausted its borrowing powers, and the board propose to increase them by another £50,000.

Callender's Cable & Construction Co.—An interim dividend at the rate of 10 per cent. per annum less tax is declared upon the ordinary shares.

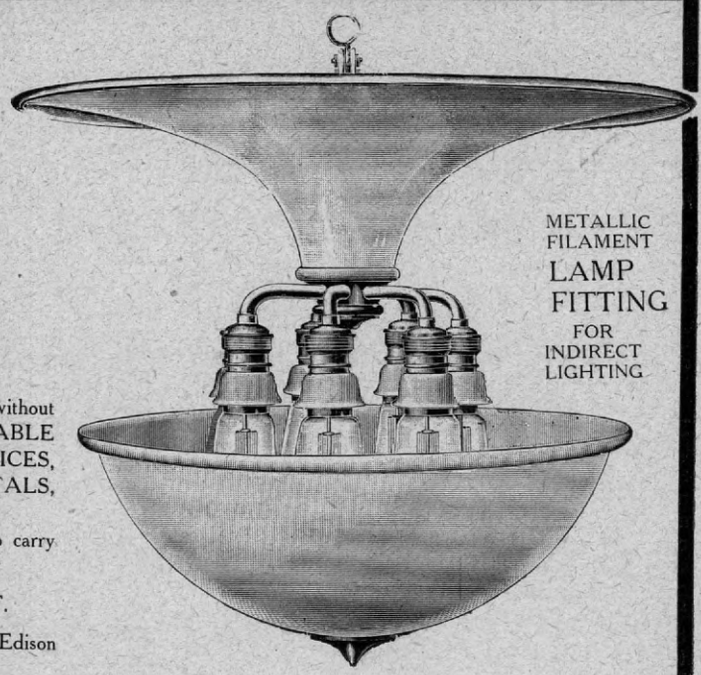
The Edison & Swan United Electric Light Co.—There was a net profit of £19,013 for the year to June 30th, to which is added £6,843 from the previous year, making a total of £25,856. Of this amount the directors propose to place £17,500 to reserve, carrying forward the balance. The report states that, since the close of the financial year on June 30th, the trading shows satisfactory progress.

The "Cole" Code.—Under the heading of "New Publications," on page 564 of our issue for Oct. 12th, we noticed the "Cole" Code, which was priced at 10s. net. We are now informed by the compiler that he has raised the price to 15s. net.

The Electrical Standardising, Testing, and Training Institution.—Mr. R. J. Wallis-Jones begins a series of demonstrations on electric welding and allied processes to the senior students of Faraday House on November 8th.

Telegrams:
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SUMMARY

Our Monthly Supplement on Electrical Engineering in Mines is given in this issue. It opens with some notes on the electric power plant of a group of shale mines and oil works in Scotland, and contains a long article describing the electrical equipment of the Rhymney Valley collieries of the Powell Duffryn Steam Coal Co., which include generating plant driven by coke oven gas and exhaust steam, as well as two of the largest electric winding plants in the world at a colliery which is entirely without boilers. Reports are given of the annual meeting of the Association of Mining Electrical Engineers, and several branch meetings. Other articles include some notes on Electricity in Mines in Scotland, and a discussion on the avoidance of electrical accidents in mines.

A meeting of the Institution of Electrical Engineers this afternoon will have proposals placed before it for admitting as "Licentiates" men who do not possess sufficient qualifications to be Associate Members, for altering the method of election of Council, and other important changes in the Articles of Association. There will be opposition. (Page 593.)

A new motor-car lighting dynamo and regulator is described on page 594.

An Electrical Exhibition was opened at the Brighton Aquarium on Saturday last. A strong feature is being made of electric cooking, in the hope that with the reduced charge of 1d. per unit the demand for energy for this purpose will be greatly increased. (Page 594.)

An illustrated article calls attention to a new circuit-breaker. (Page 594.)

Mr. Cramp's inaugural address to the Manchester Local Section of the Institution of Electrical Engineers dealt with education. (Page 595.)

An electrically-driven transporter bridge was opened at Middlesbrough during last month. (Page 595.)

A correspondent calls attention to the coming into effect in India next year of a new Patent Act. (Page 595.)

Messrs. Waring and Gillow are giving a series of demonstrations in electric cooking in one of their departments, where a very representative collection of other heating apparatus is to be seen, as well as some very finely decorated dining-tables, which are arranged in adjoining rooms. (Page 596.)

In our Electric Traction Notes, we mention that the difficulties between the board of the British Electric Traction Co. and some of the shareholders as to the capital re-organisation have been overcome. The London County Council are applying to Parliament for powers to run trailer cars, owing to opposition by the Commissioner of Police. The arbitration award as to the price for tramway energy at Paisley has not been found satisfactory. The Brighton Corporation have decided in favour of adopting trolley omnibuses. Arbitration has been resorted to as to the price to be paid for electrical energy in Gravesend. (Page 597.)

Further long "loaded" telephone cables are to be laid. Telephone users in Jersey want the Government of the island to purchase the telephone system from the Post Office when it passes from the hands of the National Telephone Co. at the end of the year. Under Telephony and Telegraphy (including Wireless) we also give some details of the proposed Imperial scheme of wireless telegraphy, and mention an application to the High Courts in connection with the Hythe telephone dispute, and a scheme for connecting France by wireless telegraphy with all her colonies. (Page 597.)

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IMPROVEMENTS in brush-holders to secure even pressure, and to eliminate sparking, by the provision of a resilient spring at the top of the brush, are described among the Specifications published at the Patent Office last week, as well as a simplified arrangement for rapidly connecting up train-lighting and similar dynamos. Specifications for sintering partly decarbonised metal filaments, and a new type of easily renewable fuse, are also published. H. Hunte has been successful with his appeal against the Comptroller's decision in connection with a patent for a dry cell. Two patents expire during the coming week, after a full term of fourteen years; one relates to a carbon electrode, and the other to an insulator for supporting telephone and telegraph wires. (Page 598.)

ONE of the cooling-towers now being erected at the Edinburgh Electricity Works was partially destroyed by fire last week.—The Heckmondwike Council have decided to take a supply in bulk from the Yorkshire Electric Power Co., and not to extend its plant.—An experiment in lighting small houses by electricity at Eccles at a charge of 6d. per week per house is said to have been quite satisfactory.—The Leigh (Lancs) Corporation are recommended to adopt a similar scheme.—The accounts of the four electricity works now included in the County Borough of Stoke-on-Trent show satisfactory increases all round. (Page 599.)

THREE 5,000-kw. turbo-alternators and 12 boilers are to be installed at the West Ham Electricity Works. Loans of £3,000 and £2,000 for mains at Bridlington and Hastings respectively are to be applied for. The Bradford Corporation propose an expenditure of £16,940, Salford £35,000, and Fulham £9,500 for electrical extensions. Mains are required at Stretford, submarine cable in Tasmania, an automatic electric lift at Newport (Mon.), and an electric light installation at the Heywood and Middleton Water Board offices. (Page 600.)

ARRANGEMENTS FOR THE WEEK

TO-DAY (THURSDAY), NOVEMBER 2ND.

Institution of Electrical Engineers.

4.30 p.m. Extraordinary General Meeting to consider proposed alterations in Articles of Association.

FRIDAY, NOVEMBER 3RD.

Northampton Institute Engineering Society.

5.45 p.m. At the Institute. "Diesel Engines," by T. R. Houston and F. G. Parnell.

Batti-Wallahs' Society.

7.45 p.m. Smoking Concert, Holborn Restaurant.

SATURDAY, NOVEMBER 4TH.

Junior Institution of Engineers.

7 p.m. Reception by the President, Sir J. J. Thomson, F.R.S., and Lady Thomson.

TUESDAY, NOVEMBER 7TH.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "The Mechanical Design of Direct-current Turbo-Generators," by R. Roberts.

Institution of Civil Engineers.

8 p.m. Presidential Address by Dr. W. C. Unwin, and presentation of medals and prizes.

Röntgen Society.

8.15 p.m. At Institution of Electrical Engineers. Presidential Address by Mr. A. A. Campbell Swinton.

WEDNESDAY, NOVEMBER 8TH.

Faraday Society.

8 p.m. Special Meeting at Institution of Electrical Engineers, when Dr. E. G. Acheson, of Niagara Falls, will give an account of his researches. [Non-members will be admitted by ticket, to be obtained from the Secretary, 82 Victoria Street, S.W.]

THURSDAY, NOVEMBER 9TH.

British Electrical and Allied Manufacturers' Association.

2.30 p.m. Council Meeting at 36 Kingsway, W.C.

Institution of Electrical Engineers.

8 p.m. Presentation of Premiums. "Modern High-voltage Power Transformers in Practice, with Special Reference to a 'T' Three-unit System," by W. T. Taylor. In the absence of the author, the Paper will be read by Mr. J. F. C. Snell.

FRIDAY, NOVEMBER 10TH.

Institution of Electrical Engineers: Birmingham Section.

7 for 7.30 p.m. Annual Dinner at Grand Hotel.



[See page 593.]

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"Electrical Engineering"
November 2, 1911.

ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

ELECTRIC POWER IN SHALE MINES AND OIL WORKS

ONE of the largest and best-equipped firms in Scotland engaged in the extraction of oil from shale is the Oakbank Oil Co. One of their mines is at New Farm, near Mid-Calder, and there are two more about two miles from the Forth Bridge, at distances of $1\frac{3}{4}$ and $2\frac{1}{2}$ miles from the Niddry Castle distillation plant at Winchburgh.

The refining of the oil is carried on at Mid-Calder, whither the oil is conveyed over the seven miles from Niddry Castle by rail. There is also a small shale pit and distillation plant at these works, but they are on a much smaller scale than those at Winchburgh.

The shafts in the mines are driven through the shale itself, which is worked partly by hand, and partly by electrically-driven bar cutters. Endless rope haulages are used to remove the shale, driven by 150-h.p. Westinghouse three-phase 400-volt 50-cycle slip-ring motors, running at 285 r.p.m. A ratchet-wheel eight to ten feet in diameter is provided to prevent the trucks running back, and this is operated by a lever fitted alongside the controller. These haulages are about two and a half miles long in each case, and have tubs fixed to the rope at intervals of about 60 feet, each tub carrying about 15 cwt. The average gradient is about one in five. On reaching the surface the tubs are hauled up an incline plane to the shale breakers and hoppers, into which they are tipped by a motor-driven cradle. The breakers consist of two rolls fitted with heavy teeth, which revolve in opposite directions at a speed of about 4 r.p.m. Each of the three sets of breaker rolls is driven by a 30-h.p. squirrel-cage Westinghouse motor, running at 710 r.p.m. From the breakers the shale is dropped into bins, and is then conveyed to the distillation plant. The mines are ventilated by fans, belt-driven by 30 h.p. squirrel-cage Westinghouse motors, running at 720 r.p.m., each situated in a house of its own.

At Winchburgh the shale waggons are drawn by locomotives constructed by the Baldwin Westinghouse firm, taking current from a 500-volt trolley line. The largest locomotive has one 85-h.p. motor, whilst the two smaller ones are each fitted with two 25-h.p. motors, permanently connected in parallel. The heavy locomotive is designed for a full-load speed of twelve miles per hour, and exerts, with a 33-inch driving wheel, a tractive effort of 5,000 lbs., whilst the lighter locomotives are designed for a full-load speed of ten miles per hour, exerting a pull of 3,000 lbs. with 30-inch driving wheels. At Winchburgh the trucks are carried to the top of the retorts by an inclined endless chain haulage, driven by a 20-h.p. Westinghouse motor. The shale is there distilled, giving off oil and water vapour, the latter containing ammonia; and then, after passing through aerial condensers to liquefy oil and water vapours, an incondensible gas passes on, and is used for the heating of the retorts.

When this process is complete, and the oil has been allowed to settle, it is pumped for storage into large tanks by motor-driven turbine pumps, while the ammoniacal liquor is pumped to the recovery plant by a three-throw ram pump driven by a 5-h.p. motor, and is pumped into steaming towers. Here the ammonia gas is brought into contact with sulphuric acid, and converted into ammonium sulphate. Underneath the drying room is the packing room, in which there are two portable grinding machines driven by a 3-h.p. Westinghouse squirrel-cage motor, so arranged that sacks may be hung underneath the machine, and when filled and weighed conveyed to railway trucks by an endless belt driven by a 3-h.p. motor through Ross reducing gear.

The company's electric power station, which supplies power for all the electric plant on the works (Niddry Castle), is situated at Winchburgh, and contains four engine generator sets, two of which are made up of 200-kw. 440-volt 450-r.p.m. three-phase 25-cycle Westinghouse generators, driven by Westinghouse compound steam engines, and the other two of 500-kw. 250-r.p.m. 3,300-volt three-phase 25-cycle Westinghouse generators, coupled to Belliss & Morcom compound self-lubricating engines, the two latter sets being a recent extension. The low-pressure current is used for all local motor circuits, whilst the high-tension is transmitted to the mines, and transformed in sub-stations, of which there is one at each mine, down to 440 volts for use. It is also fed through transformers to two rotary converters, one of 100 kw. in the power station, and the other of 150 kw. in a sub-station, which convert alternating current to direct at 500 volts for use on the electric railway system. The two mine sub-stations are practically similar, each being equipped with four single-phase 250-kw. 25-cycle single-phase oil-immersed transformers, stepping down to 400/330 volts, one of which is kept as a spare. The sub-station switchgear is mounted on white marble boards, and comprises a high-tension feeder panel, and low-tension distribution panels mounted with oil-immersed circuit-breakers and the usual meters and switches.

The crude oil is taken to Mid-Calder, where it undergoes a series of refining processes which there is no need to detail here.

Steam has been entirely displaced at these works as a source of direct motive power, as all the pumping and compressing is done by electric motors of the three-phase 400-volt squirrel-cage induction type, controlled in the majority of cases by auto-starters. In connection with the refrigerating arrangements, there are two 150-h.p. slip-ring motors, driving the compressors, one of which has been in service nine years, whilst the other is a recent extension. These are controlled by drum-type controllers and drive by raw-hide pinions into machine-cut steel gears. A similar drive, though on a smaller scale, is the air-compressor for supplying the paraffin blowers, which is driven by bolts from a 40-h.p. squirrel-cage motor. There are a large number of small motors used for pumping the oil from process to process.

The company's power station at Mid-Calder contains two 200-kw. Westinghouse engine-driven sets. A new 275-kw. set has since been put down, consisting of a British Westinghouse three-phase 440-volt 25-cycle alternator, driven by a Belliss & Morcom engine. These units are controlled by a seven-panel marble switchboard. Part of this energy is stepped up to 3,300 volts for transmission to the mine, a distance of about one mile. The transmission lines are carried on the same pedestals as the aerial rope-ways, which convey the shale from the mines to Mid-Calder, and is actuated by a 60-b.h.p. squirrel-cage Westinghouse motor running at 720 r.p.m., driven by belt and bevel gear up to the main pulley wheel of the rope gear.

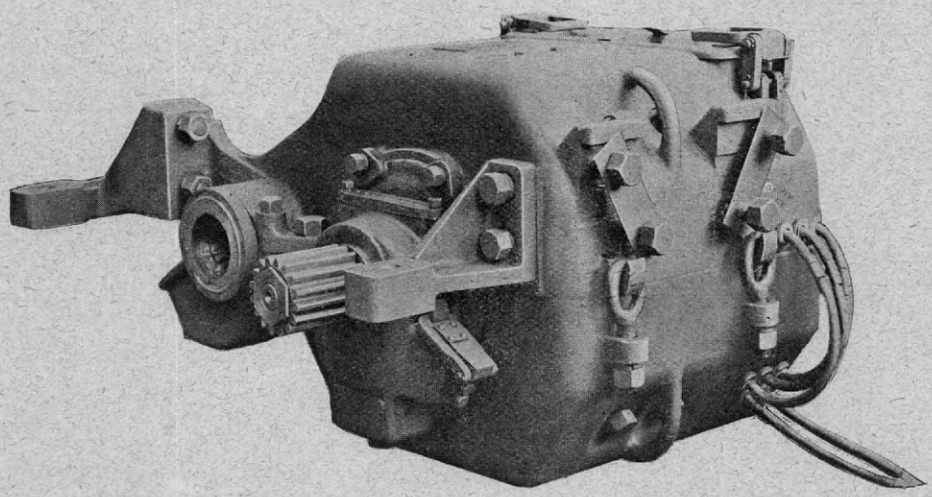
Electrical driving has been in use since 1901, and extensions have been added continuously right up to the present day.

The entire electrical equipment, both at Niddry Castle and at Mid-Calder, was supplied by the British Westinghouse Electric & Manufacturing Company, Limited, of Trafford Park, Manchester.

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THE ELECTRICAL EQUIPMENT OF THE RHYMNEY VALLEY COLLIERIES OF THE POWELL DUFFRYN STEAM COAL CO.

THE electrical equipment of the Bargoed, Britannia, and Penallta pits, which together with two others form a group of collieries united by a self-contained electrical power scheme, forms a fine example of modern methods of power generation from waste heat, and includes, at the Britannia pits now in process of sinking, a pair of the largest electric winders in the world. Indeed, this colliery is notable as being the first in South Wales, if not in Great Britain, to be so far entirely without boiler plant. The relative positions of the pits are seen in Fig. 1, which also shows the arrangement of high-tension feeders by which they are linked and the distribution of the generating plant. They only form a part of the companies' total number of collieries equipped with electric power. Another group in the adjoining Aberdare valley take power from a large generating station at Aberamman.

The working of the Bargoed colliery was commenced in 1877, and it now has an output of some 775,000 tons of coal per annum. Electric power for the use of this and other collieries of the group is generated by gas-engine driven alternators supplied by gas from a battery of 100 Köppers regenerative bye-product coke ovens, where sulphuric acid and sulphate of ammonia are produced from the impurities in the gas. The resulting gas is of a quality such that 31 cubic feet are required per kilowatt-hour on full load.

The engine-room is a fine light building, and the main generating sets consist of a pair of four-cylinder gas-engines of the four-cycle double-acting tandem type, running at 100 r.p.m., made by the Maschinenfabrik Augsburg-Nürnberg, direct coupled to 1,650-kw. flywheel A.E.G. alternator supplied by the Electrical Co., and a two-cylinder engine of the same type driving an 850-kw. alternator of the older A.E.G. external field design. They all generate current at 3,000 volts 50 cycles, at which pressure current is transmitted by overhead lines to the other collieries in the same valley. These sets were put in successively at different times, but the engines are all of exactly the same design, the older small one simply consisting of one line of cylinders instead of two, and corresponding parts are interchangeable, so that only a limited number of spares need be kept. In addition to these main sets there is a 300-h.p. Crossley gas-engine which drives a continuous current generator through ropes. The supply from this is used locally for certain continuous current motors used in connection with the screens and other surface plant, and also for lighting. Continuous current can also be obtained from another generator of the same size as that driven by the Crossley engine, which is driven by an induction motor from the 3,000-volt mains.

In view of a possible temporary shut down of the coke ovens, a 750-kw. steam-driven alternator is provided as a stand-by in a separate building, from which a certain amount of power can be obtained for emergency purposes. This is driven by a Yates & Thom horizontal cross compound engine that is not usually kept running.

The main high-tension switchgear is in a gallery overlooking the main engine-room, and the switchgear is of the A.E.G. withdrawable carriage pattern supplied by the Electrical Co. At the time of our visit the voltage regulation was being carried out by a Tirrill regulator, supplied by the British Thomson-Houston Co., with five sets of contacts in parallel connected to one of the large sets. The whole station is arranged to be run in parallel with the generating plant at the other pits described below, and we understand that later on the main regulation of the pressure will be effected by a Tirrill regulator on the 3,000-kw. turbo-generator at the Penallta colliery. The total output of the gas-engine station is from 11 to 12 million units per annum. Transformers are provided to raise the pressure to 10,000 volts for transmission to the Britannia pits.

Electric power is not used at the Bargoed pits for main shaft winding, nor for the main fans, but the main underground haulage is performed electrically, although for some of the subsidiary haulages and face conveyors compressed air has been considered more suitable. There are, however, electrically driven pumps aggregating a capacity of 60,000 gallons for hour from a depth of 1,620 ft. in the small pit, while 65,700 gallons per hour is pumped electrically in the Britannia pit. Electric motors are used for a variety of purposes on the surface, including the washing and screening plant, the workshops and for driving the rotary air-pump of the

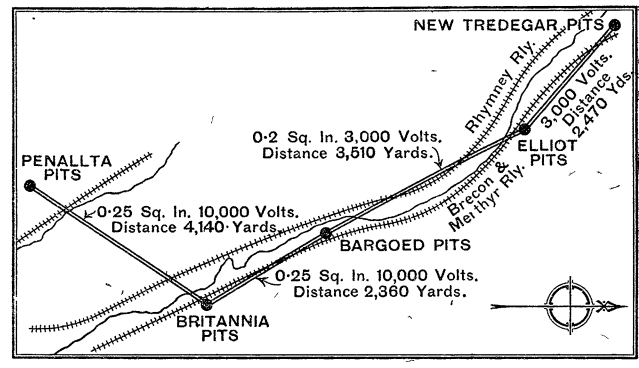


FIG. 1.—SKETCH MAP OF DISTRIBUTION SYSTEM.

Westinghouse-Leblanc condenser, into which the winding engine of the South pit exhausts.

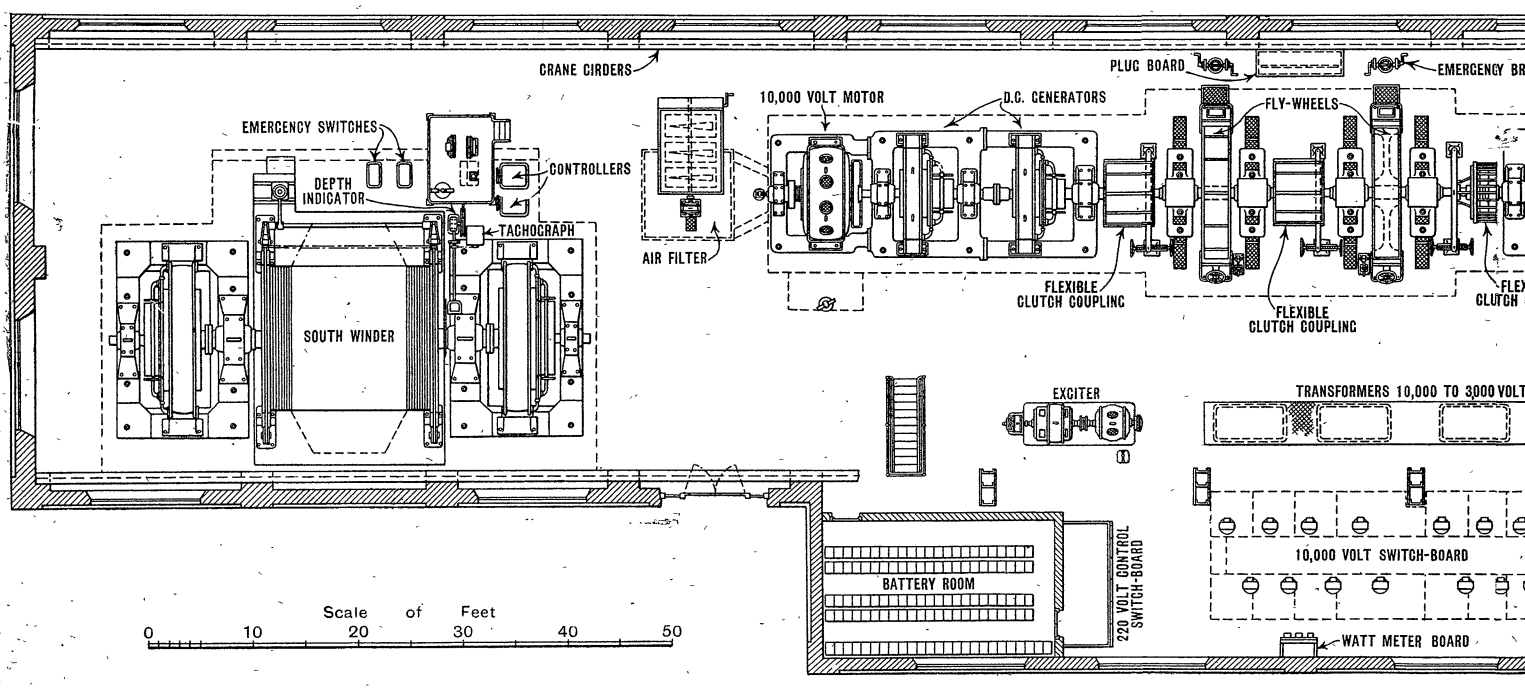
Waste heat is utilised in another form at the Penallta pits, where the principal item of the generating plant is a 3,000-kw. mixed pressure turbine, driven partly by the exhaust from the two large steam winding engines. At this colliery, which is situated in the Cylla branch of the Rhymney Valley, there are two shafts over 2,250 ft. deep, served by two Fraser & Chalmers steam winding engines, both situated in a large engine-house 300 ft. long by 70 ft. wide, containing all the machinery, including also the electric generating plant, under one roof. The original generating plant consisted of two 750-kw. A.E.G. alternators driven direct by slow-speed steam engines, and these were in use during the sinking of the shafts. Quite recently, however, the most important item of plant, a 3,000-kw. Westinghouse mixed pressure 10,000-volt turbo-alternator, has been put to work. This fine set is of the British Westinghouse Electric & Manufacturing Co.'s latest combined impulse and reaction design, and the alternator is rated at 3,000 kw., 10,000/11,000 volts, 50 cycles, at 1,500 r.p.m. three-phase. The alternator is self-ventilating, drawing air from conduits below the floor from an external intake, and expelling the warmed air from a "chimney" into the engine-room. An exact duplicate of this set is on order as a stand-by. The turbine takes the exhaust steam from all the steam plant in the engine-room, including the winding engines, which exhaust into a 36-in. main running the whole length of the building and connected to a large Rateau heat accumulator. It is anticipated that when the output of the colliery reaches 3,000 tons per day, during the coal winding shift, 1,700 kw. will be available from the exhaust steam, the balance of the 3,000 kw. being obtained by live steam. For this purpose

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new boiler plant is being put down, and a large Babcock & Wilcox land type water tube boiler, capable of evaporating 30,000 lbs. of water per hour, the large size standardised in this type, has just been added to the eight smaller units of the same make, evaporating 10,000 lbs. of water per hour each. The new boiler is interesting as being fitted with a chain grate stoker capable of burning Welsh steam coal, an arrangement involving considerable deviation from the usual arrangement of the proportions of the furnace and boiler setting on account of the less readiness of this coal to give off gas during the earlier stages of its combustion as compared with more bitumenous fuel. Messrs. Babcock & Wilcox have for some time been experimenting with a view to this useful result, and this is one of the first large boilers which has been fitted up in this way, and demonstrates the success with which the difficulties have been overcome. The older boilers will all be fitted ultimately with mechanical stokers. The new boiler is provided with a short steel chimney, and works on the ejector induced draught system, in which a small jet of air is injected by an electrically driven fan in the centre of the chimney, avoiding passage of hot gases through the fan. This arrangement forms a great contrast to the tall brick natural draught chimney-shaft belonging to the older boilers. The water before reaching the boilers is treated by a Kennicott water softener.

The turbine exhausts into a surface condenser of 15,000 sq. ft. surface, with a Leblanc rotary air-pump, which together with the circulating pump are driven by a small steam turbine. A pair of Balcke cooling towers deal with the circulating water.

The switchgear in connection with the older alternators, like that at Bargoed, is of the A.E.G. carriage type, but the new 10,000-volt switchgear for the 3,000-kw. turbo-alternator was supplied by Siemens Brothers Dynamo Works, and is of the latest pillar pattern, with all operating handles, instruments releasing coils, &c., neatly mounted on cast-iron pillars on the engine-room floor level, and the actual oil switches and all other high-tension apparatus in fire-proof cells below. One of these pillars carries the Tirrill regulator by means of which, as already stated, the main voltage regulation will eventually be carried out. The connection between the 3,000-volt and 10,000-volt systems is made by a group of eight 1,000-k.v.a. Westinghouse water-cooled transformers, and 10,000 volts is the transmission line pressure from Penallta to the Britannia pit. At Penallta electric power is used to a considerable extent for pumping, and three 350-h.p. electrically driven Sulzer pumps for a head of 1,050 feet are provided in various parts of the mine. Eight fully enclosed motors are employed in connection with the tipplers and



screens, all driving through worm gears and entirely without belts. The underground haulage is at present worked temporarily by compressed air, but will ultimately be mainly electrical.

The only other generating plant at this group of collieries is a pair of 500-kw. exhaust steam turbo-alternators, and a 750-kw. set driven by a line steam reciprocating engine at the Elliot pit.

From an electrical point of view, the most interesting of the group of collieries is the new Britannia colliery at Pengham, which is now in process of sinking, and is at present entirely without steam plant, as power is derived entirely from the Bargoed and Penallta generating plants already described, and where a pair

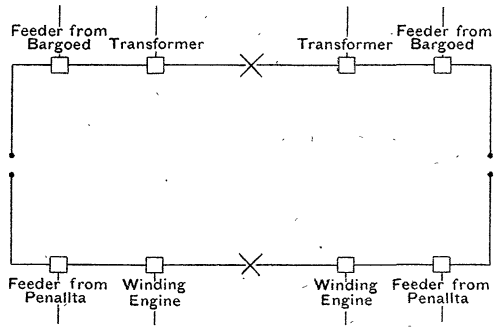


FIG. 3.—SKETCH SHOWING ARRANGEMENT OF BUS-BARS AT BRITANNIA PITS.

of the largest electric winding engines in the world are at work. As at Penallta, a prominent feature is the collection of all the machinery under one roof, but there is the important difference that the whole plant is electrical. The inclusion of winding plant in the same engine-room as other machinery is one of the points dealt with in the new Coal Mines Bill, and it is possible that if the Bill in its present form becomes law, that screens may have to be erected across the engine-room both here and at Penallta to isolate the winding engines from the rest of the plant, although it may be that in view of its quietness electrical plant may be ex-

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empted from this requirement. A plan showing the arrangement of the plant is given in Fig. 2.

The sinking of these two shafts was commenced in June, 1910, with cranes, but when a depth of 185 feet was reached a pause was made till the completion of the electric winding plant, but sinking operations have

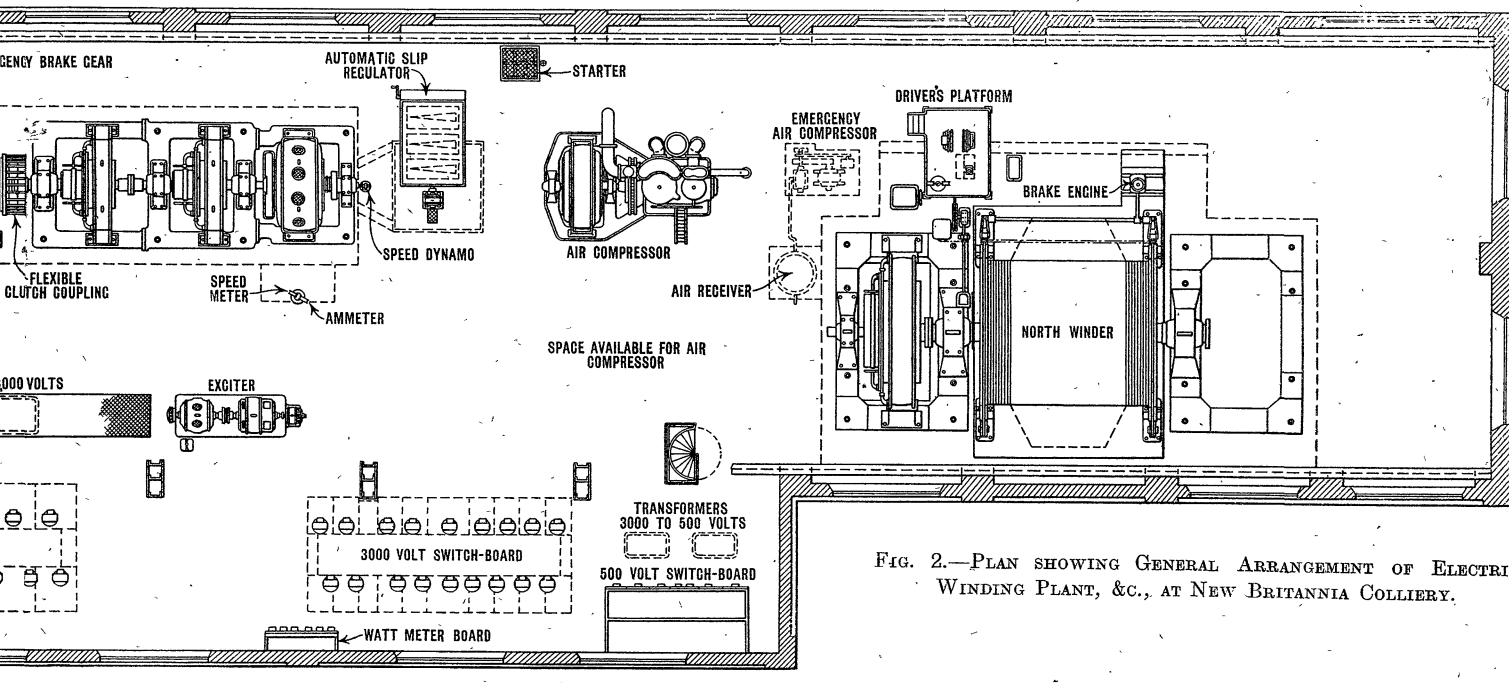


FIG. 2.—PLAN SHOWING GENERAL ARRANGEMENT OF ELECTRIC WINDING PLANT, &c., AT NEW BRITANNIA COLLIERY.

recently been recommenced with the winding engines, which have been fitted with temporary drums for the purpose. The winding plants are on the Ilgner system, and were supplied by Siemens Brothers Dynamo Works, Ltd., almost the whole of the electrical plant was made at the Stafford Works, and the mechanical parts of the gear, such as the drums, brakes, &c., were made by Messrs. Fraser & Chalmers as subcontractors. Indeed, it is notable that, with very minor exceptions, the whole of the new plant, both here and at Penallta, is of British manufacture.

The Ilgner system of flywheel storage, as applied to winding engines driven by continuous current motors with variable voltage control, is now well known, and is employed in a very large number of winding plants on the Continent as well as several in Great Britain The present plant is an example of the modification in which the flywheel is attached to a motor generator consisting of an induction motor of the slip-ring type driving a pair of continuous current generators, which supply current to the two large slow-speed motors direct coupled to the winding drum. The speed and direction of motion by the winding motors is controlled, as in the Ward-Leonard system, entirely by operating on the field of the generators, the armature circuits never being broken. The capability of the flywheels to store and give out kinetic energy is rendered available for storage of energy in the following way:—When the set is running light the flywheel runs at its full speed, the induction motor having as little slip as possible, but when a heavy call is made for power the "slip regulator" comes automatically into action, and switches resistance into the motor circuit, slowing down the set and allowing the flywheel to give up energy. When the demand for power decreases the converse takes place, resistance is switched out, and the motor and flywheel rise in speed, drawing power from the power station. Thus, notwithstanding the enormous peaks in the load on the winding motors, the current drawn from the station can be reasonably constant—and the plant capacity necessarily is far less than would be required were no such power storage available. Also it will be readily seen that the method of control by variation of the voltage applied to winding motors renders regenerative braking possible, with a considerable saving in power consumption, as well as permitting of a single lever to accomplish the whole of the starting, stopping, speed regulation, and electric braking.

This brief reminder of the general principle of the Ilgner system as applied by the Siemens firms will elucidate the relations between the ratings of the machines forming this equipment. Each winding drum is coupled to two motors, one at each end, and each is rated at a maximum horse-power of 2,160 and a normal output of 1,300 h.p., they run at a maximum speed of 62·8 r.p.m., and the voltage at the armature terminals varies from 0 to 600. They are separately excited from a 220-volt circuit derived from separate motor generators. They are 16 pole machines with interpoles as well as distributed compensatory windings to perfect the commutation, and the commutators are built in two portions, with ventilating channels between them.

The two flywheel sets, one for each winding plant, consist each of an induction motor, two continuous current generators, and a 33-ton solid steel flywheel running at a maximum speed of 500 r.p.m., and capable of storing 30,000 foot tons. The two sets are placed in line, and can be coupled together, so that when both plants are winding coal each will assist in dealing with the peaks of the other. Further couplings are provided between each motor generator and its flywheel, so that the set can be run in any one of the following ways:—Either motor generator alone with one or both flywheels or without a flywheel, both motor generators entirely without flywheels, or the whole coupled up together. The flywheels are cased in, and their bearings are water-cooled with forced lubrication. At present, during sinking, only one motor generator is in use, each of its two generators supplying a single motor on each winder. Also the induction motors have their stator circuits temporarily connected in mesh, with current transformed down to 3,000 volts on their terminals, whereas when winding is in full swing they will be star connected and supplied at the full transmission pressure of 10,000 volts. When coal is being raised from the full depth of 2,190 ft. at the full rate of one complete wind per minute, or 360 tons per hour, the maximum demand of the winding motors will be about 4,850 h.p., but the constant load put into each motor generator will

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not exceed 1,850 h.p. The two generators (one for each winding motor) on each Ilgner set are designed for 1,730 kw., or 2,830 amperes maximum, and 1,035 h.p., or 1,720 amperes normal, at 425 to 500 r.p.m., and work up to 600 volts. They are eight-pole machines with interpoles, compensating winding and double commutators similar to those of the winding motors. The excitation of the generators is drawn from separate motor-driven exciters, but a battery is provided as stand-by capable of allowing the winding engines to continue working after a cessation of supply until the energy stored in the flywheels is spent. The battery serves also as a stand-by for lighting.

The induction motors are designed for 10,000 volts, 91 amperes per phase, and an output of 1,750 h.p. continuously. The slip-ring voltage reaches 700 volts and the machines are of the enclosed self-ventilating pattern, drawing air from below the floor and expelling it through apertures around the stator frames. The slip regulators are of the liquid type, controlled by series transformers in the motor circuits, the secondaries of which supply current to a small induction motor unable to revolve, but arranged to cut in or out more or less of the liquid resistance, according to the torque on the motors.

The winding engines are provided with devices for preventing too rapid acceleration and overrunning by mechanisms which interlock the depth indicator and the control lever, thus making it impossible for it to be put over too rapidly at starting, and returning it to the zero position automatically at the end of the wind and applying the brakes, should the driver omit to do so. Excellently arranged mechanical working and emerging brakes are provided, actuated mainly by compressed air and electrically interlocked with the current supply, in addition to the provision for electric braking.

The main switchgear is of the Siemens pillar type, similar to that at Penallta. The 10,000-volt bus-bars are arranged in a ring with two sections, as indicated diagrammatically in Fig. 3. Each section has one incoming feeder from Bargoed or Penallta, and if there should be a failure on any part of the board supply, can be continued through another portion. The 3,000-volt gear is of generally similar construction, and a separate 500-volt board provides for the smaller motors and a continuous current board contains the necessary connections and instruments for the winding engine circuits.

The duplicate overhead 10,000-volt line from Penallta is of 0·25 sq. in. copper, designed to transmit 2,000 kw. at 0·7 power factor with a 4 per cent. drop of pressure. Similar sized lines are brought from Bargoed, and the Merz-Price system of protection with Reyrolle relays is used for all the overhead lines as well as for the large transformers.

There is also in the main engine-room a Belliss & Morcom air compressor, driven by a Lahmeyer 3,000-volt 400 h.p. motor running at 290 r.p.m., and other electrically driven plant at the colliery includes temporary hoists for the staging, &c., used in the sinking of each shaft, driven by 130 h.p. motors, and another temporary air compressor driven by a 130 h.p. motor

The plant at these three collieries was visited on September 14th by a large party of members of the Institution of Mining Engineers and others on the occasion of the annual meeting at Cardiff, and the Powell Duffryn Company, who are justly proud of this example of up-to-date mining electrical engineering, showed much kind hospitality to the party. It is to the opportunity thus afforded and to the personal assistance of Mr. C. P. Sparks, under whose supervision as consulting engineer the work was carried out, that we are indebted for the material that has enabled us to compile this article, with the kind permission of Mr. G. Hann, the manager of these collieries.

THE ASSOCIATION OF MINING ELECTRICAL ENGINEERS

Conference in Glasgow.

THE Association of Mining Electrical Engineers held its annual meeting at the Scottish Exhibition at Glasgow on October 6th. The proceedings opened with a meeting of the General Council in the forenoon. A luncheon followed in the Atholl Restaurant at the Exhibition, and subsequently the annual meeting of the Association took place. In the evening members and lady friends attended a reception given by the Glasgow Corporation in the City Chambers. A varied programme of sight-seeing was arranged for the Saturday, including several large generating stations in the district.

Mr. W. Maurice (Nottingham), the President, occupied the chair at the luncheon, which was attended by about 200 members. Mr. A. Anderson proposed the toast of the Glasgow Corporation, which was replied to by Bailie Campbell. Mr. C. A. Carlow, President of the East of Scotland Branch of the Association, replied to the toast of the Mining Industry, proposed by Mr. W. C. Mountain, Newcastle, and referred to the great burdens which were now being put upon the coal trade.

Mr. D. M. Mowat (Coatbridge), gave the toast of "The Association," and the President, in his reply, emphasised that their Association was not a rival to any existing Society.

At the annual meeting in the afternoon, which was presided over by Mr. W. Maurice, the following office-bearers were elected:—*President*, Mr. W. Maurice (Nottingham); *Vice-Presidents*, W. C. Mountain (Newcastle) and Prof. W. Robinson (Nottingham); *Treasurer*, Mr. C. F. Jackson (Nuneaton).

The report of the Council was to the effect that the Association was making rapid progress during the year. Branches had been formed in East and West of Scotland, bringing the total number up to 10, and the total membership was now about 900. The first examinations were held at various centres on March 11th and 18th, 1911, and proved highly successful, the number of candidates being 74, of which number 32 passed for first-class certificates, 26 for second-class certificates, 5 for service certificates, and 11 failed.

The President, in the course of his address, said that the Association entered that day on the third year of its existence as a technical society, and upon its first full session as an incorporated body. He explained that the essential object of the Association was to encourage the use of right materials and right methods, and to cultivate a feeling for honest craftsmanship. What they as an Association wanted to produce was thoroughly capable and reliable colliery electricians.

Three forms of portable electric lamps fitted with a fire-damp detecting device were on view, and their working was explained by the inventor, Mr. Ralph, and thereafter Dr. Fries explained his apparatus for automatic artificial respiration. In recognition of his services as examiner for the Association, Dr. W. M. Thornton, Newcastle, was presented with a gold watch.

At the reception at the City Chambers in the evening there was a company of about 600 ladies and gentlemen.

The Lord Provost (Sir Archibald M'Innes Shaw), in welcoming the guests, said that electrical apparatus in mines got over the difficulties incidental to mining in a way that no other form of machinery would possibly do. He looked to the Association to improve the methods of installation and maintenance of electrical plant in mines, and prophesied that before long no man would be allowed to handle electrical apparatus in a mine who did not hold a certificate from the Association. Mr. W. Maurice, the President, replied.

West of Scotland Branch.

On October 20th the West of Scotland Branch of the Association held its opening meeting at the Technical College, Glasgow. Mr. Alexander Anderson, who has been elected local branch President for a second term, delivered his presidential address, in which he pointed out that many accidents attributed to electrical causes could have been avoided if a more widespread and general knowledge of the subject was held by those whose business it was to be identified with its use. The Association should make a special effort to assist motor men and others in charge of electrical apparatus and plant in collieries, as seven out of every ten breakdowns were due to a lack of superficial knowledge on the part of those in charge.

The Chairman (Mr. M. Brown) intimated that the Council had under consideration the giving of lectures at outlying collieries for the elementary instruction of those interested. A discussion of this suggestion was invited, and taken part in by Messrs. W. L. Spence, A. W. Jones, James Caldwell, H. McGuffie, and W. A. Wilson. The matter was afterwards further explained by Mr. Muirhead, who acted as secretary in Mr. Martin's absence.

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East of Scotland Branch.

The opening meeting of the East of Scotland Branch was held on October 21st, at the Heriot Watt College, Edinburgh. Mr. C. A. Carlow (Fife Coal Co.), was in the chair. Mr. Davidson intimated his resignation as secretary of the branch. Mr. R. H. Willis (British Electric Plant Co.), was appointed.

A Paper, entitled "Electricity in Connection with Explosives," was read, in which the author (Mr. E. Kilburn Scott) emphasised the important part played by electric light and power in the safe manufacture of explosives. The equipment of an explosive factory with electrical plant was almost exactly the same as equipping a gaseous coal mine with electricity. The same precautions had to be observed as regards protecting the lamp bulbs by strong water-tight fittings, whilst cables had to be armoured and carefully laid, so that they would not be injured by moving machinery. Earthing was important, and was even more carefully carried out than in a colliery installation, as the risks were greater, so that even the workmen were earthed by wearing shoes with copper rivets in the soles. Although there was admittedly more risk in an explosive factory, as compared with a gaseous coal mine, the suggestion to do away with electric light and power at such factories, and to substitute miners' safety lamps and compressed air machinery would be ridiculous. It was the introduction of up-to-date electrical plant, and the careful study of the various risks of those familiar with electrical phenomena that had made modern explosives possible. The discussion was joined in by Messrs. G. Winthrop, R. W. Peters, R. H. Willis, and ultimately adjourned till next meeting.

Yorkshire Branch.

The first meeting at Leeds was held in the Enginering Lecture Theatre of the University of Leeds, on October 28th. Mr. R. Holiday was in the chair. Mr. E. Kilburn Scott gave an address, pointing out the objects of the Association, and what has already been done, &c., and also read his Paper on "Electricity in connection with Explosives," referred to above. A Paper was also down for reading by Mr. J. A. M'Lay on the use of turbine pumps in collieries.

Warwickshire & South Staffordshire Branch

A meeting of this branch was held on Saturday last, October 28th, at Birmingham. There was a good attendance of members. The Branch President gave a brief account of the annual general meeting of the Association held in Glasgow. He also exhibited a specimen of twin double armoured bitumen insulated cable, specially made for colliery use; where it is in use it has given every satisfaction. The discussion was then taken up by Mr. Willis's Paper on "Turbine Pumps for Mining Work." Some of the members considered the author was not very partial to the ram pump, which possessed several advantages over the turbine pump, although exceeding them in capital cost.

ELECTRICITY IN MINES IN SCOTLAND

IN a pamphlet circulated at the annual meeting of the Association of Mining Electrical Engineers at Glasgow, giving some general notes on the Scottish coal fields, it is remarked that the first electrical installation at a colliery in the world, was put down at Earnock Colliery in the Hamilton District in the year 1879. The late Lord Kelvin advised the erection of a dynamo to light the pit bottom of this colliery. A "Gramme" machine capable of lighting 30 lamps was supplied by Messrs. Anderson & Munro to the order of the late Sir John Watson, and was installed as an experiment under the direction of Professor Jamieson. It proved so successful that shortly afterwards three Siemens Dynamos capable of lighting 60 lamps each were introduced to light the pithead arrangements, and extending the pitbottom lighting to the stables and main roads. Practically every mine in Scotland has now adopted Electrical Power very extensively for lighting, pumping, hauling, coal-cutting, face conveying, and ventilation, and in a few cases for winding. The generating plants represent the latest developments in high speed engines; high pressure, mixed pressure, and exhaust turbines with all their latest adjuncts in the form of air filters, condensing and water cooling apparatus. The principal stations vary in capacity from 500 to 2,000 kw. and fairly well represent the leading makers of turbo-generating plant. Up till a few years ago the installations were entirely of the continuous current type, but in recent years, with the introduction of the central station for groups of collieries, high tension 3 phase transmission has become fairly common, and is now considered quite good practice from the switchboard to the coal face sub-stations. There is still a feeling, however, that in the case of small fields, not deep and requiring a moderate amount of power, the continuous current system at medium voltage is very suitable. Scottish mining companies, profiting by their early experience of having a wide range of direct current voltages, early recognised the necessity for standardising both voltage and periodicity in the case of alternating current, with the result that nearly all private installations have adopted 50 periods 500 volts as their standard for medium pressure. Unfortunately the same cannot be said of the principal power companies in the various Scottish coal fields, who have adopted different periodicities and voltages.

This has been a drawback in many cases, resulting, as it does, in apparatus not being interchangeable in the case of a colliery company which may want to augment their own supply from the Power Companies' mains, or who may have collieries situated in different areas of public supply. In a few cases current is supplied by one or other of the Power Companies exclusively, and collieries are already drawing coal, which are supplied entirely throughout from the coal cutter to the winding gear from the Power Companies' mains. The tendency, however, is for the Colliery Companies who use Electrical Power extensively to generate for themselves, and where it has been possible to instal Mixed Pressure or Exhaust Turbines the capital outlay has been justified by the good and economical results obtained.

THE AVOIDANCE OF ELECTRICAL ACCIDENTS IN MINES

MR. GEORGE GIBB presided at a joint meeting of the Scottish Branches of the National Association of Colliery Managers and the Association of Mining Electrical Engineers on the 30th September, in the Heriot Watt College, Edinburgh. The Paper submitted for discussion was that on "Electricity in Mines—the avoidance of Accidents," read by Mr. Robert Nelson, H.M. Electrical Inspector of Mines, in 1909 before the Institution of Mining Engineers (see ELECTRICAL ENGINEERING, Vol. V., page 527, and Vol. VI., page 59).

Mr. George L. Kerr (Glasgow), in referring to fire-damp explosions, said that the stringent regulations embodied in the new Coal Mines Bill regarding the installation and use of electricity in collieries was due to accidents suspected of having been caused by electricity. Fire-damp would ignite by the flame from a defective safety lamp, and as these lamps are considerably in excess of electrical apparatus underground, one could not help realising where the greater danger lay. Mr. M'Phee (Holytown) spoke in defence of compressed air for underground operations, and Mr. J. M'Luckie (Larkhall) mentioned that armoured cable, if properly installed, was better than unarmoured cable, but if it was faulty it was more dangerous. Mr. J. Parker (Cowdenbeath) was opposed to the introduction of electricity into collieries where there was any danger of an ignition of fire-damp. He considered compressed air as a means of transmitting power was not inferior to electricity, but some pneumatic tools produced were not capable of performing their work satisfactorily, due to faulty design and construction. Professor Baily (Heriot Watt College) said it ought to be recognised that the conditions of electrical engineering underground were much more difficult than those above ground, and safety could not be obtained until it was acknowledged that the cost of installations underground was bound to exceed those on the surface.

Steam v. Electric Winding.—A discussion on electric winding, arising out of a Paper by Mr. F. Thursfield, read at a former meeting, was held at the beginning of last month by the Midland Institute of Mining, Civil and Mechanical Engineers. A communication was read from Mr. G. Hann (Powell Duffryn Steam Coal Co.), who thought that where steam was already available steam winders in conjunction with exhaust steam turbines were more economical than electric winding, unless power could be obtained from a power company at less than 0·25d. per unit. The province of the electric winder was, in his opinion, at a colliery, where boilers could be entirely dispensed with and the generating plant could be concentrated at neighbouring collieries and power obtained from coke-oven gas or exhaust steam. The increased economy obtainable by adding exhaust steam turbines to steam winders was also referred to by Mr. J. A. Watts, and Mr. C. E. Rhodes emphasised the greater steadiness of electric winding. Mr. Thursfield, in his reply, said that it was generally admitted that with a well-designed electric winding scheme, the actual fuel consumption, taken over the whole year, would be less than with steam.

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Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during October.

October 5th.—Monthly supplement on "Electrical Engineering in Mines," in which two illustrated articles on colliery generating plants and electrical equipment are included, and a new electric miners' lamp is described. An account is also given in the special exhibition supplement with the same issue of Messrs. A. Reyrolle & Co.'s exhibit of mining and other switchgear, including their striking experimental demonstrations of the flame tight qualities of the method of enclosure they adopt. Various exhibits relating to mining switchgear, cable boxes, instruments, telephones, &c., are also given.

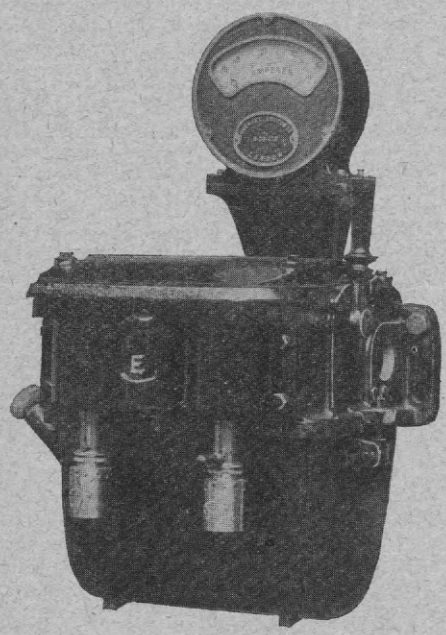
October 12th.—Fourth Olympia exhibition supplement includes descriptions of a special design of motor for running under water, a special induction motor with enclosed sliprings, and several other exhibits of motor switchgear, &c., relating to mines.

October 19th.—Fifth Olympia exhibition supplement, including illustrated description of a cable sinking drum for mines. A new form of high-speed generator.

October 26th.—Illustrated description of a large Diesel engine set. Article on some new H.T. switchgear. Sixth notice of the Olympia Electrical Exhibition, containing illustrations of motor-control apparatus and other novelties.

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PROPOSED ALTERATION IN THE CONSTITUTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS

FAR-REACHING and drastic changes are proposed in the constitution of the Institution of Electrical Engineers, and will be submitted to a meeting of Members and Associate Members at 4.30 p.m. to-day (Thursday), and we urge all Members of these two classes who can attend to be present. Notices convening the meeting, and enclosing a draft of the new Articles of Association proposed, were only received last Thursday, and as the alterations are of considerable magnitude, an attempt will be made to induce the President and Council to adjourn the voting on the resolution to a subsequent meeting, to allow formal notice to be given of amendments. This proposal for adjournment to a later date will, we trust, be accepted, but in any event it will be in order to discuss the details of the proposed changes to-day. It is true that even if the new Articles of Association are accepted to-day *en bloc* as they stand, the resolution must necessarily be confirmed by a second special meeting, to be held from a fortnight to a month later, but at this formal confirmatory meeting it would only be possible to pass or reject the resolution.

The Committee to which the Council has relegated the revision of the Articles of Association has evidently attacked the arduous task in an earnest and painstaking manner, but it would have been almost impossible for the Committee to remodel the Articles in such a way that no detail in the new draft should prove unacceptable to some section of the membership, and it is the Associate Members of the Institution who will not approve of the innovations proposed. We may point out that more than two-thirds of the total Corporate Members are Associate Members, and although they have at present only one representative on the Council, it is certainly desirable that full consideration should be given to their views.

The Council proposes to make an effort to enrol as Associates more persons who are not electrical engineers, and also to create a new class of "Licentiates," whose only qualification is to be that they are over 23 years of age, of good education, and employed in an engineering or scientific capacity in the applications of electricity. Support must naturally be accorded to any effort to increase the power of the Institution by adding to its numbers all who are usefully connected with the industry in any capacity, but these new adherents with minor qualifications must not be permitted to have titles which will place them nominally, and in the eyes of the public, on an equal rank to the more experienced and fully qualified Associate Members. The title "Licentiate" implies recognition of proficiency and licence to practise, which the Institution has no right to accord to juniors with practically no experience. It is also proposed to give Associates who are not electrical engineers an absolute right to equal representation on the Council to Associate Members. Lastly, the Associate Members may also complain that the proposed new Articles indicate a desire on the part of the Council to elect as full Members gentlemen who do not possess the qualifications for Associate Membership. There are at present on the roll of the Institution a number of Members, elected in the days when the conditions were easier, who, if they sent in their application to-day, would not qualify even as Associate Members. Applications from additional persons with similar qualifications would under the existing Articles of Association meet with the reply that the Council had no power to elect them as Members, but under the proposed new Articles the Council is given far wider powers to elect non-engineering Members, and their reply would have to be one far harder to give, namely, that they would not (instead of that they could not) elect the candidate.

Another serious change indicated in the proposed new Articles of Association is in the method of election of Council. Hitherto the outgoing Council has nominated a Council for the ensuing year and has invited alternative nominations from the membership. Now it is proposed that any nominations from outside the Council Chamber must be made about three months before the election, and that if the Council's nominations, which are made about two months later, include these names, there shall be no ballot, so that the membership is placed in such a position that it is compelled to accept the outgoing Council's nomination of their successors, and is practically deprived of the power of electing its representatives. Such a proposition cannot possibly be agreed to; we can only believe that it has arisen through an oversight in drafting the proposed new Articles, and we do not doubt that the amendment opposing this new rule, and placing the election of Council on a more popular basis, will be cordially supported.

As has already been announced in the Council's report last summer, the subscriptions of Members, Associate Members, and Associates, are to be raised, and examinations for new Associate Members and Students are to be introduced in 1913. Other alterations proposed in the draft Articles of Association are the inclusion in them of the rules for "Professional Conduct" of Consultants, an arrangement by which each Local Section has the option of sending up either its Chairman or Past-Chairman to represent it at Council meetings, and an Article giving the Council unfettered discretion in arranging for the incorporation of any kindred society with the Institution.

We trust that every Member and Associate Member of the Institution of Electrical Engineers who reads this notice this morning will make an effort to attend the meeting at 4.30 at the Institution building on Victoria Embankment. The Council, we are convinced, will prefer to profit by this opportunity of ascertaining other views than their own on the new proposals, and if the attendance at the meeting indicates to them that it would be wise to postpone the adoption of the new Articles of Association until the 1,331 Members and 2,809 Associate Members of the Institution have had further time to express their opinions on them, we feel sure that they will do so.

Electric Chime-Striking Mechanism.—We are asked by Messrs. Gent & Co., Ltd. (Faraday Works, Leicester), to state that the clockwork chiming gear and striking mechanism exhibited by them at Olympia and described on page 582 of last week's ELECTRICAL ENGINEERING, are fully covered by patents.

Electrically-heated Bakers' Ovens.—According to the *Elektrotechnische Zeitschrift*, the Municipal Electricity Works of Vienna has offered to place electrically-heated ovens at the disposal of members of the Bakers' Association of that city free of charge, and to guarantee that their use will not entail any increase in the working costs. The experiment is being made to demonstrate the advantages of electric heating for this purpose, foremost among which are cleanliness, evenness and certainty of baking, and small space required.

The Generators.—This mystic society gathered in its full force of 66 units for the first dinner of the season on Friday last, October 27th, at the Imperial Restaurant, Regent Street, under the genial presidency of Chief-Generator Chisholm. It is an exceptional pleasure in these days to attend an electrical engineering function in which the staid formalities of evening dress and after-dinner speeches are expressly debarred by the rules. Dry toasts—dry, of course, only in the sense that they are unaccompanied by speeches—are the order of the day with The Generators, and even these are officially limited to two, though unofficially many a toast was spontaneously proposed and always well responded to. Owing to the exertions of the versatile Scribe Corneille, who, apparently, has an equally large circle of good and talented friends in the musical world as in the electrical world, the concert following the dinner was of a most varied and excellent character. We condole with those electrical men who have not yet been able to enrol themselves amongst the mystic 66.

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A MOTOR CAR LIGHTING SET

AMONG the exhibits at the forthcoming Automobile Exhibition at Olympia is a new design of car lighting dynamo equipment, which will be shown by S. Smith & Son (9 The Strand, W.C.), and is produced by them in conjunction with the British Thomson-Houston Co., Ltd., of Rugby.

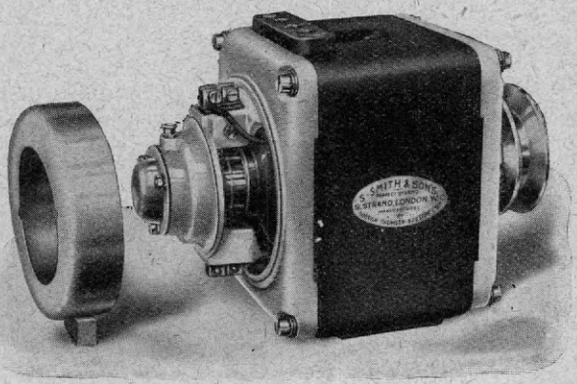


FIG. 1.—B.T.-H. CAR-LIGHTING DYNAMO.

The equipment, with the exception of the instruments, is of British design and construction, and for size, lightness, and output is claimed to be in advance of anything of the kind that has yet been put on the market. The dynamo itself differs from most of those at present in use in that it is an ordinary type of dynamo with no subsidiary poles or mechanical governors. Great reliability should therefore be secured. A view with the cover removed to show the brush

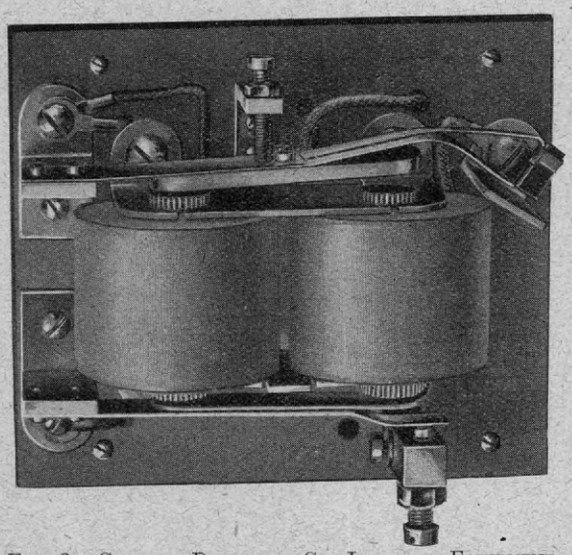


FIG. 2.—CONTROL DEVICE OF CAR-LIGHTING EQUIPMENT.

gear is given in Fig. 1. The patented automatic electrical control device, illustrated in Fig. 2, is a most ingenious piece of mechanism, and is designed to cause a constant output of 8 amperes to be supplied to the accumulator, whether the speed of the car be 12 or 50 miles an hour. This device is contained in a neat case on the dash-board provided with ammeter, voltmeter, and a row of six control switches. This equipment will be shown in operation.

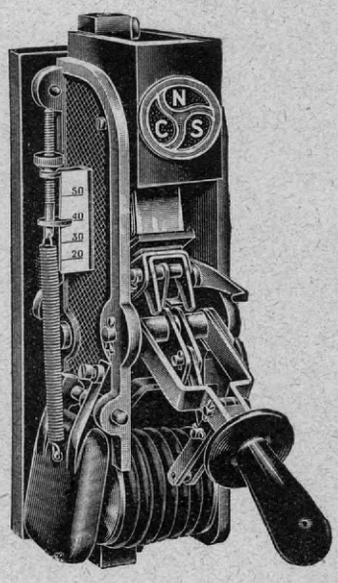
The Batti-Wallahs.—This society of good fellows of the electrical industry has completed the arrangements for its programme for the season 1911-12. The programme includes four smoking concerts, four informal meetings, and the annual dinner. The first of the smoking concerts takes place on Friday next, November 3rd, as announced in our "Arrangements for the Week" column. The programmes at these smoking concerts are always excellent, and we have often wondered how it is they do not attract a very much larger audience. We are informed that the membership of the society has had a considerable recent increase, due to the excellent fare afforded by the committee during the past season, and we can thoroughly recommend membership of the society to anyone wishing to pass a pleasant evening with his fellow electrical men.

ELECTRICAL EXHIBITION AT BRIGHTON

THE Mayor of Brighton, Alderman C. Thomas-Stanford, J.P., opened an electrical exhibition at the Aquarium on Saturday last. In his opening speech, he recalled the rapid advance electricity had made in the town, and gave the following interesting figures; since 1892 the number of consumers had steadily increased from 213, until to-day there are no less than 5,239 connected to the supply. The lamps connected in 1892 numbered 11,000, whereas now there are 375,099, representing some 10¼ million units. He also said that the undertaking had always paid its way, and during the 20 years of its existence it had relieved the rates to the extent of £14,000. These returns, however, are chiefly due to lighting, and it is the object of this exhibition to bring home to the people the economy of using electricity for heating purposes. A special feature is, therefore, being made of electric cooking. Messrs. Muttons are cooking the whole of the requirements for their restaurant in the King's Road on the apparatus at the exhibition. Mr. Christie, too, has apparently put aside his characteristic modesty on this occasion, as he is, personally, giving practical demonstrations in using the apparatus three times daily. With the small unrestricted flat rate of 1d. per unit recently passed by the Council for heating and cooking, the latter should soon become popular with the people. The exhibits are fully representative of the many uses to which electricity can be put, and practically everything that was to be seen at the Olympia Exhibition is on view at the Brighton Aquarium. We are glad to hear that the exhibition, which has been advertised all over the town, has already met with a hearty response from the public.

A NEW CIRCUIT BREAKER

MESSRS. NALDER BROS. & THOMPSON, LTD., of 34 Queen Street, E.C., have just placed upon the market a circuit breaker, of the pattern illustrated here, of which examples were shown on their stand at Olympia. The apparatus is compact in design, although of robust construction, and is fitted with magnetic blow-out and loose handle, although carbon breaks can be supplied if preferred. The breaker can be supplied in various forms, either as an overload with or without time limit, reverse current, or overload and reverse current combined. The tripping mechanism is new; it possesses the advantage of being extremely light to trip. The effort required to release the breaker is extremely small, but at the same time there is not the slightest possibility of it opening accidentally. Being of the loose-handle type it cannot be replaced while the overload is still on. It can be tripped by hand, therefore it combines the properties of a circuit breaker with the advantages of a switch.



N.P.U. CIRCUIT BREAKER.

OBITUARY

J. C. FULLER.

WE regret to record the death at the advanced age of 91 of Mr. John Crisp Fuller, whose name is familiar to many in connection with the Fuller bichromate battery. Born in Bristol in 1821, Mr. Fuller early came to London and identified himself with electrical and telegraph matters, having been for a while a temporary assistant of Faraday. In 1854 he joined the Electrical and International Telegraph Co., and did pioneering work with batteries and land lines. Three years later he turned his attention to rubber-covering machines with Messrs. Silver & Co. (now the India-rubber, Gutta-percha, and Telegraph Works Co.), and before founding his own firm of J. C. Fuller & Son he was associated also with Mr. W. T. Henley.

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ENGINEERING EDUCATION

MR. W. CRAMP delivered his inaugural address as chairman of the Manchester Local Section of the Institution of Electrical Engineers on Friday last, and chose as his subject a general discussion of some of the problems of higher education, confining himself to engineering for purposes of illustration. As the importance of science as the basis of education had been realised, there had been a great tendency to carry matters too far, and to praise curricula crowded with disjointed science subjects, to the vital neglect of the "humanities." In a general scheme the consistent co-ordination of the various paths leading from the infant school to the finishing school or university should be aimed at with the planning of higher education, so that it is correlated with the succeeding paths in life. He pleaded for wider scientific knowledge and wider general culture. Higher education, as at present carried out, tended to produce a specialist at an impossibly early stage in his career, instead of a well-informed and broad-minded man. Reform in such directions would fit in with the scheme of education proposed by Dr. Pohl, for it would standardise a general curriculum in all technical schools and colleges throughout the country for the first three years of training, while higher training than this could be given at scholarship aided centres. Thus the advanced textile school could be at Manchester, and the advanced electrical school could be in London. In the general course no distinction between pure and technical science should be made. The method he advocated was the simultaneous teaching and correlation of all the usual subjects. Physical, chemical, and mechanical phenomena and relations should be linked up, and the similar principles pervading them should be traced in their different aspects. Mr. Cramp gave several examples illustrating his meaning in the laws of energy, transformation, current flow, &c. Passing on to the equally necessary parts of education which dealt more with social aspects and the development of qualities of mind, apart from the mere provision of the scientific materials required in the profession to be followed, Mr. Cramp outlined some of the conditions existing at the older universities, and dwelt on the difficulties in obtaining such advantages at non-resident "universities" of the newer type. He emphasised the importance of the principals and teaching staff being in the best sense of the words men and gentlemen, and pleaded for much greater freedom of action for the students, as developing a higher "co-efficient of self-instruction," greater power of initiative and individual responsibility. He urged the importance of good literary form being required in all such work as writing reports of experiments, &c.

In conclusion, his recommendations may be summed up as follows:—The division of technical colleges and universities into two sections, viz., the general and the specialised. The arrangement of a course suitable for each of the five great professions (medicine, law, engineering, architecture, and theology) at every "general" school. The teaching of the science appropriate to the profession to be as broad as possible. In non-residential colleges the provision of adequate social and æsthetic activities, giving special attention to: A most carefully selected principal and staff; avoidance of unnecessary restraint; an arrangement by which the student should know that he was dependent upon his own efforts to remain at college; proper opportunities for social intercourse, not only between student and student, but also between staff and student; and definite official encouragement of university unions, literary and debating societies, and æsthetic and athletic clubs.

The address was followed by a very successful smoking concert.

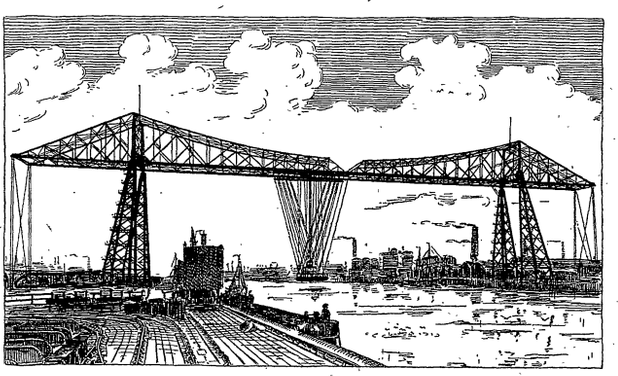
Sir William Ramsay and the Coal Supply.—The statements made by Sir William Ramsay, K.C.B., F.R.S., in his Presidential Address to the British Association (ELECTRICAL ENGINEERING, September 7th, p. 499) regarding the exhaustion of the coal supply of Great Britain have been brought to the notice of the President of the Board of Trade. In reply to a question by Mr. Touche on Monday, he stated that Sir William Ramsay had omitted to take into account the amount of coal in fields unproved at the time of the inquiry by the Royal Commission, and the amount of the coal lying below 4,000 ft., which it might yet be found possible to work. The suggestion that the Government should impose a penalty on wasteful use of coal would, added the Home Secretary, involve an amount of control over the industries of the country it would be impossible for any Government to undertake. On the question of limiting exports, Mr. McKenna quoted the report of the Royal Commission to the effect that the maintenance of the export trade was essential to the prosperity of the coal districts, and that they saw no reason to restrict it artificially.

THE MIDDLESBROUGH TRANSPORTER BRIDGE

SCHEMES for the improvement of facilities for the crossing of the River Tees at Middlesbrough have been in the air for some years, but it was not till July, 1907, that the Middlesbrough corporation finally obtained their Act for the construction of a transporter bridge. The contract for the construction was given in June, 1909, to Sir William Arrol & Co., Ltd. (Glasgow), and in August of that year the foundation-stone was laid, and on October 17th last the completed bridge was opened by H.R.H. Prince Arthur of Connaught.

The general arrangement of the bridge is shown in the sketch, and the following are some of the leading dimensions:—Total length of bridge and approach span, 850 ft.; span across the water between the centre of the towers, 570 ft.; height from the high-water mark to underside of girders over the river, 177 ft.; total height of towers, 225 ft. The total weight of the steelwork is 2,600 tons in the bridge and 600 tons in the caisson foundations.

The bridge is built on the cantilever principle, and the extremities of the main span are anchored and secured to concrete anchorage blocks on each bank of the river by



THE MIDDLESBROUGH TRANSPORTER BRIDGE.

sixteen wire ropes embedded in the concrete. Each rope is capable of withstanding a breaking strain of 300 tons. From the main span is suspended the travelling car, the floor of which is level with the roadway on either side of the river. The car, the dimensions of which are 44 ft. by 39 ft., is capable of completing the journey from shore to shore under two minutes, and has accommodation for 500 to 600 passengers and six vehicles. It is driven electrically from the power house, in which are two 60-h.p. motors, one serving as a stand-by. The consulting engineers were the Cleveland Bridge & Engineering Co., Ltd., Darlington, represented by Mr. G. C. Imbault, their chief engineer, under whose supervision the work was carried out, with the assistance of Mr. S. E. Burgess, Borough Engineer of Middlesbrough, and Mr. Robert Anderson, resident engineer. The electrical equipment was supervised by Mr. H. M. Taylor, Borough Electrical Engineer.

CORRESPONDENCE

NEW INDIAN PATENTS ACT.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—May I through the columns of your paper bring to the notice of such of your readers as are interested in Indian Patents the fact that a new Act comes into force in India on January 1st, 1912, which will alter the conditions under which valid patents are obtainable? The particular point to which I should like to draw attention is that, under the new Act, valid Letters Patent cannot be obtained for an invention which has been previously used or published (as by the printed British specification) in India. Under the present Act, however, it is allowable to file an application at any time within one year of the filing of the British application, or of the actual sealing of the British Letters Patent. Therefore any intending applicants for Indian patents, of which the corresponding British specifications are now published, or will be published by December 31st next, should take care to have their applications filed before that date.

Yours faithfully,

128 Culmore Row, Birmingham. CHAS. B. KETLEY.
October 24th, 1911.

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ELECTRIC COOKING AT WARING & GILLOW'S

SUCH great interest was taken in electric cooking and other heating apparatus at the recent Olympia Exhibition, that Messrs. Waring & Gillow, Ltd. (164–8 Oxford Street), thinking that a further series of demonstrations would be welcomed in London, have set apart for the next few weeks one of their large departments, where a good selection of heating and cooking apparatus is on view, and they are to be congratulated on their enterprise.

An expert lady cook has been engaged to give a series of demonstrations daily from 10 a.m. to 5 p.m., and private demonstrations can be arranged by request. Besides the "Tricity" cooker, which is now well known, there is the new Jackson stove. This has two 8 in. hot plates and one 6 in. plate, besides a griller, which are all arranged on the top of the oven, the whole measuring 28 in. by 19½ in. The hot plates can be regulated for ¼, ½, and full heats, but the griller has only one heat, and takes 1,250 watts to heat up. The oven, measuring 23 in. by 15½ in. by 14½ in., is heated by elements fitted on iron plates, which are screwed on to, but are clear of, the sides of the oven, so that the whole of the elements are entirely inside the oven, and the hot air circulates round and round the interior. The terminals are arranged at the back and the connections pass between the walls, which are packed with slag wool. The normal consumption is about two units per hour when working at its full capacity, which is for about twelve people. The Marylebone Borough Council has erected a special switchboard over this stove, which comprises Diamond H switches and "Z" fuses for each hot plate, for the grill, and for each oven heat, the switches for the plates having four positions, off, medium, high, and low heats. When these are on, a red lamp glows, showing the cook exactly what she is doing, which also serves as a warning. A range of these stoves is being installed in the new Polytechnic, and also in the block of flats in Portland Place. Passing now to the other exhibits, we noticed a very handsome hot plate with a highly finished nickel plated extension piece, on which a kettle and saucepan can be boiled at the same time, one of which has been purchased by Queen Alexandra. A grill and toaster can also be used with it by removing the extension plate. Another domestic appliance was a Mary Ann, which has often been referred to in ELECTRICAL ENGINEERING. An improved hair-dryer has a switch for cutting the heating element in and out, instead of having to remove it when cold air is required. The Murray radiator, with an adjustable oval reflector for supplying heat locally, is also to be seen; this has one tubular lamp, which gives a temperature of about 240° F. It is largely used for roll-top desks. The special radiator, however, will be the new Ferranti type, described in ELECTRICAL ENGINEERING Supplement, Part II., of September 28th, p. 28. An interesting exhibit for motor-car owners will be the tyre pump, which is driven by a small motor. A large assortment of quartz heaters, kettles, bed-warmers, cigar-lighters, coffee percolators, vacuum cleaners, &c., are on view, besides a log fire made of special glass to take any heating element, and a Holmquist electric bath.

The power station is represented by a 2½-h.p. Hornsby oil engine coupled to a small dynamo machine. Adjoining this room Messrs. Waring and Gillow have furnished four other rooms, with decorated dining-tables, which originally represented their £750 fully furnished house. At the entrance there is an electric fountain, and the rooms, which are lighted with 240-volt metallum lamps, have telephones, Ozonair apparatus, radiators, Eureka clocks and fittings, the latter being a special feature with the company. In one of the rooms we noticed a carved alabaster dished fitting, from which the light was reflected from the ceiling. A visit to the electrical department revealed one of the biggest ranges of electrical fittings in London, and special rooms were devoted to French, old Dutch, and old English period fittings. Amongst the latter we specially noticed a copy of the grand old Louis XVI. candelabra, which has been adapted to electricity by neat wiring on the outside. A large assortment of glass and lustre fittings is arranged on a gallery, and on another floor a large quantity of cheaper fittings, amongst which was a particularly neat little Faraday lamp stand at the small cost of 7s. 6d. Messrs. Waring and Gillow are prepared to give estimates for a complete cooking installation on application.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

FOREIGN WEIGHTS AND MEASURES.—We have received from Rosenblum's Translation Bureau, 40 High Holborn, W.C., a convenient card giving tables of equivalents of British, metric, and Russian weights and measures, as well as British and foreign moneys.

BELLS, WIRES, &c.—A catalogue from The Wright Electrical Sales Co., Ltd. (Upper Mill Hill, Leeds), gives some details of bells, wires, motor-car accessories, and various electric novelties.

ELECTRIC RADIATORS AND MEDICAL APPARATUS.—A list of radiators in a variety of designs on the Dowsing-Huntley system, and some medical apparatus, including the Solarium bath, is to hand from the Dowsing Radiant Heat Co., Ltd. (115 Great Portland Street, London, W.).

LARGE COOKING APPARATUS.—A catalogue from the British Prometheus Co., Ltd. (Salop Street Works, Birmingham), gives particulars of their larger electric cooking ranges, ovens, and other appliances, for restaurant and hotel cooking, some of which were described in our exhibition supplement of October 19th.

DOMESTIC HEATING AND COOKING APPARATUS.—A collection of leaflets in a handsome cover is being issued by Ferranti, Ltd. (Hollinwood, Lancashire), to call attention to their heating and cooking apparatus, to some of which we referred in our exhibition supplement of September 28th. The items dealt with include irons, disc stoves or hot plates in several forms, special aluminium utensils for use with these, complete breakfast cooking outfits, and eight designs of their new "electric fire," with its glowing quartz centre and ornamental metal reflector.

THE O.S. WIRING SYSTEM.—Siemens Brothers and Co., Ltd. (Caxton House, Westminster, S.W.), are issuing a new edition of their pamphlet on this popular system of wiring, superseding the issue of May, 1910. This pamphlet gives an up-to-date and more or less popular description of the O.S. wiring system, and illustrations of the various applications of "Stannos" wiring; also illustrations of some typical buildings, in which the system has been used, giving the names of the respective contractors, consulting engineers, &c. Copies are available for the use of contractors without the name of the firm.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

METAL FILAMENT LAMPS.—A new catalogue, including the latest types of Royal Ediswan metal (tungsten) filament lamps, is being issued by the Edison & Swan United Electric Light Co., Ltd. (36 and 37 Queen Street, E.C.). As we have already announced, reductions have lately been made in the prices of the most widely used sizes, and the new types now listed for the first time include a 100-130 volt 12-watt 9-c.p. lamp, and a 200-260-volt 24-watt 16-c.p. lamp. These are in smaller bulbs than heretofore, that of the 12-watt lamp being 4 in. long by 2¼ in diameter, while the 24-watt lamp is the same diameter and only ½ in. longer. The high-voltage 32-40 watt lamps are now also supplied in this bulb. Some new fancy lamps in small round bulbs have also been introduced.

ELECTRICAL SUPPLIES.—The new edition of the electrical supplies catalogue of Siemens Brothers Dynamo Works, Ltd., contains particulars in a convenient and compact form of a great variety of electrical apparatus, including tantalum, one-watt, and carbon incandescent lamps, arc lamps and carbons, installation accessories, bells, batteries, conduits, wires and cables, "O.S." wiring material, "Zed" fuses, switches, circuit breakers, lightning arresters, instruments, meters, heating and cooking appliances, electric horns, fans, small motors, vacuum cleaners, &c., &c. The wiring rules of the Institution of Electrical Engineers and a quantity of useful information on wires and cables are given at the end of the volume.

CABLES.—A leaflet from the St. Helens Cable & Rubber Co., Ltd. (Warrington), calls special attention to the substantial covering for cables, known as "cab tyre sheathing," which protects them from mechanical or chemical damage or the effects of moisture.

METAL FILAMENT LAMPS.—The Electric & Ordnance Accessories Co., Ltd. (Cheston Road, Aston, Birmingham), have advised us in a corrected leaflet of reductions in the prices of their "V. S. M." metal filament lamps. The prices of all the sizes above 60 volts are reduced, the 100/135-volt 16-50-c.p. lamps being now 2s. 3d., and the 200/260-volt 25-50-c.p. lamps, 2s. 9d.

RAILWAY SIGNALS.—Siemens Brothers & Co. (Caxton House, Westminster) are issuing a new pamphlet describing the battery-worked signal which was a conspicuous feature of their stand at Olympia. The latest form of this apparatus retains the general features of the earlier designs, but modifications have been made by substituting spur gearing for worm-driven machines. This has had the effect of increasing the efficiency considerably, for whereas with the old pattern machine the time taken was 8 to 9 seconds to lower a standard signal arm, with the new form of machine only 4 seconds are taken with the same expenditure of current for the time being, and, therefore, the life of the battery is proportionately longer.

SIGNS.—The Globe Electric Co., Ltd. (11 Farringdon Avenue, E.C.), have sent a leaflet illustrating an effective example of their new "Glob-o-lite" sign, in which solid glass spheres are let into suitable perforations in a metal sheet.

METAL FILAMENT LAMPS.—A neat leather-bound pocket memorandum book from the British Thomson-Houston Co. reminds us of the removal of their Mazda Lamp Sales Department to 77 Upper Thames Street, and of the good points of Mazda, Gem, and Edison incandescent lamps, besides being of use as a pocket-book and calendar.

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ELECTRIC TRACTION NOTES

The report of the deputation appointed by the Corporation of Edinburgh to investigate systems of railless electric traction contains some interesting particulars of the working of the trolley omnibus services in Leeds and Bradford, at the latter of which towns the success of the 1¼ miles now running has led to the decision to equip an additional 9 miles at a cost, including 12 cars and depôt accommodation, of £26,500. A general description of the system was given in ELECTRICAL ENGINEERING, June 29th, page 363. The capital cost of the 1¼ miles already laid works out at £1,734 per mile, and the two cars cost £700 each. A 30-minute service is given each way, with 15-minute service on Saturday and Sunday afternoons. The running cost per car mile (partly estimated) is given as follows:—Current at 1d. per unit, 0·95d.; wages, 2d.; vehicles, 0·80d.; overhead work, 0·09d.; tyres, 1·50d.; total, 5·34d. At Leeds the current cost works out at 0·76d. per car mile, and the consumption is 0·87 unit per car mile (28 passengers) as against 1·75 unit for an ordinary tramcar (60 passengers). The capital cost was £1,246 per mile for the 4 miles and £700 per car. The running costs are estimated at 5½d. per car mile, and so far the revenue is 8·78d. per car mile.

As the result of a consultation with representative holders of both preference and ordinary shares, the Board of the British Electric Traction Co. have been able to put forward a modified scheme which disposes of the principal objections raised at the recent meeting. The nominal capital of the company, which is now £4,000,000, divided into £2,000,000 in £10 preference shares, and £2,000,000 in £10 ordinary shares will, if the new scheme is carried out, be divided into £500,000 cumulative preference stock, £1,000,000 non-cumulative preference stock, £1,500,000 preferred ordinary stock, and £1,000,000 deferred ordinary stock.

The Paisley Corporation and the Paisley District Tramways Co. have come to an arrangement, by which the company pays a flat rate of 1d. per unit for current for traction purposes. Under the arbitration award of Mr. R. Hammond (ELECTRICAL ENGINEERING, Vol. VI., December 1st, 1910, p. 765) it was found that the sliding scale awarded had the effect of causing the company, at special times, to give an insufficient service with a corresponding reduction in revenue for the Corporation Electricity Department.

In consequence of difficulties with the Board of Trade and the Commissioner of Police in regard to running coupled and trailer cars on the L.C.C. tramways, the Highways Committee recommend the Council to apply for Parliamentary powers. Such cars have been run experimentally on the Euston Road to Hampstead, but the Commissioner of Police has declined to allow their continuance on the ground of obstruction and danger to other traffic. The Highways Committee are particularly anxious to secure these powers for the purpose of increasing the carrying capacity of the Holborn-Strand subway. It is pointed out that no complaints are made against the technical arrangements for coupling the cars. The Council procured, at a cost of £410, the equipment required for coupling two single-deck cars, and this was passed by the Commissioner of Police. This, however, was prior to the experimental working, which is now stated to be dangerous to the other traffic. In their report the Highways Committee point out that trailer cars are extensively used on the Continent and in America, where much higher speeds are allowed than is the case on tramways in this country.

A touring car fitted with the Thomas electrical transmission gear, the working of which was fully described in an illustrated article in ELECTRICAL ENGINEERING May 4th, page 236, has completed an R.A.C. road trial from London to Edinburgh and back (794·5 miles) at an average speed of 19·5 miles per hour without any adjustments being made, with the remarkably low petrol consumption of 35·73 miles per gallon, or 67·92 ton miles per gallon, figures which we believe are above all previous records.

The car in question was a standard 13·96 h.p. (R.A.C. rating) Delahaze car (with four cylinders 75 × 110 mm.), to which the Thomas transmission had been fitted, and a Claudel-Hobson carburettor was used. Previous to the trial the car had covered some 24,000 miles. The weight was 3,219 lbs., increased by live and dead load to 4,258 lbs. The gear ratio was 5·42 to 1. The trial was completed in four days under rather adverse weather conditions. A 12-volt 50-ampere battery was carried on the footboard. This battery was automatically charged when running along on top speed, and in addition to providing current for starting up the engine from the driver's seat whenever required, it also supplied the following lamps:—Two powerful head lamps, two side lamps, a tail lamp, and a dashboard lamp. The lamps were in use altogether about eight hours, and the engine was started up approximately 50 times. The fact that the car had been in used for experimental purposes for about eighteen months, and had travelled in all 24,000 miles before the trial, should be taken as evidence of the reliability of the transmission rather than the comparatively short run from London to Edinburgh and back.

The Sunderland and District Electric Tramways Co. has been in the hands of a Receiver since the meeting of 1910. At the meeting held last week, it was stated that as a result three out of the five members of the Board resigned. A third director has since been appointed, however. The Receiver has reported the urgent necessity for more cars, and for the relaying of a large proportion of the track, owing to damage from subsidence due to the coal mines. In the past twelve months, the revenue was insufficient to meet the debenture interest and other expenses, to the extent of £1,598. Mr. H. R. Hogg, who presided, said that a good deal of economy would still have to be practised, but in the interests of the ordinary shareholders an effort must be made to keep the undertaking going.

The Brighton Corporation have decided in favour of adopting trolley omnibuses over the important routes at present monopolised by the Brighton, Preston & Hove Omnibus Co., and the Town Clerk has been instructed to prepare a Bill for promotion next session. On the other hand, the Hove Council, whom it was thought at one time would co-operate with the Brighton Council in this matter, have decided to take no further action.

The Sheffield Tramways Department are inaugurating a new system with regard to the collection of fares on their tramways, in order to keep the conductors of top-decked cars on the platform as much as possible. All passengers using the top deck will be required to pay as they enter the car. It is stated that as many as 1,060 accidents have occurred in the course of the year owing to the conductor being on the upper deck.

Mr. Robert Hammond recently sat as arbitrator to determine the dispute between the Gravesend & Northfleet Tramway Co. and the Gravesend Corporation as to the price which the former shall pay for traction current. Under an agreement which expired last year the company paid 2d. per unit up to 180,000 units, 1¾d. per unit for all in excess up to 350,000 units per annum, and 1½d. per unit for all additional units. Mr. C. P. Sparks and Mr. C. W. Little were the technical witnesses for the tramway company, whilst the chief witnesses for the Corporation were Mr. J. F. C. Snell and Mr. C. F. McInnes. One of the main points in the case for the Corporation against the reduction was that the tramway supply of recent years had tended to diminish, whilst the tramway company's argument was that the tramway supply was from 40 to 50 per cent. of the total units sold by the Corporation. The arbitrator reserved his award, but we understand that negotiations are proceeding between the parties on the basis of abiding by the existing price on the understanding that the tramway company shall have a reduction on the price paid on the higher number of units taken per annum.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

We are able to state that in view of the success of the new Anglo-Belgian telephone cable, the laying of other and longer "loaded" cables will be undertaken in the near future.

In Jersey the telephone system is owned by the National Telephone Co. (while Guernsey has successfully worked its own telephone system for many years), and there is a feeling in Jersey that the telephone rates there will be increased on the Post Office taking over the system at the end of the year. On Saturday last a well-attended meeting under the auspices of the Jersey Chamber of Commerce and the Jersey Commercial Association passed a resolution in favour of the States of Jersey (the governing authority of the island) purchasing the telephone system from the Post Office. Mr. A. R. Bennett was one of the principal speakers at the meeting.

It is stated that the conference of municipal authorities to discuss matters connected with the transfer of the telephones to the State, which was to have been held at the Guildhall

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Oct. 26, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

27,162/10. **Brush-holders.** S. BEETON and THE MORGAN CRUCIBLE CO., LTD. In combination with the usual tension device on brushes, the inertia of which often prevents it acting quickly, a brass plate is attached to the side of the brush, and bent over the top and back again upon itself clear of the brush, to form a spring, on which the ordinary tension device bears. The brass plate may be attached as in the Battersea connection, described in our last issue, page 583; or with tubular-spun rivets passed through the brush and flattened over the plate. Four figures.

709/11. **Dynamo Connection.** H. LEITNER. To facilitate the work of connecting dynamos to the external circuit, especially on motor-cars, boats, or trains, the connections are all brought to a plug made in two parts. The shunt field and armature are connected to sockets in one half, which is attached to the dynamo, and the external connections are taken to studs in the other half, which fit the corresponding sockets. The studs are of different sizes, so that no mistake can be made in connecting up, and they are split to ensure good contact. Three figures.

1,544/11. **Metal Filaments.** W. C. HERAEUS G.M.B.H. and C. TRENZEN. A process of sintering partly decarbonised metal filaments consists of placing them in a tube of pure iridium, which is heated to a temperature between 1,400° and 1,600° C. by passing currents up to 1,500 amperes through it, in the presence of a reducing gas. Means for passing the current, reducing gas, &c., are also covered by this patent Two figures.

1,914/11. **Fusible Cut-out.** H. HIRST and F. M. CHAPMAN. An improved form of cut-out has a base in the form of a cylindrical china box, which has two raised portions. Spring contact plates are mounted on these, and clamped by the terminals. The former project beyond the raised portions, and are folded to give resilience. The lid is also provided with contact pieces, and so arranged that when slightly rotated it makes contact with the plates in the base. The fuse wire is carried in a channel formed in a separate wall in the lid, so that it can be easily renewed. Four figures.

Opposition to Grant of Patents

14,615/08. **Dry Cell.** H. HUNTE. The appeal referred to in ELECTRICAL ENGINEERING, January 20th, 1910, p. 50, which was lodged against the decision of the Comptroller to grant this patent, has been abandoned. It relates to a dry cell with vertical air-passages through the depolariser open at the top and bottom. The specification was abstracted in ELECTRICAL ENGINEERING, September 30th, 1909, Vol. V., p. 859.

Restoration of Lapsed Patents

8,421/04. **Railway Signalling.** F. H. HIGLEY. An application for the restoration of this patent has been granted. It relates to crossing permit apparatus to enable the working on a single line of wire, together and in combination with tablet apparatus.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Names in italics indicate communicators of inventions from abroad.

Distributing Systems, Cables, and Wires, Insulating Materials: TURNER [Insulating sheets] 23,621/10; JAMES and JONES [Fastening conductors to walls, &c.] 25,846/10; DUNNING [Circuit controlling devices] 13,830/11.

Dynamos, Motors, and Transformers: MILLER [Portable D.-C. transforming devices] 25,065/10; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Dynamo brushes, connections] 76/11; WALKER [Brush-holders] 1,338/11.

Electric Ignition: LUX, 325/11.

Heating: LOFQUIST [Water-heating] 15,302/11.

Instruments and Meters: HARDINGHAM (*Hartmann and Braun Akt.-Ges.*) [Recording apparatus] 8,612/11; SPRAGUE, and CHAMBERLAIN & HOOKHAM, LTD. [Prepayment mechanism] 11,929/11.

Switchgear and Fittings: HATTON [Lamp reflectors] 23,085/10; FOSTER [Automatic switch for accumulator charging] 23,377/10; ECKSTEIN and HEAP [Switches] 23,525/10, and [Spring contacts for switches, fuses, &c.] 23,526/10, and [Switchboards] 23,894/10; WELFORD [Switches] 23,622/10; CHAPMAN and MASON [Grip for flexible cords] 26,909/10; TUCKER [Switches] 27,903/10; ROBINSON [Combination locks for switches] 2,722/11.

Telephony and Telegraphy: SCHIESSLER [Apparatus for electrical vibrations] 24,696/10; MAGINI [Rectification of alternating discharges] 3,865/11; THOMPSON (*Ges. für Drahtlose Telegraphie*) [Producing oscillations by D.C.] 6,682/11; MACKENZIE (*American Transmitter & Manufacturing Co.*) [Telegraph transmitters] 10,043/11; CROWE and BRITISH L. M. ERICSSON MANUFACTURING CO. [Telephone transmitters, receivers, &c.] 11,132/11.

Traction: PRATGINESTOS DE BONAPARTE [Safety interrupter for trolley trams] 7,645/11; HARHORN [Hub-motors] 5,870/11.

Miscellaneous: KOOPMAN, and PONTELEC WELDING PATENTS [Electric welding] 23,735/10; MARTIN [Extracting iron from ores] 24,052/10; ALCOCK & Co. PROPRIETARY, LTD. [Drying timber, electrical process] 25,175/10; MORRISON [Primary batteries] 25,315/10; HEATH [Combined bell-push and temperature alarm] 27,508/10; MACKEY [Treating liquids] 1,327/11; BEY [Electric signs] 3,789/11; RAILING and KRAUSE [Fans] 3,918/11; TOUSEY [X-ray tubes] 7,076/11; ROGERS [Alarm signal] 8,044/11; SCHAEFFER [Motor-driven air propeller] 13,623/11; NEUDOERFFER [Pocket lamps] 14,604/11; WARIN [Electric letter-box signal device] 365/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: ROBERT BOSCH [Starting device] 18,082/11.

Telephony and Signalling: MANSON [Signalling devices] 15,138/11; AKTIEBOLAGET L. M. ERICSSON & Co. [Common battery system] 21,924/11; MCLARN [Switchboards] 22,046/11.

Miscellaneous: ROBERT BOSCH [Condensers] 17,438/11; PLANIAWERKE A.-G. KOHLEN-FABRIKATION [Carbon electrode] 18,733/11.

The following amended Specification can now be obtained.

LACHMAN [Electric welding] 23,077/05.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

25,519 of November 2nd, 1897. **Electrodes.** J. HARGREAVES. Pieces of gas-retort carbon with true or rough surfaces are arranged in the form of walls, columns, or arches. These are secured by screws or wedges in a cell of Portland cement or other material, and supported by the walls of the cell. To ensure good contact, powdered plumbago is inserted in the spaces between the pieces of carbon.

25,816 of November 6th, 1897. **Insulator.** D. SINCLAIR and W. AITKIN. An insulator for supporting telegraph, telephone, and other wires, and intended for use in connecting branch or leading-off wires from the main lines without lowering the insulation, consists of two parts. The inner has a groove cut up the sides and across the top to take a portion of the covered conductor. The outer part, which is of the usual material, is threaded, and fits into a corresponding thread on the inner part, so that good protection is obtained from the weather.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: E. R. VIALE, 15,481/03; J. O. GIRDLESTONE [Multiple-carbon] 15,857/07; J. C. CHALMERS and W. A. ROBERTSON, 16,027/07.

Distributing Systems: W. E. EBERT [Distribution] 15,634/07; W. FENNELL and W. P. PERRY [Distribution] 15,846/07.

Dynamos, Motors and Transformers: C. A. PARSONS (*C. E. L. Brown*) [Regulating, by prime mover] 15,431/02; ELECTRIC & ORDNANCE ACCESSORIES Co. and R. F. HALL [Suspension gear for driving] 15,532/03; M. J. E. TILNEY [Speed control] 15,989/06; J. BRUNCKEN [Induction motor control] 15,648/07; C. A. PFANSTIEHL [Transformers] 15,810/07; LA COUR [Controlling motors] 15,834/07.

Electrochemistry: J. HARGREAVES [Producing alkalies by electrolysis] 15,502/98; A. G. BETTS [Obtaining antimony, &c., by electrolysis] 15,294/04, and [Anode slime, treating] 15,298/04.

Storage Batteries: M. J. E. TILNEY [Regulation] 15,988/06.

Switchgear, Fuses, and Fittings: H. M. DARRAH and L. A. HACKETT [Lamp holders] 15,247/03; M. B. FIELD, C. C. GARRARD and FERRANTI, LTD. [Cut-outs; switches] 15,455/04; VERITYS, LTD. and E. E. GOTT [Starter resistances] 15,648/04; BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Switches] 15,984/06.

Telephony and Telegraphy: Q. MAJORANA [Microphones] 14,314/05; A. W. SHARMAN and DE FOREST WIRELESS TELEGRAPH SYNDICATE [Adjustable capacity-inductance] 15,615/06; ELECTRIC & ORDNANCE ACCESSORIES Co. and R. F. HALL [Line selecting switch] 15,704/06; C. F. SCOTT and T. BOULEVARD [Telegraph and telephone systems] 14,752-3/07; A. ANKER [Hygienic receiver attachment] 15,755/07; W. W. POWLES and E. E. MOORE [Two-tone sounder] 15,773/07; SIEMENS BROS. & Co. and G. S. GRIMSTON [Selective switch] 15,878/07; J. W. MACKENZIE (*C. Lorenz*) [Telephone call bell] 16,087/07.

Traction: M. and P. DALEY [Railway station indicator] 15,636/07; L. BEECHER [Conduits, collectors] 15,769/07.

Miscellaneous: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Resistances] 15,985/06; T. P. POLLITT [Winches] 15,922/07; W. THOMSON [Pocket lamps] 16,034/07.

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this month, has been postponed, and in all probability will not be called together until the price which the Government will pay is known.

In consequence of the threat of the National Telephone Co. to remove certain telephone poles in Hythe (see ELECTRICAL ENGINEERING of October 19th and 26th), a Hythe subscriber named Dickens applied in the Chancery Division on Friday for an injunction to restrain the company from cutting off his service. After some discussion it was agreed between the parties that the company should not disconnect service at any rate for a week, when a further application will be made to the Courts.

According to the Paris correspondent of the *Morning Advertiser*, an ambitious scheme for connecting France with her possessions in all parts of the world by wireless telegraphy is under consideration. The estimated cost of this colonial scheme is £480,000, and, if decided upon, it would be completed in about three years.

The proposed increase of the Marconi Wireless Telegraph Co.'s capital of 250,000 £1 ordinary shares was sanctioned at an extraordinary general meeting on Wednesday last week. Mr. Godfrey C. Isaacs, managing director, who presided, surveyed the position of the company. In addition to Capt. Adrian Simpson, a member of the company's staff, having been appointed managing director of the Russian company, Mr. Marconi and Mr. Isaacs have joined the Board. The company's offer to construct a number of stations in Chili has been accepted by the Government there, and he hoped that he would be able shortly to announce that the construction of the stations involved in the Imperial scheme had been commenced. According to newspaper reports, these stations will, in all probability, be under the direct control of the General Post Office, and the Postmaster-General himself will fix the rates for the transmission of messages. The number of stations will be about twenty-five, and the average cost £60,000 per station. As already announced, the stations will be Malta, Cyprus, Aden, Adelaide, Bombay, Colombo, Singapore, Perth (Australia), Sydney, and Wellington, with an extension later to Singapore and Hong Kong. In this way Great Britain would become quite independent of the submarine cable system.

The various happenings in the telegraph world to be brought to the notice of our readers this week are not of a very exciting nature. The Kedah route was down on October 24th, and on the following day the Teneriffe—St. Louis cable failed, and messages will be sent until repair via the Brest—Dakar route. On October 27th the Kotonou—Gradbassam cable ceased working, and the Bhano route was down on 30th. As from the 31st ulto communication with Mogador was again normal. Owing to the Chinese revolution private telegrams for all places in China, with the exception of Shanghai, Foochow, and Amoy, should only be accepted at sender's risk, and telegrams for Hankow can only be accepted when written in plain English. Telegrams for Hongkong are circulating as usual. The cable between Assab and Perim, which has been down since July 8th, 1909, is still on the sick list, as is also the cable between Lattaquie and Cyprus, which has been down since May 24th, 1910. Communication with Alaska is still interrupted, and the cable between Bissao and Bolama has been broken since September 26th last.

LOCAL NOTES

Brighton: *Charge for Heating.*—The Council have adopted the recommendation of the Electricity Committee to charge a flat rate of 1d. per unit for current for heating and cooking purposes.

Cardiff: *Electricity Undertaking.*—For the June quarter the revenue from the electric light undertaking increased by £750 over the corresponding quarter last year, whilst the working expenses increased by only £100. Mr. Arthur Ellis, the Electrical Engineer, reports that builders are now recognising the value of wiring houses.

Chester: *Electrical Extension Scheme.*—The Electricity Committee recommend the Council to retain Mr. J. F. C. Snell to inquire fully into the financial and engineering conditions of the electricity undertaking at a fee of 250 guineas. The Finance Committee, however, express the opinion that it is not desirable to make this appointment owing to the large expense involved.

Douglas (I.O.M.): *Electric Lighting.*—At a public meeting held in the Town Hall last week, the question of proceeding with the scheme prepared by Messrs. Handcock & Dykes, referred to in our last issue, was discussed. After some discussion, the matter was adjourned.

Eccles: *Lighting Small Houses.*—The Borough Electrical Engineer has reported upon the experiment of lighting a number of small houses in Corporation Road. The houses were built by the Corporation, and are supplied with light at 6d. per week per house, this charge being included in the rental, and the supply being unrestricted. The report states that the Health Committee have made a slight profit on the transaction, and that the experiment must be regarded as satisfactory.

Edinburgh: *Fire in Cooling Tower.*—A considerable portion of the woodwork of one of the new cooling towers now in course of erection at the electricity works was destroyed by fire last week. The fire, which was confined to the inside of the tower, received considerable assistance by the fact that the woodwork is creosoted. The walls of the tower consist of cast-iron plates, and it is thought possible that the fire was caused by the dropping of a red-hot bolt by the riveters working at the top. Mr. F. A. Newington, City Electrical Engineer, is at present unable to estimate the damage, but, providing none of the outside structural plates have buckled and the main wooden stanchions are uninjured, the delay will not be serious.

Heckmondwike: *Supply from Power Company.*—For some time the Council have been discussing whether to add to their own generating plant or take a supply in bulk from the Yorkshire Electric Power Co. After considerable negotiation, the latter course has been adopted.

Leigh (Lancs): *Lighting Small Houses.*—The Electrical Engineer recommends a scheme for supplying electric light to cottages on the lines of the experiment at Eccles mentioned above! The Committee have asked for further details.

Oldham: *Electrification of Mills.*—It was reported to the last meeting of the Oldham Electricity Committee that Messrs. W. H. Haigh & Co. have under consideration the conversion to electric driving of their Lowermoor works, and the Borough Electrical Engineer has been in consultation with the company with regard to the scheme. If the experiment is satisfactory, the firm might next year also convert their Plane Street works.

Stoke-on-Trent: *Electricity Accounts.*—The first year's report of the working of the electricity undertakings belonging to the new County Borough of Stoke-on-Trent has just been issued. At Burslem there has been an increase in sales of 180,000 units; in Hanley, 230,000 units; Longton, 90,000 units; and in Stoke, 250,000 units. After meeting capital charges, the Burslem Electricity Works show a profit of £825; Hanley, £259; Stoke, £275; and Longton, £195. In all cases, with the exception of Stoke, the profit has been transferred to reserve, whilst the balance at Stoke has been devoted to wiping out the loss on the previous year's working.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Argentine.—The Direccion General de Obras Hidraulicas, Buenos Aires, has been authorised to proceed with the erection of workshops at the harbour of Concepcion del Uruguay. It is proposed to instal generating plant as well as electrically-driven machinery, cranes, &c.

Bootle.—Extensions to the generating plant are proposed.

Bradford.—A Local Government Board inquiry was held last week concerning a loan of £16,940 for electricity extensions. There was very little opposition.

Bridlington.—Application is to be made to the Local Government Board for sanction to borrow £3,000 for mains and services.

Erith.—The Electrical Engineer has submitted an estimate showing the prospective expenditure during the next few years as follows:—Mains and cables, £4,000; house services, transformers, and sub-stations, £3,258.

OSRAM-LAMPS

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Hastings.—A loan of £2,000 for mains extensions is to be applied for.

Java.—The Ankola Tea & Rubber Co., which has just been formed, proposes to erect an electric generating plant upon their estate.

London: *Fulham.*—The Finance Committee of the London County Council recommend a loan of £9,500 for extensions to the electricity undertaking.

Salford.—The Electricity Committee have submitted a scheme for extensions of the generating plant at a cost of £35,000. In addition, it is recommended that application be made for powers to borrow £15,500 for two 1,000 kw. turbo-generators. The Corporation have adopted the whole scheme.

Stretford.—Tenders are invited by November 13th for electric mains and accessories. Particular from the Electrical Engineer.

West Ham.—An application is to be made to the Local Government Board for a loan in connection with the provision of three 5,000-kw. two-phase 6,000-volt turbo-alternators, and twelve boilers each with an evaporative capacity of 37,500 lbs.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Birmingham.—Considerable extensions to Council House and Art Gallery.

Croydon.—New public library at Thornton Heath.

Eastbourne.—New wing at Queen Alexandra's cottage homes.

Heywood.—Tenders are invited for an electric light installation at the offices of the Heywood and Middleton Water Board. Architects, Messrs. J. Diggle & Son, Heywood.

Leicester.—New public hall. Town Clerk.

Rochdale.—It has been decided to light the Smith Street baths by electricity.

Swansea.—Fifteen houses, Maesteg Street, Mr. D. W. A. Saunders.—Eighteen houses, Ysgol Street, E. Murphy.

Warrington.—A new boys' department at the Bolton Council school. Architects, Messrs. Wright & Hamlyn. Tenders by November 10th.

MISCELLANEOUS

India.—The Secretary of State for India invites tenders by November 14th for electric cranes. Particulars from W. G. Butler, Director-General of Stores, Whitehall.

Newport (Mon.).—An automatic electric lift is required at the workhouse infirmary. Architect, H. J. Griggs, Metropolitan Bank Chambers, Newport.

Tasmania.—Tenders are invited by the Deputy Postmaster-General, Hobart, by December 11th, for 4-nauts of india-rubber-insulated submarine telegraph cable. Further particulars at 72 Victoria Street, London, S.W.

TENDERS RECEIVED AND ACCEPTED

Bradford.—Subject to the Local Government Board's sanction, a third Curtis turbo-generator is to be supplied by the British Thomson-Houston Co., Ltd., at £10,292.

Glasgow.—The tender of Messrs. Richardson, Westgarth & Co., for a turbo-alternator (Brown Boveri alternator) for the Pinkston power station at £13,413, has been accepted.

Hastings.—The following tenders have been received for the electric wiring, &c., at the workhouse. In the case of those firms where two prices are quoted, the second includes the use of Stannos wire. The other price is for ordinary wood casing. Edmundson's Electricity Corporation, £1,026 and £986; Harland, Bowden & Co., £755 11s.; Bruce & Co., £775; Taylor & Co., £870; Sherrard Bros., £535 and £500; Tredegar & Co., £412 and £348 5s.; Galliers & Co., £609 17s. and £704 18s.; A. H. Wood, £796 14s.; Savill & Walton, £928 18s. and £983; Newbald & Co., £758 and £775; Electrical Co., £600; F. G. Pettitt, £672 and £785; Fryer & Co., £1,255 10s.; Price & Co., £401 and £380; Tilley Bros., £560 14s. and £595 14s.; Besant & Co., £750 and £765; Hancock & Rickson, £568 5s. and £489 15s.; Weston & Co., £608 8s. and £690; Reed & Sons, £695 11s. and £687 9s. The tender of Messrs. Tredegar & Co., for Stannos wire, at £348, has been accepted.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £57 7s. 6d. to £57 12s. 6d. (last week £57 15s. to £58 5s.).

Switchgear and Cowans (1911), Ltd.—The business of Cowans, Ltd., will in future be carried on in conjunction with that of The Switchgear Co., Ltd., for which purpose a new company under the above name has been registered. The business will be carried on at the Springfield Lane Works, under the personal control of Mr. J. G. Statter, as managing director, who heretofore controlled the business of the Switchgear Co., Ltd.

G. Braulik.—We are informed by G. Braulik that he is now supplying under licence under the Bremer-Westinghouse patents his old type D.C. flame arc lamp, which can be supplied from stock. The firm are opening a branch office at Prince's Chambers, 16 John Dalton Street, Manchester, under the charge of Mr. Wyndham Wadsworth.

Liquidations.—The trade creditors of the Davis Electrical Co., Ltd., 17 Moor Street, Cambridge Circus, London, find themselves in a somewhat awkward position. The total unsecured liabilities of the trade creditors amount to £3,333, but they find themselves prevented from participating in any distribution owing to the existence of a debenture, which entails first charges amounting to £3,100. This debenture, moreover, has been created in respect of arrears of salary of Mr. Davis, and the circumstance caused a good deal of discussion at the meeting of creditors last week.

The Beck Flame Lamp, Ltd., is to be wound up voluntarily with a view to reconstruction. Mr. H. J. Page, 21 Ironmonger Lane, is liquidator.

The Winchester Electric Light and Power Co., Ltd., having been acquired by the Winchester Corporation, is now to be wound up voluntarily. Mr. F. E. Gripper and Mr. A. R. Dyer are liquidators.

A meeting of the Aluminium Corporation, Ltd. (1907), will be held at 60 London Wall, on December 6th, at 12 noon, to hear the liquidator's account of the winding up. This notice does not refer to the Aluminium Corporation, Ltd., which was incorporated in 1909.

The Economic Electric Co., Ltd., is to be wound up voluntarily, and Mr. F. T. Deyes, 5 Cook Street, Liverpool, is liquidator.

A meeting of creditors of the Doncaster Electrical Co., Ltd., was held at 13 Printing Office Street, Doncaster, on Monday. A. E. Stringer, Cheapside Chambers, Bradford, is liquidator.

Dissolution of Partnership.—J. Williamson and F. Woodfin, electrical engineers, 138 Northgate Street, Chester, have dissolved partnership.

APPOINTMENTS AND PERSONAL NOTES

Mr. H. W. Marshall's agreement with the Hammersmith Borough Council as canvasser and agent for the Electricity Department has been terminated, and a fresh appointment is to be made.

Mr. J. R. Garner, for eight years works manager of the Electric & Ordnance Accessories Co., Ltd., Aston, Birmingham, has resigned in order to take up a similar position with the Lancashire Dynamo & Motor Co., Ltd., Manchester. On Friday last, at a farewell smoking concert, Mr. J. D. Morrison, on behalf of the staff, made a presentation of a specially designed roll-top desk to Mr. Garner, which was represented by a model made by the pattern-makers in their spare time.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Calcutta Electric Supply Corporation.—An interim dividend at the rate of 7 per cent. per annum has been declared for the June half-year upon the ordinary shares.

Toronto Power Co.—This company is offering for subscription £821,917 4½ per cent. consolidated debenture stock at 96.

Companies Struck Off Register.—The names of the following have been struck off the register of joint stock companies: Macclesfield Electric Light & Power Co., Penarth Tramway Syndicate, Phœnix Electric Heating Co. Notice is also given that the name of the British Electric Co., Ltd., will be struck off the register in three months unless cause is shown to the contrary.



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ELECTRICAL ENGINEERING

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Electrical Works, Plant and Stock.

WHEATLEY KIRK, PRICE & CO.,

[Established 1850.]

46, WATLING STREET, LONDON, E.C. 16, ALBERT SQUARE, MANCHESTER.

26, Collingwood Street, Newcastle-on-Tyne.

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SUMMARY

The Council of the Institution of Electrical Engineers has consented to the consideration of the proposed new Articles of Association being adjourned, and the meeting last Thursday resolved itself finally into an informal discussion, in which, however, valuable suggestions for the amendment of the Council's proposals were put forward, and met with cordial support by the members present. We have formulated a list of objections to the proposals which we have sent to the Council, and to which we have obtained numerous signatures. These objections are set out in our article, and we invite our readers to co-operate. In the Provinces the opposition is even more marked than in London, and in addition to the objections to the name "Licentiate," proposed for the new class of members, and to the unfortunate mistake the Council has made in proposing an unacceptable method for the yearly election of Council, feeling runs very high against the proposals for increasing subscriptions. (Pages 605 and 611.)

The Electrical Apparatus Co.'s new works is described in an illustrated article. The principal manufactures carried on there are motor starters, ironclad switches, fuses, and ampere-hour meters, including a prepayment pattern. (Page 605.)

Three Papers on electrometallurgy of iron and steel, read at a previous meeting, were discussed at the last meeting of the Faraday Society. In these Mr. J. Härdén described his combined arc and resistance furnace; Mr. D. F. Campbell gave a general survey of recent progress; and Mr. E. K. Scott described the Hering "pinch effect" furnace. (Page 606.)

Mr. J. F. C. Snell's address to the Manchester Students' Section of the Institution of Electrical Engineers contained some words of advice to young engineers and a description of a power scheme at Bahia Blanca. (Page 607.)

The Borough Council of Southwark has installed a turbo-generator in the power station at Walworth. The turbine is of the mixed pressure impulse type, and the generator is designed to give either D.-C. or A.-C., the commutator of which is specially cooled. A cooling tower has had to be installed, and this is erected over the boiler house. (Page 608.)

After a long debate at the meeting of the St. Marylebone Borough Council on Thursday, it was decided to instruct the Electric Supply Committee to report as to the advisability of continuing the Sales and Publicity Department upon its present lines. A not unimportant feature of the debate was the expressed desire of the opponents of the Sales Department that their action should not be construed into any attack upon the officials who, as a matter of fact, received credit for the manner in which their work is being carried out. (Page 609.)

The application by a consumer for the appointment of an electrical inspector at St. Pancras was further discussed at the Clerkenwell Police Court last week. The Magistrate expressed the opinion that he ought to appoint an inspector but on the application of the St.

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Pancras Borough Council he again adjourned the hearing of the application. (Page 609.)

Professor W. C. Unwin's Presidential address to the Institution of Civil Engineers dealt largely with engineering education. (Page 610.)

The appeal against the arbitrator's award in connection with the substitution of Parson's for Westinghouse turbines at the Lot's Road generating station has been heard this week. The Westinghouse Co., object to the decision that they are to bear the whole cost of the Parson's turbines, plus the difference between the actual and contract steam consumptions of the Westinghouse machine. In this way they claimed that the Underground Electric Railways Co. is placed in a more favourable position than it would be had the Westinghouse machines been up to contract and continued to work. (Page 611.)

In our Electric Traction Notes we give a report of an important arbitration, which is now proceeding, to determine the price which the L.C.C. has to pay for the London lines of the London United Tramways Co. The Dundee Corporation have accepted the tender for the installation of a trolley-omnibus system.—An amalgamation is proposed between the London General Omnibus Co., the London Electric Railways Co., and the Metropolitan District Railway Co.—A tube scheme for Manchester is in course of preparation. (Page 613.)

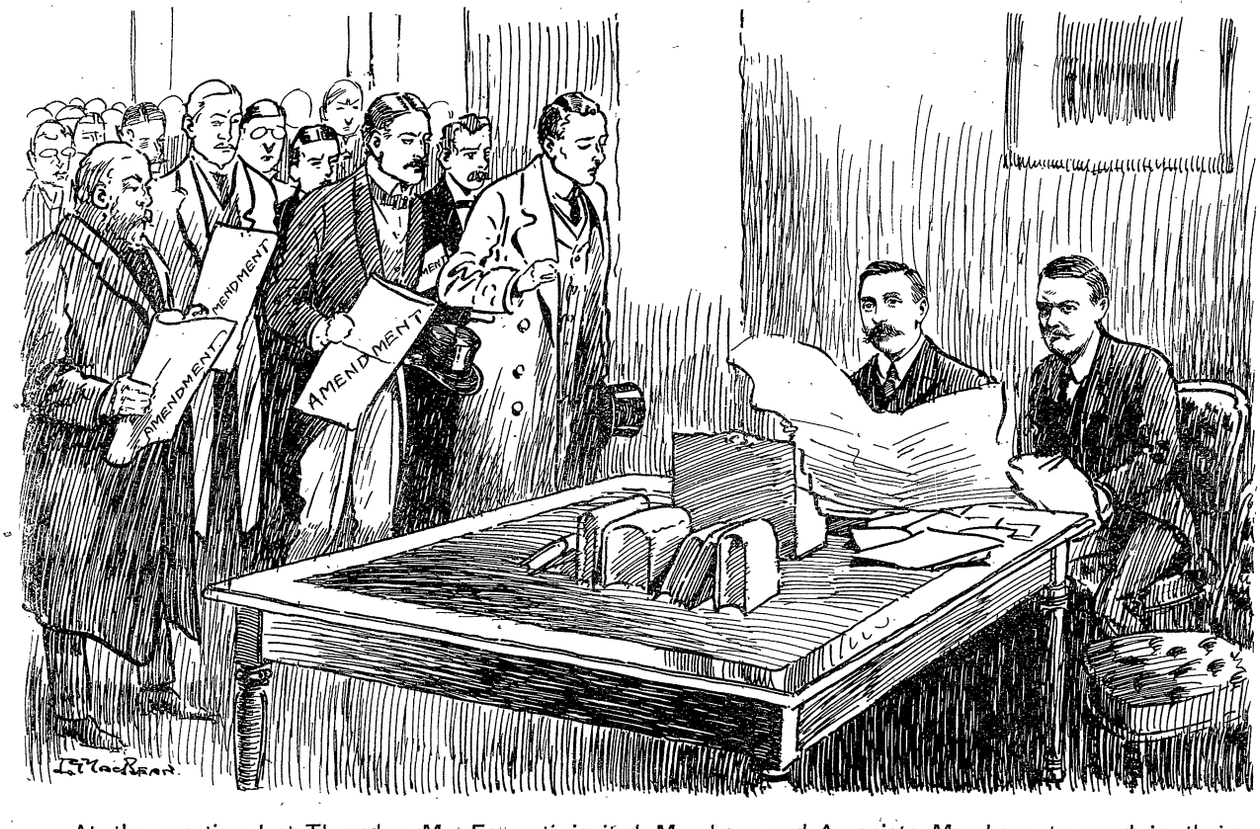
Under Telegraphy and Telephony (including Wireless) we refer to the suggested co-operation between the London Borough Councils to oppose the Postmaster-General on the question of overhead wires; and the laying by the Postmaster-General of an underground telephone cable at Hythe. (Page 613.)

An improved method of connecting flexible conductors to carbon brushes, by the British Thomson-Houston Co., and another for lamp-holders, in which an angle grip is provided on the cup and ball principle, were published by the Patent Office last week. Liquid instead of metal electrodes for drying timber, and an improved construction for hair dryers, are also protected. A process for welding metal plates together is covered by E. B. Koopman and the Pontelec Welding Patents, Ltd., as well as a new form of electric sign by H. Bey. (Page 614.)

An inquiry is to be held into the working of the Elland Electricity Works for the past year's work.—The Mayor of Marylebone (Mr. E. R. Debenham) spoke highly of the manner in which Mr. A. Wright had put the supply undertaking upon a sound foundation. With regard to the work of the Sales Department he said that the officials were only carrying out the declared policy of the Council, and that every effort was made not to interfere with the work of contractors.—The Luton Electricity Committee are to spend £200 upon the purchase of electric cooking apparatus for hiring out.—The Finance Committee of the L.C.C. suggest that a programme should be arranged for the future development of electric supply in London in view of the purchase of the Companies' undertakings.—The new works of Metalite, Ltd. at Derby were opened on Monday. (Page 615.)

The Wolverhampton Corporation are to spend £21,000 upon electrical extensions, of which £10,000 is to be provided from reserve.—Two 1,000-kw. turbo-generators are required at Salford; an electric tramway, lighting and power works at Napier (N.Z.); an electric power station in Jerusalem; stores at Bournville; and boosters at Sydney.—New mains are to be laid at Llandudno and Walsall.—The New Zealand Government is conducting an inquiry with a view to large extensions of the telephone system. (Page 615.)

For Arrangements for the Week, see p. 610.



At the meeting last Thursday, Mr. Ferranti invited Members and Associate Members to send in their suggestions and amendments to the Council's proposals for alteration of the Articles of Association of the Institution of Electrical Engineers. We predict a hearty response.

PUBLISHERS' NOTICE:—Books containing 48 Reprints of the Cartoons from Oct., 1910, to Sept., 1911, may be obtained, Price* 8d. *net (post free 9½d.).

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OBJECTIONS TO THE PROPOSED CHANGES AT THE INSTITUTION OF ELECTRICAL ENGINEERS

THE Council's proposed new Articles of Association are meeting with strong opposition. At the meeting called to pass these new Articles last Thursday, there were nearly a hundred members present, most of whom had evidently come for the purpose of objecting to the new proposals. In fact the opposition would have been strong enough to have defeated the Council's Resolution by an overwhelming majority had not the President announced that the Council would defer to the wishes of a large number of members from all parts of the country, and would adjourn the formal meeting to discuss the proposals. This formal meeting will not be held until November 30th, possibly later, but in the meantime there will be an informal meeting at the Institution in London on Thursday next (Nov. 16th), to discuss the matter, and discussions are taking place in the provinces at the Local Sections. Never before has any proposition of the Council given rise to so much dissatisfaction.

The alterations proposed by the Council may be summarised as follows:

THE COUNCIL'S PROPOSALS.

Candidates for Associate Membership may be called upon to pass examinations.

The Associate class to be confined to men who are *not* electrical engineers.

A new class of members to be formed, called "Licentiates," and permitted to use the abbreviation Licentiate I.E.E., whose only qualification is that they are educated persons engaged in electrical engineering or science.

The Council to be free to elect any man of science as a (full) Member.

One hundred eminent lawyers or commercial men who have rendered important services to electrical engineering to be eligible for (full) Membership—fifty at first and then ten a year.

Candidates for membership of any class, if they reside abroad, to require only one signature instead of five to their application form.

The rules for Professional Conduct to be embodied in the Articles, and members breaking them to be liable to expulsion.

The Ordinary Members of Council to consist of 12 Members, 3 Associate Members, and 3 Associates.

A Past-Chairman as well as the Chairman of each Local Section to have a seat on the Council, but the two may not vote simultaneously.

In the ordinary course the new Council for the following session is not to be elected by the membership, but is to be nominated by the Council. The only exception is to be if twenty-five Corporate Members have, previously to March 1st, (*i.e.*, nearly three months before the annual general meeting) nominated candidates to whom the Council object.

The Council to be allowed to delegate all its powers to any Committee, whether appointed from their own body or not.

The Council to have absolute discretion to incorporate any other society whatsoever with the Institution.

The subscription of every class of members, except students, to be raised: Members to pay 4 guineas instead of 3; existing Associate Members and Associates, 2½ guineas instead of 2; new Associate Members and Associates 3 guineas. The subscription of "Licentiates" to be 2 guineas, of students over nineteen 1½ guineas, and students under nineteen 1 guinea.

In view of the heavy drain on the funds of the Institution on account of the acquisition and rebuilding of the Institution's palatial home on the Victoria Embankment, an increase in the subscriptions may be necessary to meet current expenses and the growing activities of the Institution, although it was formally announced when the scheme for the new building was adopted that it would entail no increase of subscription. Apparently the Council has been more lavish than was originally contemplated, and omitted to take account of the possibility of the upper part of the building being untenanted, a possible contingency against which they now find they must make provision. If a mistake has been made in providing the Institution with more luxurious quarters than it can afford, it is too late to mend it, and we can only enjoy our luxury and pay for it. In view, however, of the possibilities of an increase in revenue from recruits to both the non-engineering and the newly-proposed junior grade, it would appear that the provincial members might, at any rate, be relieved of the burden of increased subscriptions.

The proposed examinations for new candidates for Associate Membership will only come in force in January, 1913, and we can reserve our comments until a more definite programme is published. Examinations are free from objections if the submission of a thesis is offered as an alternative. The insistence on observance of the rules for Professional Conduct is good, but the wording of the preamble does not make it clear that they are intended only to apply to members practising as consulting engineers; an amendment has been suggested which doubtless the Council will accept. That Local Sections may send a Past Chairman to represent them on the Council when the Chairman cannot conveniently attend is an extremely sensible arrangement.

Our approval of the proposed new Articles goes no further, however. We object most strongly to all the other innovations. We have formulated our objections in the form of a series of amendments, and have already been supported by a number of Members and Associate Members.

OBJECTIONS TO THE COUNCIL'S PROPOSALS.

We contend that—

(*a*) **Only Members and Associate Members must be permitted to use the Official Abbreviations.**

(*b*) **"Associates" must henceforth be called "Affiliated Members." [Members of this class, not being engineers, should have a name which will avoid confusion with Associate Members.]**

(*c*) **The new class of Members must be called "Subscribers" instead of "Licentiates" [for this new class will be composed of men with limited qualifications and experience].**

(*d*) **Not more than two persons whose only qualification is eminence in science and who are not engineers must be admitted annually as Members. [Others can be elected as Affiliated Members or Subscribers.]**

(*e*) **Eminence in law must only qualify for Affiliated Membership and not for Membership.**

(*f*) **In the case of foreign candidates for Membership, the same number of personal recommendations must be required as in the case of British subjects, and not less.**

(*g*) **There must be four Associate Members and only two Affiliated Members (Associates) on the Council, instead of three of each.**

(*h*) **The Council's proposals for new Members of Council must be sent to every Corporate Member six weeks before the Annual General Meeting, inviting further nominations within three weeks.**

(*j*) **Committees containing non-members of Council must be Advisory only, and must not possess the full powers of the Council.**

(*k*) **The Incorporation of other societies must not be effected unless allowed by a Special Resolution of Corporate Members of the Institution of which twenty-one days' notice has been given.**

In order that concerted action may be taken, and that the Council may not be embarrassed by receiving numbers of slightly conflicting amendments, we beg every Member and Associate Member who is in agreement with the above objections to the proposed new Articles to

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inform us on a postcard, and we will send them a form for their signature.

The Council, as will be seen from the report of the meeting which follows, is disinclined to make any alterations whatsoever in the proposed new Articles, and pressure can best be brought to bear upon them by the force of numbers. Some of our readers may have other criticisms to offer, but practically all of them will agree that, at any rate, the recommendations we have made in large type must be adopted.

The matter is urgent: the prestige of the Institution itself and of the Members and Associate Members individually is at stake, and we beg our readers to communicate with us at once.

REPORT OF THE MEETING.

An Extraordinary General Meeting of Members and Associate Members of the Institution of Electrical Engineers was held at 4.30 p.m. on Thursday, November 2nd. Seven days' notice of the meeting had been given, accompanied by a draft of the proposed new Articles of Association, and a notice of a resolution that they should be adopted.

The President (Mr. S. Z. de Ferranti) said that the Council believed that the amended Articles were in every way good from the point of view of the interests of the Institution, but they thought that a mistake had been made by making the time too short to enable a proper consideration of the Articles by the members. He therefore proposed: "That this meeting stand adjourned to a date to be notified not being earlier than the 30th November." After this resolution had been passed he would say a few words on the subject of the new Articles, and would invite suggestions from other speakers.

Mr. ROBERT HAMMOND (Honorary Treasurer), who was chairman of the committee entrusted by the Council with the revision of the Articles, seconded the proposal.

The PRESIDENT: I will now put it to the meeting.

Mr. A. J. MAKOWER suggested that the time of the meeting should be 8 p.m. and not 4.30.

This was opposed by the President, Mr. Hammond, and Mr. Siemens, but on Mr. Makower insisting, supported by Mr. A. P. O'Brien and the meeting generally, the President agreed to the change of time.

Mr. F. C. RAPHAEL pointed out that if the meeting were adjourned and notices were sent out in the same terms as for the present meeting, it would only be competent to discuss the entire Articles *en bloc*, and it would not be possible for any amendments to be proposed. The point was important, for Members and Associate Members were desirous of having a great many amendments made, and he trusted that they might have an assurance that at the next meeting steps would be taken so that these amendments should be in order.

Mr. Maurice Solomon supported Mr. Raphael, and after much discussion, in which the President, Mr. Alexander Siemens, and Mr. Sydney Morse took part, this was conceded.

Mr. MAKOWER: If the meeting stands adjourned, are we correct in going on discussing the proposals?

The PRESIDENT: It would be an informal meeting, of course.

Mr. A. J. CRIDGE asked whether, as the meeting would be an informal one after the resolution for amendment had been passed, any record would be taken of it. Otherwise the discussion would be useless.

Mr. A. H. DYKES urged that the resolution for amendment should be passed and the discussion proceeded with.

The PRESIDENT said that as members of the Press were present, the informal discussion would doubtless be reported and circulated.

Mr. RAPHAEL, who is Editor of ELECTRICAL ENGINEERING, said that only those members of the Press were present who are Members and Associate Members. He had been refused permission to send his shorthand reporter, and now requested that the shorthand notes of the official reporter should be placed at the disposal of the Press.

The PRESIDENT agreed to this; and after some further discussion the motion for adjournment was passed.

The PRESIDENT then said that there were two outstanding things to be considered in the new Articles. The first was the amount of subscriptions. He wanted to bring the Institution more into touch with the needs of the industry, in order to get more prosperity in electrical work, but the difficulty he met at every turn was that the Institution was working on so narrow a margin that there was no money for anything it wanted to do. The second question was that of the new membership or the alteration of membership. He had been largely responsible for trying to force home the idea that the Institution wanted to be not only a scientific society, but also a body which dealt generally with the whole wide interests of electrical work in this country. In order to put the Institution in such a form that it could be really useful to the interests of all concerned in electrical work, it was desirable not to limit the membership to the purely technical people. They wanted to bring in many able men who were not purely electrical engineers, and to get them to help to conduct the business of the Institution. He then called on Mr. Hammond to speak first as the Chairman of the Articles Committee.

Mr. HAMMOND's remarks, with amplification, have already been printed, and sent by the Institution to every Member and Associate Member, so that they need not be reported at length here. He reviewed some of the alterations which the Council proposed to make in the Articles of Association (summarised on page 603), and mentioned that the Committee appointed to revise them consisted of 12 Members, and included six Chairmen of Local Sections. He said that an increase in subscriptions was not necessitated by the new building *per se*, although he admitted (in the subsequent additions made in the printed report), that the present small margin was contingent upon the letting of the upper part of the building on similar terms to that paid by present tenants, who are leaving next June; otherwise there might be a liability of about £3,000 a year to meet. To meet this possible liability a number of past and present members of Council have generously formed a guarantee fund, amounting to about £7,500, but the increased subscriptions would certainly be a welcome addition to the credit side of the account. He mentioned a number of proposals which would be possible to carry out if the revenue were greater, namely, the establishment of an employment and information bureau, a lending library, additional meetings and lectures, summer meetings, additional staff, more frequent publication of the journal, &c., which he estimated (in his statement made subsequently to the meeting), would involve an initial expenditure of about £2,000, and an annual expenditure of over £2,000 per annum. Finally, he said (amid cries of "No, no") that the proposals were not new, but had been mentioned in the Council's Annual Report.

Mr. MAURICE SOLOMON, who was the next speaker, and who may be taken to give expression to the opinions of members of the Birmingham Local Section, objected to the introduction of a new class of members, and the splitting up of the Institution into so many classes and divisions. The Institution could be made a purely professional body, or an Association of all concerned in electrical engineering trade or industry. But it was not possible to do both, and the Council's endeavour to do so was destined to failure. To be a professional Institution three classes of members only were required: Members who are at the top of their profession, Associate Members, who are the great average of the people in the profession (both classes strictly professional men), and Associates, including all the non-technical men. The other and broader ideal would entail only two divisions: Members, including the most distinguished people, whether technical or non-technical, and Associate Members, including the great run of people, whether technical or non-technical. Mr. Hammond, in his statement for the reason of the increase of the fees, Mr. Solomon continued, had made a financial statement in which not one figure whatever was put before them. If they were to be asked to raise their subscriptions they should be shown what the additional income was to be used for. Consideration should also be shown for the fact that country members cannot enjoy the same advantages as town members, for the palatial Institution was of no practical use to them. Mr. Solomon also criticised the representation of Associates on the Council as not being in keeping with the remainder of the proposals, and objected strongly to the new method put forward in the Articles for the selection of new members of Council. Finally, he said that the Local Sections and individual members were very anxious to propose amendments, and a good discussion on them by the members all over the country was necessary. At Birmingham a meeting had been hastily called on the previous Tuesday, and a resolution was sent in requesting the Council to submit these Articles for discussion at the local centres. He hoped the Council would accede to that request, which was signed by most of the leading members of the Birmingham Section. He understood that similar resolutions had been sent in from many of the other branches.

Mr. CRAMP pressed for some definite decision as to the mode of procedure, especially with regard to discussion and amendments by the Local Sections.

Mr. E. H. RAYNOR asked that an explanatory letter should be sent out dealing with the effect of the Council's proposals [a similar request had been sent in by others], and a review of the present and future financial situation. He asked that a *résumé* of the Treasurer's statement should be sent out to all members. Incidentally he also criticised the method of calculating the fees for life membership.

Mr. ALBERT CAMPBELL suggested a referendum on the subscription question. He considered that the present subscription of Associate Members was sufficiently high.

Mr. F. C. RAPHAEL expressed his approval of the desirability of enrolling every useful member into the Institution, and said that if an increase of subscription was necessary it must be paid. Mr. Hammond had spoken about the representation of Local Sections on the Committee, but had forgotten all about the representation of the Associate Members not only on the Committee, but on the Council. There is, Mr. Raphael pointed out, only one single Associate Member on the Council, and

(*Continued on p.* 611.)

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THE VAUXHALL WORKS OF THE ELECTRICAL APPARATUS CO.

WE had an opportunity recently of inspecting the new works in South Lambeth Road, into which the Electrial Apparatus Co., Ltd., moved last spring, and where now the whole of their manufacturing activites are carried on. The company was founded in 1907 for the manufacture of meters of the well-known design of Mr. E. B. Schattner, as well as a considerable range of motor starters and other switchgear of moderate size. The original Milford Works at Battersea after a few years proved inadequate for the rapidly growing needs of the business, and the construction of the present works upon a site suitable for still further extensions was decided upon.

The works are arranged all on one floor, and at present about 130 men are employed. The main shops are in parallel bays, without partitions, except those by which the test-room is shut off; the offices run along the front of the building, and the stores for material, parts, and finished apparatus run along the back. The machinery is concentrated at one end, the assembling benches for starters, &c., are in the centre, while the meter department and the test-room occupy the other end. Thus all work, in passing through its various stages, continually travels towards the test-room, adjacent to which is the packing and despatch department. The whole organisation is very systematic and the arrangement of designs permit of a large variety of forms of apparatus being turned out without undue multiplication of standard parts. Fig. 1 gives a good idea of the shops with the assembly benches in the foreground and the machinery to the right.

The machine tools are of a fairly light character suited to the size of the work put through, and are all driven through shafts and belting by one 15-h.p. single-phase motor off the mains of the South Metropolitan Electric Light and Power Co. This also drives a couple of small D.-C. machines for supplying current and charging accumulators for the testing department. The machines include drilling and tapping machines of various patterns, light semi-automatic turret lathes for making small parts, studs, special screws, &c., and a few stamping presses. The firm also cut all their small gear wheels for meter mechanisms on a particularly ingenious form of gear-cutter. There are also special winding lathes for resistance coils and for the flat former wound coils of the E.A.C. meter, to which we refer below. The company believe in making as many small parts as possible themselves, and we even saw small hexagon nuts going through in very large quantities. Some of the details show remarkable ingenuity, and we were particularly struck by the neat method



FIG. 1.—GENERAL VIEW OF STARTER ASSEMBLING DEPARTMENT AND MACHINE SHOP.

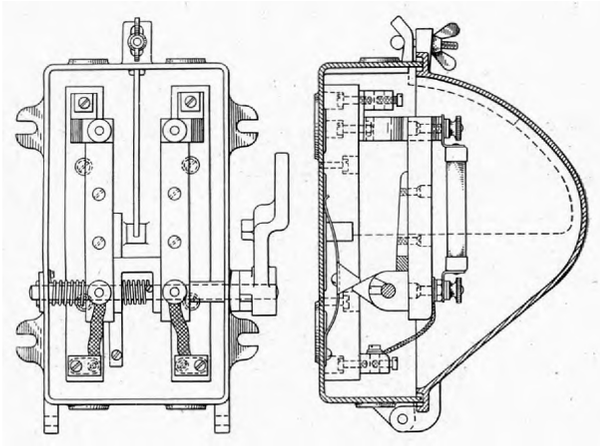


FIG. 3.—IRON-CLAD DOUBLE-POLE FUSED SWITCH (SCALE ONE-FIFTH).

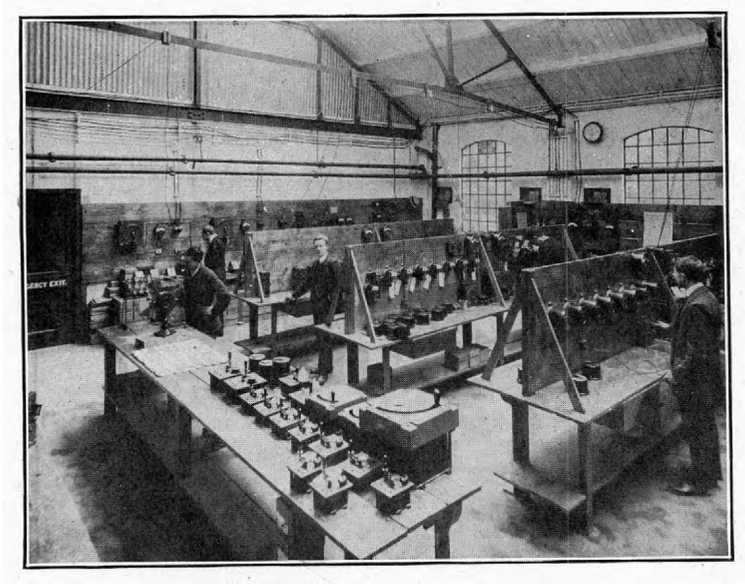


FIG. 2.—TESTING ROOM.

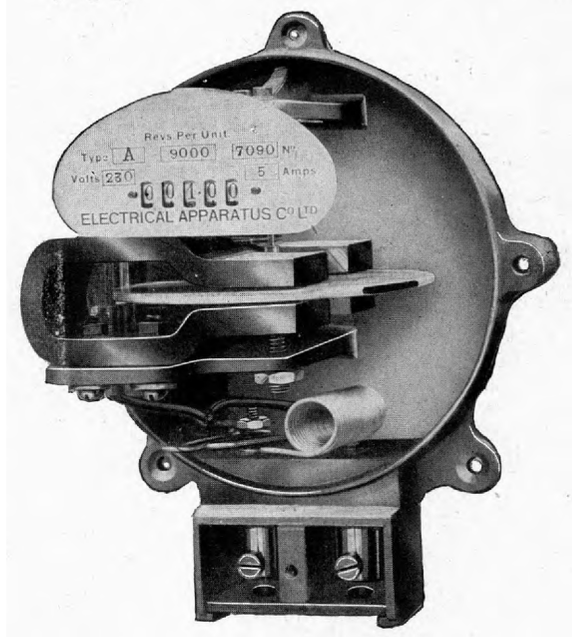


FIG. 4.—E.A.C. HIGH TORQUE METER WITH COVER REMOVED.

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by which what corresponds to a steady-pin on the starter contacts is stamped out from the other side of the blank. Templates and jigs are largely made use of, and parts are made as interchangeable as possible.

The meter department is at the other end, and here the E.A.C. high-torque meter is put together both in its standard form and with the addition of a prepayment mechanism. A few precision machines are in use at this end, but the chief work is assembling at the bench. This part of the works is specially well lighted by 110-volt metal filament lamps, which are placed nearer together here than in the rest of the works.

The whole of the apparatus made passes through the test-room, of which a view is given in Fig. 2, where the resistance of the starter rheostats is checked, the insulation resistance of every piece measured, and a 2,000-volt flash test applied. The setting of all releases, &c., is also thoroughly tested. The meters are tested and calibrated in the same department, and an ingenious system is adopted for testing the cyclometer dial trains for friction by mounting little propellers on their shafts and blowing them round by a large electric fan.

Having thus sketched the general characteristics of the works, we will add a few words as to the apparatus made there. With many of the special forms of starters emanating from this works our readers are already familiar, including the slow-motion starter illustrated in an account of the company's stand at the Olympia Exhibition (ELECTRICAL ENGINEERING, fourth Exhibition Supplement, October 12th, page 67), with its cleverly arranged zig-zag guide ensuring a step by step motion, the automatic solenoid starters, and the special lever-type starter for single-phase induction motors (see ELECTRICAL ENGINEERING, June 15th, p. 331). Other special forms include reversing starters, combined starters and speed regulators, &c. Attention may also be drawn to a new form of ironclad fused switch, provided with a special arrangement of springs, giving a quick make as well as a quick break, and equipped with the company's "Koolark" cartridge fuse. The details of this switch, which is being made in large quantities, are shown in Fig. 3.

The E.A.C. high-torque meter, with its three flat armature coils held between two aluminium discs, forming also the brake, and moving in the field of two permanent magnets, is now well known; over 150 supply authorities now order them regularly, and they are being sold at a rate of over 6,000 per annum. When they first introduced a commutator ampere-hour meter the company had to face strong distrust of this type, due probably to experience with designs originating on the Continent which were not suited to English conditions, for the climate here destroys in a few months insulating and other materials that will last for years in dry places. The main insulation of the imported meters was fibre; that of the E.A.C. meter is mica. Moreover, in the construction of the E.A.C. meter the greatest care is taken to use nothing that can deteriorate. Only the very best enamel-insulated wire is used, phosphor-bronze is used for the spindle in the gears in place of steel, the brushes and commutator are actually made of 18-carat gold. An important feature of these meters is that they use three or four times as many turns in the armature as there are in any other meter. It is therefore claimed by the makers that as the torque is thus three times as great, where another make is really accurate and reliable down to say ¼-load, the E.A.C. meter is the same on 1/12th load. The prepayment meter was also illustrated in ELECTRICAL ENGINEERING in connection with the company's stand at the Olympia Exhibition. Briefly, the prepayment mechanism provides means whereby the insertion of each coin permits of the controlling wheel being wound up a certain amount, by which it has to be overtaken by the meter train before it releases the switch, and the mechanism is so arranged that the force required to release the switch is supplied by the spring which is wound up when the coin is inserted, and not by the meter.

The "Corona" Loss on H.T. Transmission Lines.—The *Elektrotechnische Zeitschrift* of Oct. 26th last contains the results of tests made at the Dresden Technical University to determine the "Corona" loss which is to be expected on the 110,000-volt transmission system of the Lauchhammer Aktiengesellschaft, described in ELECTRICAL ENGINEERING, Sept. 28th last. The experiments were made with conductors 0·065 sq. in. in section, as used in the actual installation. The results compared well with those of Ryan, published recently in the *Proceedings* of the American Institute of Electrical Engineers. With the spacing of 175 cm. between the conductors of the three phases, a temperature of 17° C. and a barometric pressure of 750 mm., the loss was found to be 2·2 kw. per km. at 100,000 volts, 4·5 kw. per km. at 105,000 volts, 8·5 kw. per km. at 110,000 volts, and 13 kw. per km. at 115,000 volts. It will be remembered that the total length of the transmission line is 50 km., so that a total "Corona" loss of nearly 200 kw. will be occurring at all loads.

ELECTROMETALLURGY

THREE Papers relating to electric furnaces were read at a meeting of the Faraday Society on October 3rd, and were discussed on October 17th. The first, by Mr. J. Härdén, described the latest form of his "Paragon" combined arc and resistance furnace in which the surface of the slag is heated by means of arcs, and the bath is also heated from the sides and beneath by means of side-plates as in the Röchling-Rodenhauser furnace. A small melting-furnace known as the "Helberger," consisting of a plumbago crucible heated by induction to temperatures up to 3,000° C. was also described. The subject was treated in a more general way by Mr. D. F. Campbell in a Paper entitled "Progress in the Electrometallurgy of Iron and Steel." In Scandinavia and Western America, where the conditions were exceptional as regards the absence of coke and cheap water power, he said that the electric smelting of iron had been proved to be able to compete with small blast furnaces, and this development would do much to compensate for the exhaustion of the wood supplies. The electric refining of steel was less dependent on the cost of power. He reviewed the advances that had been made in California, and dwelt on the superior quality of steel made in the electric furnace. Great improvements had been effected in details, and the power consumption for melting and refining soap had been reduced to 600 kw.-hours per ton. In the third Paper, Mr. E. K. Scott gave a description of the Hering "pinch effect" furnace, in which the electromagnetic force acting from the circumference to the centre of a conductor carrying a heavy current is utilised to cause a vigorous circulation of the charge, and enables a very simple and inexpensive design of furnace to be used. The current enters and leaves the bottom of the furnace through vertical metallic electrodes contained in resistor tubes, which are very small compared with the bulk of the furnace. The circulation of the molten mass takes place above and around the resistor tubes, on account of their lower ends being closed by the electrodes.

The discussion on all the Papers was opened by Mr. C. Hering, who gave some further particulars of his furnace, which was now being made up to 10 tons capacity with resistor tubes of magnesite or alundum. Mr. W. M. Morrison, in a written communication, anticipated trouble with corrosion of the metallic electrodes of the Hering furnace, and thought that they would have to be water-cooled. Mr. C. C. Gow suggested that the risk of erosion of the resistor tubes by the flow of steel would be serious. Mr. D. F. Campbell also criticised the construction of the Hering furnace, and said that Mr. Härdén's Paper amounted to a confession that the induction principle might be done away with, and that arcs were absolutely necessary for refining, as slag reductions must take place if the electric furnace was to have any considerable use.

AUTOMATIC CONTROL GEAR FOR MOTORS

WE have received from the British Thomson-Houston Co. an advance proof of a pamphlet dealing in a general way with the functions of the various forms of automatic motor control gear which they have developed. The advantages of automatic control in the greater uniformity of operation secured, reduced cost of attendance, and economy due to running plant only when actually required, are pointed out, and the leading features of time, counter E.M.F. and current control are discussed to show the advantages of the last mentioned, which ensures a rate of acceleration dependent on the load. In the smallest and simplest solenoid starters time control by a dash-pot is used, and various float switches, pressure gauge relays, and other control devices for special purposes are described. Above 15 h.p., however, the company recommend contactor equipments with current limit control, and this class of apparatus is made in panel form for both alternating and continuous current motors up to very large sizes. (A panel of this nature was illustrated in ELECTRICAL ENGINEERING, May 11th, page 251.) The contactors themselves are similar to those employed in very large numbers under the very trying conditions of electric railway work.

Physical Society.—The annual exhibition of apparatus will be held on Tuesday, Dec. 19th, and will be open both in the afternoon and evening.

The Institution of Post Office Electrical Engineers.—At the next meeting (at the Institution of Electrical Engineers' Building), on Nov. 13th at 6 p.m., a Paper will be read by Mr. W. S. Mountain on "Departmental Contracts." Subsequent papers down for reading are: "Distribution by means of Parallel Cables," by E. A. Pink (Dec. 11th); "Precautions against Fire," by A. J. Stubbs (Jan. 8th); "Economics of Telephone Transmission," by A. W. Martin (Feb. 12th); "Machine Switching in Telephony," by B. O. Anson (Feb. 26th); and "Telegraph History," by H. R. Kempe (March 11th). The annual general meeting is fixed for April 22nd.

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MR. J. F. C. SNELL'S ADDRESS TO THE MANCHESTER STUDENTS

A South American Power Scheme

THE inaugural address to the Manchester Students Section of the Institution of Electrical Engineers was given on Tuesday last by Mr. J. F. C. Snell. In his advice to young engineers about to commence their careers, he expressed the view that in years to come all engineers would have to learn the fundamentals of electrical engineering, and there would be a smaller proportion of specialists. It

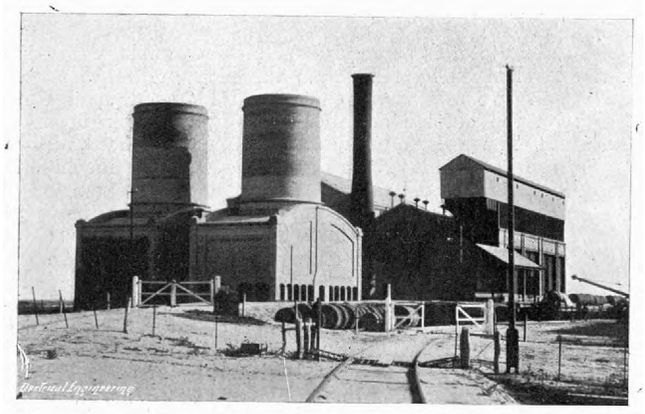


FIG. 1.—BAHIA BLANCA GENERATING STATION, SHOWING BRICK COOLING TOWERS, &C.

was of the utmost importance that the training of electrical engineers should not be too narrow. What he wished to emphasise particularly, however, was that in this country more electrically trained young men were being turned out from universities and technical colleges than there were places for them to fill. Young engineers must be prepared to go abroad much more than they do. The engineer was the pioneer of civilisation, and could also act as the missionary of British influence. It was necessary to broaden one's experience as much as possible. He also emphasised that spirit of true economy which was the basis of sound commercial engineering. It was one of the main functions of the engineer to get the most he could out of the money spent. He dwelt further on the necessity for breadth in the engineer's training, and gave a word of warning against the very common desire of running before they had learned to walk.

The latter part of the address was devoted to some impressions of a recent visit to South America, and a description

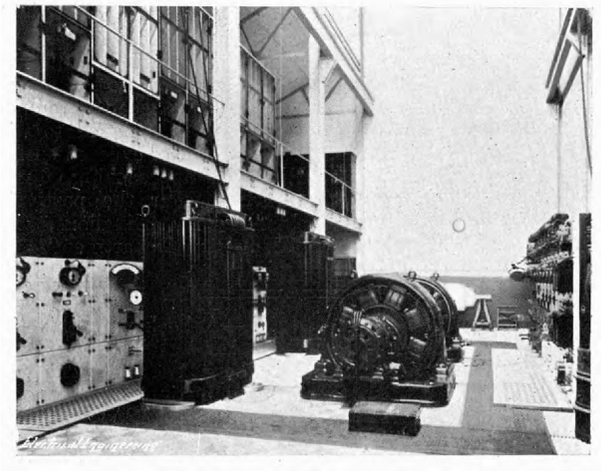


FIG. 2.—INTERIOR OF TYPICAL SUB-STATION.

of the electric supply and traction system of Bahia Blanca, for which Mr. Snell was responsible, and a number of interesting lantern slides were shown. A general description of this system appeared in ELECTRICAL ENGINEERING, May 19th, 1910, page 321, but through the kindness of Mr. Snell we are now able to reproduce one or two photographs of the plant. The scheme involves a large power station at Paraguaya at present containing three 1,000-kw. Browett-Lindley-Westinghouse triple expansion steam alternators, forming the first quarter of the ultimate equipment, and a few smaller sets. Babcock Wilcox boilers are used, burning Welsh coal in stokers of the underfeed type, and the consumption of coal has worked out to 2·7 lbs. per unit generated on a 32 per cent. load factor. Features of the station are

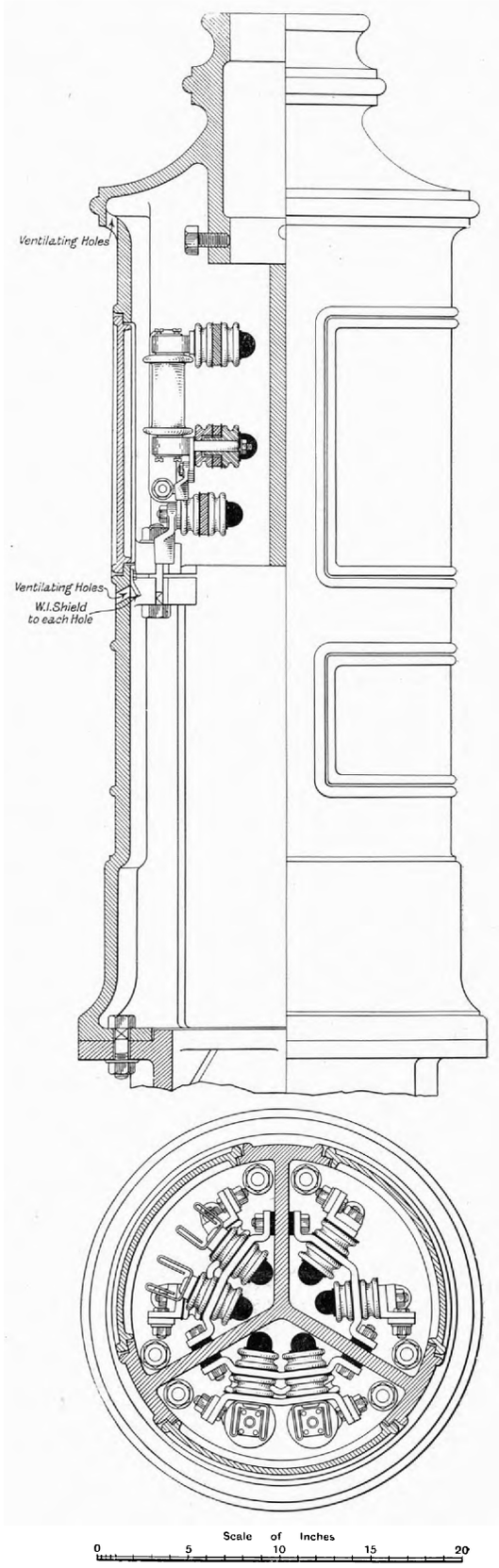


FIG. 3.—COMBINED FEEDER PILLAR AND ARC-LAMP POST BASE.

the use of Westinghouse-Leblanc condensing plant and the Balke natural draught cooling towers of brickwork and ferro-concrete, which figure prominently in Fig. 1. The alternators generate at 6,600 volts three-phase 50 cycles, and special care was taken with their insulation in view of the

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heat and moisture of the climate. The switchgear is of the remote control pattern, with desk-pattern operating boards, and, like the whole of the plant, was supplied by the British Westinghouse Co. Energy is supplied from this station to several sub-stations, and a three-phase four-wire system is

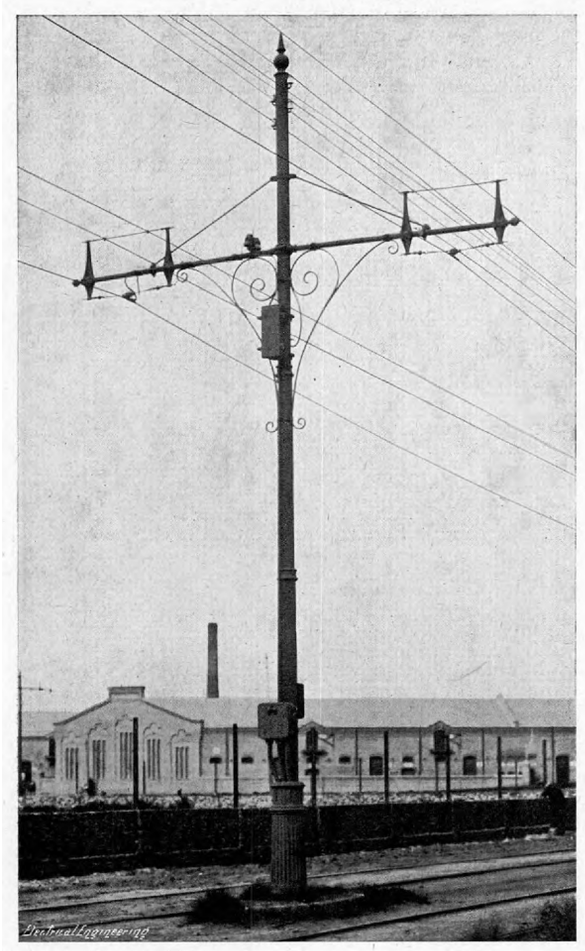


FIG. 4.—TRAMWAY POLE, SHOWING BOWSTRING SUSPENSION AND FEEDING ARRANGEMENTS.

used, both for the tramway and lighting supply. There is also a considerable power load in connection with the docks and railway workshops, and tramway extensions are contemplated. A view of one of the tramway sub-stations, with rotary converters, is given in Fig. 2, while Fig. 4 shows the bowstring suspension and guard wire mounting used on the tramway overhead work. The whole of the public lighting is by A.C. arc lamps, worked in connection with constant current transformers. A special combined feeder pillar and lamp column is employed, supplied by W. T. Henley's Telegraph Works Co. Details are given in Fig. 3.

EXTENSION OF PLANT AT THE SOUTHWARK ELECTRICITY WORKS

IT speaks well for the electricity supply in Southwark that it has been found necessary by the Council to instal additional plant at the generating station in Penrose Street, Walworth, S.E., to cope with a great increase in demand for energy, both for lighting and power. This takes the form of a mixed pressure turbine made by Messrs. Belliss & Morcom, Ltd., which will be supplied with steam at 160–170 lbs. per sq. in. from the exhaust of two 700-h.p. Willans engines, which are coupled to Siemens dynamos of 450 kw. each. High and low pressure governor valves are provided, so that it can run on different circuits to the reciprocating sets, supplying the exhaust steam when required. The governing arrangements follow the firm's usual practice, and consist of separate oil relay systems for both the main and emergency valves. The turbine will drive a generator designed by the General Electric Co. to give an output of 600 kw. at 500 volts at a speed of 1,500 r.p.m. This is of the enclosed type with self-contained fan ventilation, the air being drawn through a duct in the foundations and expelled from an outlet at the top of the frame. The magnet poles are made of laminated charcoal iron plates of high permeability, which are rigidly bolted to the cast steel frame. Four commutating poles and a compensating winding, distributed over the whole face of the main magnet poles to neutralise the armature reaction, are also provided. The armature is made up of steel stampings. These are supported and keyed on the shaft, and are clamped together by two cast steel end plates, which also form a support for the projecting portion of the armature winding. This is secured in slots by means of strong maple wedges, and is also bound down at the ends to prevent movement. The armature is thoroughly cooled by means of fans, which give both axial and radial ventilation, and is balanced both dynamically and statically.

The commutator is assembled on steel cones keyed to the shaft and clamped by large nuts threaded on the shaft. It is made in two sections, each secured by solid steel rings shrunk on the outside and insulated by a thick layer of micanite. The segments, which are made of hard, drawn copper, are insulated by pure mica plates. The machine is cooled in quite a novel way: A fan fixed on an extension of the shaft sends air through a pipe, which terminates in nozzles under the commutator. This also serves to remove any carbon or other dust sticking to the surface. The extremely high speeds of the armature and commutator, namely, 14,000 and 8,500 feet per minute at the periphery respectively, renders a special brush gear necessary. Each brush is independent and can be adjusted by itself in any direction, whilst the whole gear is moved round by a special hand wheel fitted on the top of the collecting gear. Arrangements are made so that the holders and brushes can be adjusted in the event of the segments wearing. Tappings are taken off the back of the armature to three slip rings, so that an A.-C. current is also available, though the main portion of the output will be D.-C. only. The condensing plant has been supplied by the Workington Pump Co., to deal with 25,000 lbs. of steam per hour, maintaining a 27-in. vacuum. It is also arranged so that the existing reciprocating engines can be run condensing if required, when the turbine is not being used. The condenser is of the rectangular surface type with 3,600 sq. ft. of cooling surface, and with about 1,530 brass tubes. These are a little over 12 ft. long, representing a total length of over 3½ miles of tubing. The air pump is of the well-known Edward's type, with three cylinders, 13½ in. by 12 in., and is driven by a 15-h.p. motor. There is also a 12 in. centrifugal pump driven by a 40-h.p. motor, which circulates, continuously, 2,400 gallons of water per minute, or 650 tons per hour, through the condenser to a cooling tower. This is 55 ft. high from the base, and has been erected over the boiler house on heavy stanchions placed between the Babcock & Wilcox boilers, which are stayed and held so that only dead-weight is transmitted to them. The wind pressure on the tower is taken entirely by rolled steel joists. The cooling tower was built by the Davenport Engineering Co., Bradford, under Holehouse's patent system, and contains a number of hurdles, each provided with rails secured without nails. These are so arranged that the water is suspended in the tower long enough to reduce the temperature to about 60 or 70° F. It has been designed to withstand a wind pressure of 40 lbs. per sq. in. of exposed surface, and has already been subjected to gales approaching 60 miles per hour without appreciably moving. For the particulars contained above we are indebted to Mr. Kinghorn, Chief Engineer and Manager to the Electricity Department of the Borough of Southwark.

Small Switches and their Circuits.—A book with this title, by M. W. Perren Maycock, is being published jointly by S. Rentell & Co. and A. P. Lundberg & Sons. The work, although of great utility to all planning installations, deals, of course, entirely with the deservedly well-known manufactures of Messrs. A. P. Lundberg & Sons. A good deal of general information on wiring and the arrangement of switches is given, with fully illustrated descriptions of the vast variety of apparatus made by the firm. The almost endless possibilities of control of single or groups of lights by the ingeniously contrived duplex, intermediate, "Marvel," and other types of switch are fully gone into with numerous diagrams, and a large variety of special forms of switch, plugs, and combinations of the two are described. A glance at these pages cannot fail to open one's eyes to arrangements of switches opening up new possibilities, and the whole is arranged in a form pleasanter to read than a trade catalogue, but with a completeness such as few catalogues possess. The work is published at the price of 2s. 6d.

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MARYLEBONE SALES DEPARTMENT

AT the meeting of the Marylebone Council on Thursday, the following motion was moved by Councillor Oswald Lewis :—"That with a view to the fact that this Council does not desire to continue competitive trading, the Electric Supply Committee be instructed to report to the Council as to the advisability of discontinuing the execution of contracts for wiring and the sale of electric fittings."

In proposing the motion, Councillor LEWIS said that after very careful inquiries in all directions he felt quite satisfied that the result of the continuance of the sales department upon its present lines would be the ruin of the small electrical contracting firms in Marylebone. It was claimed by the department that the work of the contractors was not interfered with, and that they did not tender for work already in the hands of private contractors unless specially asked to do so. Whilst dissociating himself entirely from any reflection upon the way in which the officials of the department carried out the declared policy of the committee, he thought it was an exceedingly different thing to employ a number of canvassers and ask them, on the one hand, to push the work of the department in wiring and fittings, and, on the other hand, to tell them that they were not to interfere with other people who were doing the same work. It was, in fact, an impossible position, and it was for this reason that he did not wish to reflect upon the action of the officials in any way. But there was no doubt that the information gained by the electricity undertaking as suppliers of electrical energy was being used by them in the pushing of the Sales Department. This, he contended, was distinctly unfair to the electrical contractors in the Borough, and was not a policy that should be continued by the Council.

Councillor J. H. INCE seconded the motion.

Alderman DENNIS moved an amendment to the effect that the Electricity Committee should be asked to report as to the advisability or otherwise of continuing the Sales and Publicity Department on the present lines, particular regard being paid to the question raised by the Electrical Contractors' Association in their recent communication to the Council. This was seconded by Councillor H. H. Dunn.

Councillor J. A. BEAUMONT said that in various directions the impartiality of the Electricity Committee had been questioned, and he suggested that it might be better to have a report from a committee independent of the Supply Committee.

Councillors RUSSELL, GARROULD, and WHITE supported the amendment by Alderman Dennis, the latter expressing the opinion that the electrical contractors in the Borough seemed to have got into a "holy terror" without any reason at all. Personally, he did not think that the electrical contractors had much to fear. One of the proudest things he ever did was to destroy one of the most gigantic municipal trading concerns London ever had, viz., the London County Council Works Department, and if he could destroy the Marylebone Sales Department without doing injury to other people he should not see much objection to do it. The fact was, however, that they had paid a fabulous price for the undertaking, and if only in atonement for that blunder they should now do their very best with the undertaking in the interests of the ratepayers. He could not believe, for instance, that Mr. Duncan Watson had lost the business of one single point through the operations of the Sales Department.

Councillor DUNCAN WATSON said he quite agreed with this remark. He had, however, investigated this matter very closely, and had ascertained that there were sixty electrical contractors in the Borough, and their annual turnover was something like £43,000, out of which the Sales Department now did £16,000 annually. Could it be said that that work could be legitimately taken away, and no one suffer? The suggestion was preposterous and absurd. If the Council left the work to contractors, they had a large body of unpaid canvassers. He hoped the Council were not going to buy something at a very great expense which they could get for nothing. In only four places in the country were municipal wiring departments carried on, viz., Sheffield, West Ham, Ipswich, and Hackney. As showing the peculiar circumstances of the electrical contractors in Marylebone, he pointed out that there were 59 contractors there to one in West Ham; 74 to one in Ipswich; 44 to one in Sheffield; and 47 to one in Hackney. He submitted that the circumstances in Marylebone were so entirely different that the question called for very serious consideration.

Colonel HOPKINS (Chairman of the Electric Supply Committee) said he was perfectly indifferent as to whether the Council appointed a Special Committee to report, or whether it was left in the hands of the Electric Supply Committee. The whole desire of the Committee was to prevent the undertaking making a loss. He was curious to know how Mr. Duncan Watson arrived at his figure of £43,000. Did he go round to all the contractors inside and outside the Borough to ascertain their turnover? Further, when Mr. Duncan Watson referred to £16,000 as the work done by the Sales Department, he had not pointed out that it also included the revenue from the hiring out of apparatus. He strongly deprecated the members of the Council ventilating their grievances in the newspapers, as it prevented him, as Chairman of the Committee, from properly replying to the charges which had been made against the department.

Eventually Alderman Dennis's amendment that the Electric Supply Committee should report upon the question was adopted by the Council.

During a discussion upon the revenue account for the June quarter, Councillor J. H. Ince asked for full particulars of all cases of the free loan of apparatus and free current to either members or officials of the Council, and when any of these people last returned the apparatus to the Committee, and whether any records of reports upon tests with the apparatus stand on the minutes of the Electric Supply Committee.

Colonel HOPKINS said that Dr. Bokenham, a member of the Electric Supply Committee, had had various pieces of apparatus for testing from time to time since January, 1909, which were returned to the department when sufficient tests had been made. For such tests a free supply of current was given, and the value of it during the past three years amounted to less than 30s. Mr. Seabrook, the general manager, and Mr. Hind, the assistant sales manager, have had the free use of pieces of apparatus for testing, but only Mr. Seabrook had a free supply of current for this purpose, as Mr. Hind did not reside in the Borough. Reports were made to the Electric Supply Committee from time to time, but they did not appear on the committee's minutes.

DISPUTE re MUNICIPAL WIRING RULES AT ST. PANCRAS

THE application to Mr. Bros, magistrate to the Clerkenwell Police Court, for the appointment of an electrical inspector, referred to on p. 559 in our issue for October 12th, was further discussed on Thursday, when Mr. R. Tweedy Smith (solicitor to the Electrical Contractors' Association) made a speech on behalf of Mr. A. E. Evans, of 38 Fitzroy Street, Fitzroy Square, and Messrs. McDonald, Syer & Co., Ltd., of 295 Gray's Inn Road, W.C., who are now both named in the application. The grounds for the application were stated in our issue referred to above.

Mr. Tweedy Smith explained that whilst the magistrate had no power to appoint an electrical inspector under the St. Pancras Electric Lighting Order of 1883 for the testing of anything except the mains of the undertakers and the meter of the consumer, the Board of Trade Regulation No. 31 provided that "any consumer who is dissatisfied with the action of the undertakers in refusing to give or in discontinuing a supply of energy to his premises," has a right to apply for the installation to be tested by an electrical inspector. In the case of Mr. Evans, he had 60 lights and four radiators in his house, a 7½-h.p. motor in his factory, and two radiators in his office. A Tucker fuse-board had been provided for some of the radiators, but the St. Pancras Borough Electrical Engineer (Mr. Sydney Baynes) had refused to connect this fuse-board on the ground that it did not comply with his regulation as to fuses. These were given in our issue for October 12th. Mr. Baynes seemed to be under the impression that he could insist upon a particular type of fuse, notwithstanding the fact that all other Metropolitan Borough electrical engineers were accepting the one which he was rejecting. There had, he said, been several faults on the St. Pancras mains, resulting in the consumers' lamps being burned out, and Mr. Baynes was really trying to protect the consumers' premises from leakages on the mains. Under the St. Pancras Provisional Order, Section 59, the Council were bound to observe the following regulations :—"The supply of electricity to any premises shall be capable of being turned off at some point outside such premises. All service lines and positive and negative poles of service lines upon the premises of any consumer shall be at a distance of not less than three inches from one another respectively." These provisions were not being complied with, and in insisting upon a larger break in the fuses the Council were really guarding against defects in their own mains. Tucker fuse-boards had been passed by the Board of Trade, and the application now was that the magistrate should appoint an inspector to examine the fuse-board and the installation at Mr. Evans's premises, to test the meter at the premises of Messrs. McDonald, Syer & Co., and the mains of the Council's.

After Mr. Syer had given evidence, Mr. Bros, the magistrate, remarked that he thought he ought to appoint an electrical inspector, but on the application of Mr. Barrington Ward, counsel for the St. Pancras Council, the hearing was again adjourned.

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ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, NOVEMBER 9TH.

British Electrical and Allied Manufacturers' Association.

2.30 p.m. Council Meeting at 36 Kingsway, W.C.

Institution of Electrical Engineers.

8 p.m. Presentation of Premiums. "Modern High-voltage Power Transformers in Practice, with Special Reference to a 'T' Three-unit System," by W. T. Taylor. In the absence of the author, the Paper will be read by Mr. J. F. C. Snell.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At Royal College of Science. "Electric Heating and Cooking," by S. L. R. Price.

FRIDAY, NOVEMBER 10TH.

Institution of Electrical Engineers: Birmingham Section.

7 for 7.30 p.m. Annual Dinner at Grand Hotel.

SATURDAY, NOVEMBER 11TH.

Birmingham and District Electric Club.

7 p.m. At Colonnade Hotel. "Light and Illumination," by H. Wheat.

MONDAY, NOVEMBER 13TH.

Institution of Post Office Electrical Engineers.

5 p.m. At Institution of Electrical Engineers. "Departmental Contracts," by W. S. Mountain.

TUESDAY, NOVEMBER 14TH.

Institution of Electrical Engineers: Glasgow Section.

8 p.m. At 207 Bath Street. Chairman's Address.

Institution of Civil Engineers.

8 p.m. At 25 Great George Street, Westminster. (1) "The Loch Leven Water Power Works," by A. H. Roberts. (2) "The Hydro-Electric Plant in the British Aluminium Co.'s Factory at Kinlochleven," by F. B. Sonnenschein.

WEDNESDAY, NOVEMBER 15TH.

Institution of Electrical Engineers: Yorkshire Section.

7.30 p.m. At Hotel Metropole. Chairman's Address; to be followed by Smoking Concert.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At Liverpool. Joint Meeting with Liverpool Engineering Society. "The Function of the Laboratory in the Training of an Engineer," by Prof. E. W. Marchant.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. At Victoria Embankment. Opening Address by Mr. C. P. Sparks, Chief Engineer, County of London Electric Supply Co., Ltd.

THURSDAY, NOVEMBER 16TH.

Institution of Electrical Engineers.

8 p.m. Informal Meeting to discuss proposed alterations to Articles of Association.

THE LOT'S ROAD TURBINES

IN the Appeal Court on Tuesday, before Lords Justices Vaughan-Williams, Kennedy, and Buckley, the appeal of the British Westinghouse Co. in respect of the price to be paid for the Westinghouse turbines at the Lot's Road power station was commenced. We gave the history of this case in our issue of January 19th, 1911, page 32. Briefly, the facts are that, between 1902 and 1906, eight Westinghouse turbines were installed by the Underground Electric Railways Co., of London, but they failed to come up to the contract figures for steam consumption. Consequently, it was agreed that, owing to the very superior steam consumption figures guaranteed, Parson's turbines should be substituted at a cost of about £220,000. The Hon. Alfred Lyttelton, K.C., was appointed arbitrator to settle the basis upon which the dispute between the Westinghouse Co. and the Underground Co. as to the price and damages for breach of contract should be settled. Owing to an important difference of opinion, the arbitrator appealed to the High Courts for direction upon the matter, when it was decided that he should proceed upon the basis that the Westinghouse Co. should pay to the Underground Co. the full cost of the Parson's machines, plus the difference between the actual and guaranteed steam consumption of the Westinghouse machines whilst they were at work. The arbitrator consequently made his award in this form. Against this the Westinghouse Co. appealed to a Divisional Court, which held that the basis adopted was the correct one.

Sir ALFRED CRIPPS, in opening the appeal for the Westinghouse Co., pointed to the fact that whereas the Westinghouse Co.'s turbines were 5,500 kw., the Parson's turbines were 6,000 kw. each, whilst the saving from the reduced steam consumption amounted to £20,000 per annum. In this way, he argued, the Underground Co. were being put in a better position than they would have been had the Westinghouse turbines come up to contract, and this "betterment" should be taken into account in favour of the Westinghouse Co. in the arbitrator's award. In answer to Lord Justice Buckley, he agreed that if the Underground Co. had preferred to have continued to run Westinghouse machines for their full life at the inferior steam consumption, they could have claimed a very much larger sum of money by way of compensation than was at present involved, but such a procedure would not have been reasonable, and the action of the Underground Co. in this connection should not entitle them to consider the cost of the new turbines as wholly irrelevant to the issue. In determining the price which the Westinghouse Co. should pay to the Underground Co., he claimed that the following were important elements which must be considered in favour of the Westinghouse Co.: (1) Greater efficiency of the Parson's turbines; (2) longer life; (3) greater capacity; and he argued that the matter should be remitted to the arbitrator.

The case is still proceeding.

Illness of Dr. Glazebrook.—Our readers will learn with regret of the serious illness of Dr. R. T. Glazebrook, F.R.S., Director of the National Physical Laboratory, who is suffering from typhoid. He has been ill for about a month, and it is thought that he contracted the disease during a visit to Switzerland. From inquiries we understand that Dr. Glazebrook is now maintaining a gradual improvement, and has had rather better rest at night during the last few days.

Faraday House Old Students' Association.—It has been decided to hold informal meetings of members of the Faraday House Old Students' Association. The next reunion will be held on Friday, Nov. 24th, at Faraday House, at 8 p.m., when it is hoped that many members of the Old Students' Association, and also those old Faradians who are not yet members, will be able to attend. A musical programme is being arranged.

City Street Lighting.—According to the *City Press*, the Streets Committee of the Corporation has under consideration an improved scheme for street lighting in the City of London. This is expected to come before the Court of Common Council early in December. We understand that the idea is to employ gas and electricity in equal proportions, and to hang the lamps centrally, wherever possible, so as to enable the standards to be done away with. The gas and electric lamps that have been recommended for use are the same as can be seen at the end of Cannon Street and in Cheapside respectively. In cases where the lamps cannot be suspended, brackets will be used, and only failing this will the standards be again resorted to. It is said that should the scheme be adopted there will be an increase of nearly 50 per cent. in the illuminating power, and a saving of some thousands of pounds per annum.

PROFESSOR UNWIN'S VIEWS ON ENGINEERING EDUCATION

DR. W. C. UNWIN, in his presidential address to the Institution of Civil Engineers, on Tuesday last, said that the great obstacle to the progress of technical education in this country was the want of any definite aim and the unsuitable character and poor average quality of our secondary education, in which respect he quoted Lord Haldane's opinion that Germany were far ahead of us in educational matters. He pointed out that it was highly essential that the student should have a good preliminary education in order to be able to take, with advantage, the technical education that was to follow. With regard to the latter, it was desirable for the pupil to obtain his first degree before going into works, as otherwise he would have to cram for it, which, he thought, was inferior to a systematic course of study. In another part of the address, he discussed the research work that had been carried out in connection with the strength of materials, and mentioned the good work that had been done in Germany on this subject. In conclusion, he ventured to urge the claims of engineering schools in preparing the engineer for service in shaping the destinies of the Empire.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

FUSES.—An attractively got up list from the British Electric Calibrated Fuse Co. (Luton) gives particulars of several special forms of fuse which this company have developed, including the Weekes "Safetee" enclosed indicating fuse and two composite fuse wire and strip materials known as Pyrotin and Pyrocopper.

CONDUITS.—A revised price list of light and heavy gauge conduits has been sent to us by Simplex Conduits, Ltd. (116 Charing Cross Road, London, W.C.), which came into force on November 1st. Their new type, the Elektroduct, which is a specially brazed tube with a smooth interior, the dimensions of which can be made much more accurate than is possible with the welded tube, is cheaper than the latter type.

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OBJECTIONS TO THE PROPOSED CHANGES AT THE INSTITUTION OF ELECTRICAL ENGINEERS

(*Continued from p.* 604.)

there are 2,809 Associate Members to 1,331 Members, a majority of more than two to one. Mr. Hammond had said that in the report of the Council last April, full notice had been given of practically the whole of the provisions put forward in the proposed amendment of the Articles. He asked him was there any mention that there was to be a proposal to have an absolutely new class of members? Was there any mention that there was to be a very serious alteration in the method of electing the Council? Was there any mention of the Council seeking powers to delegate its own powers to non-members of the Council? All these things were included in the proposed new Articles. The Council also took power in the new Articles to incorporate any other association whatsoever with the Institution without seeking permission of the members. These should not be things of which only a week's notice was given, and given in such a way as to indicate that the Council proposed the acceptance of them *en bloc* without opportunity for discussion. They had heard from Mr. Ferranti that the class of Associates was to be largely increased by as many new members as possible who are not electrical engineers. They had also heard that there was to be a new class called "Licentiates," in which everybody who were electrical engineers would be eligible, men with limited experience, who certainly could not be licensed to practice as the word "Licentiate" obviously implied.

The PRESIDENT: Cannot you suggest a name?

Mr. RAPHAEL reminded the President that he had suggested the name "Subscribers" in the amendment he had put in. They would subscribe to the funds and obtain the benefits of membership, but they would have practically no qualifications, and did not need to have an abbreviated title. Again, if there were to be a large number of new Associates, obviously the position of the Associate Members would be prejudiced. To the general mind there was very little difference between Associate and Associate Member. He also proposed that Associates should be called "Affiliated Members." They were members of an affiliated profession; they were not electrical engineers. The next point was the representation on the Council. In one of the amendments he had submitted he had proposed that, instead of there being three Associate Members and three Associates on the Council, there should be four Associate Members and two Associates. It was only fair the Associate Members should have better representation. The question of the election of the Council had already been referred to. It was perfectly clear what the proposals meant. Unless people had sent in nominations before March 1st, the Council simply nominated its successors; and even if they had sent in names, unless they had sent in so many names as to embarrass the Council, the Council would still nominate its successors. For instance, if six names had been sent in, there would remain twelve members to be elected. The Council would nominate twelve members themselves, and would incorporate the six proposed, and not a single Member or Associate Member would have the right to object.

Mr. W. R. COOPER quoted a statement made by Mr. Mordey at the meeting at which it was decided to take over the building: "One important thing I must not omit to mention; no increase of subscription will be necessary nor any general levy on the members." Would it not be possible, he asked, merely to raise the subscriptions of new members, and to make a distinction between country members and town members? He agreed with the criticisms directed against the "Licentiate" class, and was afraid the public would esteem Licentiates more fully than the full members. He suggested that, after a certain age has been reached, their subscription should be made equal to that of the Associate Members, so as to tend to make the Licentiates transfer to the higher class. Finally, he suggested that there should be another informal meeting for further discussion before the formal meeting on November 30th.

Mr. A. P. O'BRIEN strongly opposed an increase in subscriptions.

Mr. T. H. ROBERTS-WRAY suggested that it might not be legally admissible to increase any member's subscription if he objected.

Mr. A. J. MAKOWER mentioned that the charge of eighty guineas for compounding for a four-guinea subscription meant, at 5 per cent. compound interest, that one's expectation of membership was exactly an infinite number of years. He suggested fifty guineas, which would represent about twenty years' purchase.

Mr. A. A. C. SWINTON supported Mr. Cooper's suggestion that there should be another meeting held before the formal meeting.

Mr. A. H. PREECE blamed the Council for giving such short notice, but expected that the Council's proposals would eventually be accepted practically as they stand. Mr. Hammond had spoken in glowing terms, but he had scorned facts, and Mr. Preece suggested that some estimate of the future expenditure and future income should be issued to the members.

Mr. HAMMOND said that as a money grant was made annually to each Local Section, which, added to travelling expenses and the cost of printing Local Section papers and discussions in the *Journal*, brought the total expenditure on Local Sections to more than one-third of the subscriptions of their members, it would be fair to fix the subscription at the same figure all round.

The PRESIDENT said that it had now been decided to have another meeting between then and the more formal meeting, namely, on Thursday, November 16th, at 8 p.m. He also requested that any suggestions should be sent in by to-day (Thursday, November 9th). At the next meeting the remarks from the Local Sections would also be available.

The meeting adjourned at 6.40 p.m.

FEELING IN THE PROVINCES.

The Provincial Members are all up in arms against the Council's new proposals, and feeling runs very high against the proposal for increased subscriptions. We have received letters from country members in districts not attached to Local Sections intimating their intention of resigning from the Institution if country subscriptions are raised, and a large proportion of the letters from influential men accompanying the form of protest on p. 603 say that their main objection is to an increase in subscription, as they contend that the advantages offered by the Institution do not warrant the imposition of higher fees.

Meetings of the Committees of the Local Sections at Manchester, Glasgow, Birmingham, Leeds, and Dublin were held on Tuesday night (this in some cases being the second or third meeting), and we are in a position to state that the opinions of the members of these Committees is, in all cases, adverse to the Council's proposals. In some cases, forms of petition or protest have already been drawn up and signed. At the meeting at Manchester on Tuesday night, the following resolution was passed unanimously:—

The Committee of the Manchester Local Section again protest against the short notice given of the date by which the suggested amendments should be sent in, particularly as the letter dated the 3rd inst. was only received on the 7th inst. They are calling a General Meeting at the first opportunity, with the object of considering the Articles as drafted. The decisions arrived at, at this meeting, will be at once forwarded to the Secretary.

Among the letters we have received is one from Mr. Maurice Solomon (Birmingham), who urges that concerted action should first be directed to securing amendments of principle, and hopes that the adjourned meeting will be arranged to allow this course to be followed. He urges the abandonment altogether of the "Licentiate" class and the deletion of the sub-clauses which permit the admission of non-professional men to full membership. He insists that better reasons should be shown and a complete financial statement issued before the subscriptions are raised, and that there must be a discrimination between town and country members in this direction. He endorses our views as to the method of electing the Council, but goes further, and suggests that the Council's nominees should always exceed the number of vacancies, so that a ballot would always be necessary, and the nomination of other candidates by the membership less invidious.

Finally, we take pleasure in publishing the following letter which we have received from Mr. M. C. Olsson:—

To the Editor of ELECTRICAL ENGINEERING.

SIR,—The informal discussion which took place on Thursday last at the Institution indicated a strong conviction upon the part of many of the members that the Council has not, in its proposed amendments to the Articles, reflected the ideas and feelings of the majority of the members themselves. I am personally in agreement with some of the objections raised, and am of opinion that in some respects the Council has erred grievously, but I do deprecate as strongly as I can the induction of any other spirit than that of grateful friendliness towards the Council into the controversy. It is to be borne in mind that these men, all of them eminent and all of them busy, have devoted time and thought for years to the affairs of the Institution with no hope of reward except in its continued progress and success. The Institution having grown to such dimensions, it is not surprising that the Council should fail on occasion to feel the pulse of the whole body; in such a case it is the duty of the members to enlighten them, for it is enlightenment they seek. If they are fully informed, I, for my part, knowing the past record of these gentlemen who have served so faithfully, look forward to a speedy and businesslike crystallisation of all that is best in the proposals put forward to improve their work.

I am, Sir, yours faithfully,

MARTIN C. OLSSON.

6 St. Helens Place, London, E.C.
Nov. 7, 1911.

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We associate ourselves entirely with our correspondent's views. Our "agitation," as it has been termed, has been solely initiated to obtain, as we are in a position to do, the feelings and opinions of the general body of Members and Associate Members, and to recommend the Council, with all the force in our power, to abstain from pressing their own views forward with too much earnestness until this had been ascertained. We recognise, as do all who are constantly in touch with the individual members of Council, that the eminent men who have given their time and energy to the conduct of the affairs of the Institution deserve the utmost gratitude and assistance.

ELECTRIC TRACTION NOTES

An important arbitration commenced in London on Monday to determine the price which the London County Council has to pay for the 5¼ route miles of tramway in the County of London belonging to the London United Tramways Co. The lines in question are the sections linking up Shepherd's Bush with Askew Arms (Uxbridge Road) and Young's Corner (Chiswick High Road) and Hammersmith Broadway. The London County Council's powers to purchase the lines were exercisable in 1909. The arbitrator is Mr. R. Elliott-Cooper, whilst Mr. Balfour-Browne, K.C., Mr. John Roskill, K.C., Mr. H. Lloyd and Mr. L. Macassey appear for the Tramways Co., and Mr. C. C. Hutchinson, K.C., and Mr. C. Munroe for the L.C.C. For the company, Mr. H. F. Parshall and Mr. S. Sellon have been retained as expert witnesses, whilst the L.C.C. have Mr. J. F. C. Snell and Mr. A. Dickinson. The L.C.C. have to purchase all "lines, buildings, works, materials, and plant suitable to and used by the company for the purposes of their undertaking within the district," and the total claim amounts to no less than £386,443. This is made up as follows:—Permanent way, £42,278; overhead equipment, £3,076; ducts, cables, and manholes, £21,843; cars, £25,905; special expenditure, £16,833; street widenings, £41,010; road lowerings (agreed figure), £1,250; Parliamentary expenses, £25,250; depot and power station, £208,997.

The Dundee Corporation have accepted a tender by the Railless Electric Traction Co., Ltd., for the installation of the trolley omnibus system between Maryfield and Strathmartine Road at a total cost of £2,657 16s. Two cars will be supplied at £700 each, which is included in the total figure given above.

The adjourned extraordinary general meeting of the British Electric Traction Co., to consider the amended scheme for rearrangement of capital, was held on Friday. After some criticism, the amended scheme was carried by 66 votes to 13.

A scheme is under consideration, which, if carried out, will result in the amalgamation of the London General Omnibus Co., the London Electric Railways Co., and the Metropolitan District Railway Co. According to reports, the idea is to convert the ordinary stock of the Omnibus Co. either into debenture or preference 6 per cent. stock, the dividend on which would be paid after the prior charges on the three undertakings. The available profits after meeting these charges will be distributed *pro rata*. The scheme has still to be discussed by the shareholders of all concerns.

The West Hartlepool Town Council have definitely decided to purchase all the tramways in the Borough. It will be remembered that the Council have already purchased certain lines.

The promoters of the proposed scheme for constructing a tube railway in Manchester at an estimated cost of £1,000,000 are proceeding with their negotiations, but, according to the Manchester local papers, doubts have been expressed owing to the unsettled state of the money market, as to the advisability of promoting a Bill in the next session of Parliament. Mr. J. W. Welch is the engineer to the scheme.

At the last meeting of the L.C.C., the proposal to run tramways over the new St. Paul's Bridge was referred back to the committee. The reason for this is that the Council anticipate that a much larger expense will be necessary upon widenings than was originally contemplated, and that their expenditure of £350,000 will be considerably increased. In these circumstances, the Improvements Committee expressed doubts as to whether it would be advisable to contribute to the scheme at all.

On Tuesday, Mr. S. Sellon explained the process by which he arrived at the various values. From Mr. Hutchinson's cross-examination, it is clear that the L.C.C. will strenuously oppose having to purchase the Chiswick power-house as being necessary to the Hammersmith lines. In this connection, of course, it is not without interest to mention that at the present time the London United Tramways Co. take power for all their Surrey lines from Lots Road.

In consequence of the refusal of the Hove Council to promote a scheme for the use of trolley omnibuses in their Borough, the Brighton Corporation have come to arrangements for extending their own proposal in this connection. It is proposed that the Brighton Corporation should run trolley omnibuses through Hove to Shoreham.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

According to the *Evening Standard*, negotiations are proceeding at Pittsburg with a view to giving an English syndicate the control of the New Jersey, Pennsylvania, West Virginia, Ohio, and Indiana Independent Telephone Companies, as well as part of the Illinois telephonic service. The price is stated to be £2,000,000 in cash and £4,400,000 in bonds.

The Post Office have commenced laying an underground telephone cable at Hythe along the overhead route about which there has been so much dispute between the Council and National Telephone Co.

In view of the activities of the Post Office in the erection of overhead wires for telephone purposes, the Camberwell Borough Council is endeavouring to obtain the opinions of the other London Borough Councils on the question. There is a desire for co-operation in order to take united action against the Postmaster-General.

The telegraph line between Teheran and Kermanshad is interrupted beyond Hamadan. Telegrams to Kermanshad and the Ottoman frontier, the region of Pozenderan or Masanderan, comprising the towns of Barfrouch, Mechedesser, and Sari, can be accepted and are forwarded by post from Teheran. —The line between Bagdad and Bassorah was down again for a short while on the 6th inst.—New telegraph offices have been opened at Gründorn, Tsumis, and Khanmine in German South-West Africa.—Official notification has been received that the Belgian Congo has become an adherent to the International Telegraph Convention of St. Petersburg, and will be included in the sixth class of contributors towards the expenses.

In the House of Lords on Monday the Telegraph Construction Bill was read a second time. The object of this Bill is to enable the Postmaster-General to take over telegraphs constructed across railways and canals. All the great trunk lines have agreed, except two Scottish railways.

Fire at Mazda House.—A serious fire broke out at the British Thomson-Houston Co.'s offices and stores at 77 Upper Thames Street on Tuesday last. We understand that it originated in the top floor, which, with the floor beneath, was burnt out, destroying a large quantity of material, rubber, lamps, &c. Reconstruction will take place as soon as possible, and in the meantime we are asked to state that business, as usual, will be carried on on the ground floor. The cause of the fire is not at present known.

The Victoria Palace.—We were permitted through the courtesy of the management, to view the premises of this variety theatre on Saturday last. Though the installation was in a very unfinished state with regard to the stage, the whole of the house was well lighted with Brimsdown metal filament lamps. The supply is taken from the mains of the City and Westminster Electric Supply Co. A pressure of 400 volts is employed for power, and 200 volts for lighting. Special mains are brought into the back of the building for the stage lighting, and into the front for the lighting of the house. The stage equipment consists of the usual dimmers, battens, floats, and arc lamps. The dimmers are of the metal resistance type, arranged on a special switchboard on the stage. The arcs, which are of the Digby hand-fed type, are supplied at 80 volts by a special motor generator. A 50-volt battery has also been installed as an additional supply, to comply with the regulations should the supply fail. The lamps in the floats and battens are also Brimsdown. The fittings do not call for special mention, but there is a very elaborate heating system, with which an even temperature can be kept throughout the winter, and a sliding roof is provided to cool the house during the summer.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Nov. 2, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

23,735/10. **Electric Welding.** E. B. KOOPMAN and THE PONTELEC WELDING PATENTS, LTD. The plates to be welded together are bridged by welding pieces of small cross section, which can be of almost any shape, and placed either on alternate sides or on the same side of the plates. Current is passed through them to the plates, and is automatically stopped when the weld is complete. When the desired temperature is reached, the welding pieces are incorporated with the plates by pressure. Six figures.

25,175/10. **Drying Timber.** ALCOCK & COMPANY PROPRIETARY, LTD. In this process liquid electrodes are used instead of metal to avoid burning, especially when H.-T. currents are used. These are carried in receptacles which allow the liquid to be against the timber. Short logs are stored in a trough containing the liquid, and into the upper end a ring is driven, which holds the other electrode into which the current wires are immersed. For drying in a horizontal position the receptacles have their sides next the timber open, and are secured one upon each end of the log, with a liquid tight joint. In the case of stacked planks, short lead electrodes are arranged at regular intervals at the sides of, and in between, the planks. The liquid may be ordinary rain-water or a solution of soda, sulphate of zinc or copper, or any other having a preservative effect on the timber. An ammeter is placed in the circuit to indicate the amount of moisture present, a zero reading indicating that the timber is dry. Six figures.

26,909/10. **Flexible Cord Grip.** A. J. CHAPMAN and H. E. MASON. This is a ball and socket arrangement with the cord grip contained inside a hollow ball, which can turn freely in the cup at any angle, there being enough room in the cup to take sufficient slack wire. In this way the wire itself is not turned at an angle, so that chafing is avoided. To prevent the ball turning a complete revolution, a pin is inserted into a hole in the ball, and fixed to the cup, which is itself secured by an ordinary coupling ring. One figure.

76/11. **Carbon Brush Connections.** BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*). In a method of connecting flexible conductors to brushes, a hole is drilled in the brush, into which a loop of the conductor is placed and secured by a cement, which in hardening expands, and makes good contact with the brush. Any cement which expands on hardening can be used. A cement, known as "Smooth-on," and consisting of 70 per cent. of cast-iron filings, 25 per cent. plaster of paris, and 5 per cent. of free carbon, gives very good results. Three figures.

3,789/11. **Electric Signs.** H. BEY. A glass panel on which the letters or figures are printed directly, is provided with the desired number of holes forming the letters or figures. The face of each of the lamp holders is flush with the surface of the glass to which they are cemented. Another type, however, is preferably used, threaded on the inside and outside, the open end of which is turned back to form a flange. This is adapted to lie on the front surface of the glass, where it is held by a rubber washer, and screwed against the back of the glass by a nut. The holders are connected by very thin tinned copper wires, and insulated with shellac. The panel is framed, and a second panel, not drilled, can be placed at the back to render it weather proof, which can at the same time, by having the lettering reproduced on it, conceal the wiring of the front panel. Three figures.

13,623/11. **Hair Dryer.** A. SCHAEFFER. A motor-driven fan is so arranged in a single casing of the usual shape, that the blades extend laterally, and utilise the whole available space between the casing and the driving device. Three figures.

Amendments

9,802/98. **Electric Driving of Printing Presses.** W. A. CLATWORTHY and J. H. HOLMES. This patent has been amended by cutting out the first and second claims, which were decided in the Appeal Court to be too wide to be valid. (ELECTRICAL ENGINEERING, February 3rd, 1910, p. 74.) The original claims, one and two, are for a method of driving printing machines, which gives a first slow running speed, and a gradual acceleration until full speed is reached without any shock. This is effected by using two motors, a main motor for driving the machine direct, and an auxiliary motor connected to the main motor shaft through worm gearing, and a free-wheel clutch, so that the main motor can over run the auxiliary motor. Further details appeared in ELECTRICAL ENGINEERING, August 4th, 1910, p. 510.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: SIEMENS BROS. DYNAMO WORKS, 14,127/11.

Cables and Wires, Insulating Materials: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Insulating material] 5,165/11; GES FÜR ELEKTROTECHNISCHE INDUSTRIE [Conductors] 5,569/11; SCHAIRER [Moving conductor contact devices] 17,481/11.

Dynamos, Motors and Transformers: FLETCHER and GATEHOUSE [Methods of starting induction motors] 27,119/10; HEYLAND [Starting and regulating methods] 4,627/11; SIEMENS BROS. & CO. (*Siemens & Halske Akt.-Ges.*) [Current-transformer] 17,208/11; INRIG and GAVAN INRIG, LTD. [Dynamos] 20,904/11.

Heating: MIETH [Electrically-heated vessel] 14,222/11.

Incandescent Lamps: HORVATH, 27,401/10.

Instruments and Meters: KILROY, NEEDHAM, and EVERSHED & VIGNOLES, LTD. [Magnet armatures for vibrating diaphragms] 24,272/10; STRELOW [Meters on Ferraris principle] 8,032/11.

Switchgear and Fittings: HÖFLE [Automatic reversing starters] 23,757/10; TAYLOR [Automatic switches] 24,611/10; ROBERT BOSCH [Circuit interrupter contact pins] 72/11; LEONARD [Lamp-holders] 3,746/11; HARTMANN & BRAUN AKT.-GES. [Push-button switches] 6,147/11; ODGERS [Switch control from a distance] 14,704/11; LARZELERE [Electromagnetic switches] 17,142/11.

Telephony, Telegraphy and Signalling: WILLIS [Telephone receivers] 24,583/09; SANCHEZ [High-frequency apparatus] 24,143/10; FISHER [Sending signals electrically through conductors] 2,686/11; MCBERTY [Automatic telephone selectors] 3,452/11.

Traction: MUNRO and RAILLESS ELECTRIC TRACTION CO. [Fittings for overhead system] 24,475/10; SHEEHY [Electro-magnetically-operated collectors] 11,740/11.

Miscellaneous: WALKER [Clocks as electric alarms] 23,780/10; PENNER [Time-alarm apparatus] 23,947/10; G. A. SCHULTZE [Resistance measurement connection] 29,465/10; TOUSEY [X-ray tube] 7,067/11; BACHE [Electric instruction apparatus] 14,999/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: CARL ZEISS [Reflector searchlights] 21,658/11.

Distribution: BRANDENBURG [Automatic sectioning in station supply] 21,001/11 and 21,149/11; HARRIS [Circuit interrupters] 21,903/11.

Electric Ignition: PODSZUS, 3,821/11; UNTERBERG and HELMLE, 21,785/11.

Heating: MONNOT, 22,315/11.

Incandescent Lamps: ALLGEMEINES CHEMISCHES LABORATORIUM OSKAR H. ARENDT [Repairing metal filaments] 22,235/11.

Instruments: BROWN, 20,452/11.

Telephony and Telegraphy: SIEMENS & HALSKE AKT.-GES. [Automatic telephone systems] 19,573/11 and 19,645/11; SOC. D'ELECTRICITÉ MORS [Telescoping aerial masts] 22,403/11.

Miscellaneous: BRÜLL [Grab-hoisting gear] 8,798/11; MORRISON [Reversible galvanic batteries] 18,360/11; SOC. D'ELECTRICITÉ NILMELIOR [System of alternating magnetic flux] 22,053/11.

The following are the more important Patents that have become void through non-payment of renewal fees.

Insulating Materials: H. MCPHAIL [Insulation] 16,372/07.

Dynamos, Motors, and Transformers: W. L. WISE (*C. O. Mailloux, U.S.A.*) [Cooling and ventilating] 16,513/07; ALLGEMEINE ELEKTRICITÄTS GES. [Step-up transformer] 16,618/07.

Electric Ignition: SOC D'ELECTRICITÉ, "NILMELIOR," and A. MICHEL [Transformer] 14,959/05; OSTERREICHISCHE DAIMLER MOTOREN GES. and F. PORSCHE, 16,226/07.

Electrochemistry: J. BAILEY [Plating by electrolysis] 15,735/02.

Incandescent Lamps: C. A. STEVENSON [For lighthouses, buoys, &c.] 16,301/07.

Switchgear and Fuses: W. C. MAYO and J. HOULEHAN [Cut-outs] 16,364/07; R. LENNER [Cut-outs and switches] 16,485/07.

Telephony, Telegraphy, and Signalling: J. N. MASKELYNE [Wireless signalling] 16,113/03; J. G. BALSILLIE [Electro-magnetic receiver] 15,022/05; SIEMENS BROS. & CO. and G. S. GRIMSTON [Selective switch for type-printing receiver] 16,334/07.

Traction: G. H. JELFS [Controlling and locking signals] 14,789/99; W. GRIFFITHS and B. H. BEDELL [Surface contact system, switches, and conductors] 15,778/04; SIEMENS BROS. & CO. (*Siemens & Halske Akt.-Ges.*) [Operating points and switches] 15,869/04; T. W. BARKER and M. T. MEDWAY [Railway signals] 16,051/06; P. ROJCSIK [Point and switch control] 16,252/07; W. C. MAYO and J. HOULEHAN [Brakes, &c.] 16,365/07; A. H. NICHOLSON [Signal contacts] 16,488/07.

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CARDIFF—4, Church Street (Mr. H. Nance); **DUBLIN**—Norwich Union Chambers, Dawson Street (Mr. D. J. Doolan);
LEEDS—11, Upper Mill Hill, Boar Lane (Messrs. Casperson Bros.); **MIDDLESBROUGH**—303, Linthorpe Rd. (Messrs. J.T Bell & Co.);
NEWCASTLE-ON-TYNE—1, Higham Place (Mr. F. T. Hanks); **SHEFFIELD**—74, High St. (Mr. Wm. Molesworth).

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LOCAL NOTES

Bognor: *Electric Light.*—The Council are recommended to agree to Mr. W. Tate, J.P. (Chairman of the Council), applying for an electric lighting provisional order for the district.

Derby: *New Electric Lamp Works.*—The new electric lamp works of Metalite, Ltd., were formally opened by the Mayor on Monday. It is expected that from 700 to 1,000 hands will be employed when the works are fully occupied.

Elland: *Electricity Works.*—On the motion of a Councillor, an inquiry is to be held into the working of the electricity undertaking. Certain complaints appear to have been made as to the cost of production.

Greenock: *Electrical Exhibition.*—A very successful electrical exhibition was organised last week by Mr. J. A. Robertson, Borough Electrical Engineer. Following the general tendency just now, particular attention was concentrated upon the application of electricity to household purposes, and an electric home formed an important feature of the exhibition.

London: *Marylebone: Electricity Undertaking.*—During the course of his review on the past year's working at the meeting of the Council on Thursday, Alderman E. R. Debenham, the Mayor, paid a hearty tribute to the work of Colonel Hopkins, Chairman of the Electric Supply Committee, and also to the officials. He pointed out that the net profit for the past year of £6,712 brought the accumulated profit to £31,696. The profit last year had been made notwithstanding an increase of £8,500 per annum in rates. Much of this success was due to the originality of Mr. A. Wright in designing and completing the station in the circumstances which he did. There had been, he said, a good deal of criticism of the Electric Supply Committee, but he asked the critics to think whether they really saw the whole position in its true proportions as did those who had been through the stress of the last ten years. The Council paid £1,355,000 for goodwill upon an output of 6½ million units, which amounted to 2·65d. per unit. By March, 1909, the output had increased to 9 millions, and the goodwill charges reduced to 1·9d. per unit. At present the output was 13½ millions, and the goodwill charges 1·3d. per unit. At this rate in six years the goodwill charges will be reduced to 0·9d. per unit. The Sales Department was the settled policy of the Council, and therefore the officials were only carrying out the Council's instructions. Great care was taken not to injure the contractors; no new houses were wired, and he was not surprised that none of the charges made against the department had been proved. There were eleven canvassers, and it redounded to their credit that they had put their personal gain on one side and kept so closely to the Council's instructions. He thought a gross profit of from 30 to 44 per cent. upon the Sales Department showed that there was no price cutting, and no work was taken away from a contractor except at the expressed desire of the consumer.

Marylebone: Consulting Engineer.—The Electric Supply Committee have served notice on Mr. Arthur Wright to terminate his agreement as Consulting Engineer to the Council, and have also conveyed to him an expression of their high appreciation of the services rendered by him to the undertaking.

Luton: *Electric Cooking.*—As a result of the visit of the Electricity and Tramways Committee to the Olympia Electrical Exhibition, the Council has been recommended to sanction an expenditure amounting to £200 for the purchase of an electric cooking apparatus to be hired out. The recommendation has been adopted, but before the larger expenditure is incurred a number of cookers are to be purchased and experimented with in order to ascertain which are the most suitable.

Rochdale: *Electric Supply.*—Arrangements are being made for the supply of electricity in the Whitworth district.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Barnsley.—The Local Government Board have sanctioned a loan of £12,503 for electrical extensions.

Biddulph.—Messrs. Crews & Handford, Consulting Engineers, of Manchester, have reported to the Council with regard to an electric lighting scheme. Messrs. Heath have offered to supply the Council with current at 1½d. per unit.

Holmfirth.—The Council have decided to apply for an electric lighting provisional order, and also to the Local Government Board for sanction to borrow £8,000 for the undertaking.

Jerusalem.—Tenders are invited for an electric power station. Particulars may be obtained by British firms, 73 Basinghall Street, London, E.C.

Leigh (Essex).—The Council have been discussing the advisability of undertaking an electric lighting scheme.

Llandudno.—A Local Government Board inquiry was held last week concerning a loan of £500 for new mains.

London: *Stepney.*—The Finance Committee of the L.C.C. have sanctioned a loan of £15,700 for electricity purposes.

Walsall.—Mains extensions are to be carried out at an estimated cost of about £350.

Wolverhampton.—A Local Government Board inquiry was held last week concerning a loan of £11,000 for extensions to the electricity undertaking. The Town Clerk explained to Mr. H. R. Hooper, the Inspector, that the Council had authorised an expenditure of £21,700, of which £10,000 will be provided from reserve, £700 from revenue, and £11,000 out of capital. This latter sum includes £5,000 for building, £1,900 battery room, £800 sub-station, £1,440 workshop and stores, £760 for offices, £540 travelling crane and steel work for sub-station, and £160 contingencies. There is also £400 for workshop equipment, and £5,000 for generating machinery and switchgear. The large storage battery is to be provided with the sum taken from reserve.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Accrington: *New Church.*—Architects, Messrs. Grimshaw & Cunliffe, Birch Street, Accrington.

Bournemouth.—New elementary schools in Cranley Road. Education Committee.

Broughty Ferry.—New school. Architect, Mr. J. A. Langlands, 31 Murray Gates, Dundee.

Dublin.—The Waterworks Committee invite tenders for electric lighting and fire signalling apparatus at the new fire station, Thomas Street. Particulars from City Electrical Engineer, and tenders by November 21st.

Glasgow.—Training college at Jordan Hill to accommodate 1,200 students. Director of Studies, Technical College, Glasgow.

Hamilton.—New schools at an estimated cost of from £10,000 to £15,000.

Inverness.—Wiring new science and art school.

Stafford.—Public library. Borough Engineer.

MISCELLANEOUS

Birmingham.—Tenders are invited by Messrs. Cadbury Bros., Ltd., for stores at Bournville, including electric cables, lamps, &c.

London: *L.C.C.*—An expenditure of £9,000 is recommended by the Highways Committee in respect of additional tramway tracks on Dog Kennel Hill.

TENDERS RECEIVED AND ACCEPTED

London: *L.C.C.*—The offer of the British Westinghouse Co. for the supply and erection of four sets of electrical equipments car traversers **at £664** per set is recommended for acceptance.

The following tenders have been received for plant for the new tramway sub-station at Vauxhall:—High-tension electric cables:—Siemens Bros. & Co. (recommended), £9,761 19s.; W. T. Henley's Telegraph Works Co., £9,897 17s.; Callender's Cable & Construction Co., £10,062 6s.; British Insulated and Helsby Cables, £10,070; Western Electric Co., £10,188; Johnson & Phillips, £10,504; W. T. Glover & Co., £11,103 13s.; Foote & Milne, £12,143. Low-tension electric cables:—Western Electric Co. (recommended), £15,161 19s.; Callender's Cable & Construction Co., £15,401 10s.; W. T. Henley's Telegraph Works Co., £15,499 12s.; Johnson & Phillips, £15,522; Foote & Milne, £15,610 17s.; British Insulated & Helsby Cables, £15,800 11s.; Siemens Bros. & Co., £16,202 18s.; W. T. Glover & Co., £16,802 16s. Rotary converters:—

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Dick, Kerr & Co. (recommended), £6,089 10s.; General Electric Co., £6,149; British Westinghouse Electric & Manufacturing Co., £6,185 and £6,002; British Thomson-Houston Co., £8,240, £5,848, £6,161, and £6,260; Electric Construction Co., £8,307; Bruce Peebles & Co., £14,646.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £57 15s. to £58 (last week, £57 7s. 6d. to £57 12s. 6d.).

Bankruptcies and Liquidations.—A meeting of the Electric Fog Signal Co., Ltd., will be held at 1 Vine Street, Uxbridge, on November 27th, at 7 p.m., to hear the liquidator's account of the winding up.

Plant Wanted.—A small motor generator or transformer is required. (See an advertisement on another page.)

Scholey & Co., Ltd.—Mr. H. Scholey and Mr. C. W. Hill have started business as electrical and mechanical engineers at 151 Queen Victoria Street, E.C. A note appears opposite.

The Record Electric Co., Ltd.—Mr. J. W. Record, late manager of the instrument department of the General Electric Co. (Salford), and Mr. T. J. Boorne, late under-manager of same company's switchgear department (London), have commenced business under the above title, and have opened new works for the manufacture of instruments, &c., at Broadheath, Manchester, under the control of Mr. Record, while Mr. Boorne will look after the firm's interests at their London office, Caxton House, Westminster.

Agency.—Messrs. Richardsons (Billiter Square Buildings, E.C.) have been appointed London representatives of Messrs. Tait & Co., Kobe, Japan, who are opening an engineering department. Firms are invited to send catalogues in duplicate to Messrs. Richardsons' export department.

For Sale.—An electrical contractor's business in Westcliffe-on-Sea is for sale. (See an advertisement on another page.)

"Osram Week."—The General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), are starting on Saturday next a special week's advertising campaign on a scale not previously attempted in the electrical industry, which should assist the electrical industry generally in the fight against gas. The chief feature of the campaign will be to make use of the great dailies throughout the Kingdom to create the personal interest of electricity consumers in Osrams and Osram lighting. The scheme also includes the principal wholesale houses and local traders, so that the public enthusiasm can be followed up by a practical response in the supply of these lamps. As a further encouragement, the local traders will be making a special shop-window display of Osrams, which will be attractive by day and brilliant to a degree by night.

APPOINTMENTS AND PERSONAL NOTES

Mr. W. C. Mountain has retired from the firm of Ernest Scott & Mountain, and has commenced practice as a consulting engineer at 8 Sydenham Terrace, Newcastle-on-Tyne, specialising more particularly in colliery equipment. He has also been appointed arbitrator by the Coal Trade to represent a number of counties in connection with the use of electricity in mines, and is acting as consulting engineer to a number of collieries.

Mr. G. F. Gregory, of Darlington, has been appointed Second Engineer-in-Charge at the Ilford Electricity Works.

Mr. E. Dormann, Chief Engineer of Aron Electricity Meter, Ltd., is leaving his present position next week in order to take up an important appointment in Sweden.

An experienced traveller is required to sell shades, globes, and accessories. (See an advertisemnt on another page.)

A canvasser is required in the Southend Electricity Department. (See an advertisement on another page.)

The salary of Mr. H. L. Mills, Chief Assistant Electrical Engineer at Southampton, is to be increased from £250 to £300 per annum, by annual increments of £10.

Mr. J. A. Cawthra, Borough Electrical Engineer at South Shields, has resigned his appointment on receiving a post with the Victoria Falls and Transvaal Power Co., at £1,400 per annum.



COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Edison & Swan Electric Light Co.—The ordinary general meeting was held last week. Mr. H. Wolfenden, who presided, said that the directors did not recommend a dividend out of the credit balance of £25,856, as they wished to conserve their profits. It was proposed to increase their representation abroad and also to increase their stocks, working capital, and probably the plant. If the present position was maintained, he had no doubt that the directors would next year recommend a dividend.

The Imperial College Union.—The students of the Royal College of Science, the School of Mines, and the Central Technical College gathered in great force under the presidency of Mr. Taylor at the opening of this new club-house on Friday last by Sir Thomas Holland, in the unavoidable absence of the Right Hon. G. W. Balfour. The speeches were very short, there being a heavy musical programme to be got through. Sir Thomas Holland said that great credit was due to Mr. Acland for bringing the students of these three large colleges together, and he congratulated Sir Aston Webb, who was responsible for the building, for which £12,000 had been realised, and raised to £18,000 by the Governors. The building is situated behind the Albert Hall, in the Prince Consort Road, and is provided with a large dining-room and smoking-room on each side of the central door, and above these there is a library and gymnasium. The library is not yet equipped, and an appeal was made for funds for this purpose. The musical arrangements were excellent; to avoid overcrowding, a concert was arranged in the library while a play was taking place in the gymnasium. There were two performances of each, with an interval for refreshments, which were served in the dining-room. Altogether the evening was a most enjoyable one, and the students are to be congratulated on their new headquarters.

Scholey & Co., Ltd.—Mr. H. Scholey (late of Dick, Kerr & Co., Ltd.) and Mr. C. W. Hill (late of the Bournemouth Tramways) invited the editors of the leading electrical newspapers to dinner last Friday, and explained the objects of the new business they are starting (Scholey & Co., Ltd., 151 Queen Victoria Street, E.C.). There are British manufacturers who specialise in particular types of plant and apparatus, and who can manufacture these to compete not only in quality but also in price with any foreign firm. By co-operation in such a way that each firm supplies only the particular kind of plant or apparatus for the manufacture of which he is most advantageously placed, Mr. Scholey contends that this country might acquire a far greater share of foreign and colonial orders than at present, and his new firm is being established so as to be the link by means of which this co-operation can exist.

In the course of his remarks, Mr. Scholey explained that he had in mind those manufacturers who specialise on a particular article, and, being able to reap the benefit of repetition work in their factories, and not being encumbered with heavy establishment charges, can produce a first-rate article at a comparatively moderate cost. Moreover, it should never be overlooked that by far the largest proportion of the capital invested in manufacturing is invested in the small and scattered works of the country. But, Mr. Scholey continued, the strength of the small manufacturer is his weakness. So long as his trading is, comparatively speaking, local, he invariably succeeds, but directly he attempts to widen the area of his operations, he runs the risks of his prices going up by virtue of his increased selling expenses. The specialist manufacturer, however, deserves a wider market on account of the quality and comparative cheapness of his wares, and Scholey & Co., Ltd., is to be an organisation which can undertake the selling for a group of specialist manufacturers. The firm has already entered into definite agreements with some manufacturers, and in time expects to add others. The proposition is that the new firm shall devote itself entirely to the development of suitable markets, and the manufacturer shall confine himself to making material, looking to the new firm to effect the sales. It is expected that considerable trading will be done at home, but the main desire is for further trade abroad, for which purpose the eventual establishment of agencies, both in this country and in the most prominent towns in the British Colonies and South America, is contemplated. In the course of further conversation, it was explained that the large manufacturers in this country are exceedingly friendly to the idea, and in three or four cases have made definite offers of help. The new Company is not confining itself to electrical work, but will actually engage in the selling of various mechanical appliances and machinery.

Mr. Scholey is one of the most popular men in the electrical industry; there are indeed few with a wider circle of friends, and he is held in high esteem by all who have had to do with him in business. We feel that we are expressing the sentiments of many of our readers, as well as our own, when we wish him and his partner every success in his new undertaking.

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ELECTRICAL ENGINEERING

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SUMMARY

A Special Literary Supplement is included in this issue, containing notices and reviews of books, and a carefully revised list of selected works on electrical engineering and allied subjects.

The electric equipment of the new London Opera House in Kingsway presents several points of interest. Metal filament lamps are used exclusively for stage lighting, a special form of metallic dimmer is employed, and extensive use is made of concealed lighting in the auditorium. (Page 619.)

A number of motor-car lighting dynamos were shown at the Olympia Motor-car Exhibition, including special machines giving constant voltage over a large range of speed or mechanical speed regulating devices. (Page 620.)

Our detailed objections to the new draft Articles of Association submitted by the Council of the Institution of Electrical Engineers, are receiving strong support. In addition, there is decided opposition from all quarters to the proposals for increasing subscriptions. We publish extracts from the mass of correspondence which we have received. There is little doubt that the Council will amend its proposals. Another meeting of the Institution will be held this evening, and we urge all Members and Associate Members who can do so to attend. (Page 621.)

A Paper on high-tension transformers by Mr. W. T. Taylor was read by Mr. J. F. C. Snell at last Thursday's meeting of the Institution of Electrical Engineers. Various points in the construction and operation of transformers were considered, and particular attention was drawn to a three-transformer modification of the Scott system of converting from three to two phase. Several points in the Paper were severely criticised in the discussion. (Page 624.)

Twenty per cent. of the entrance fees is to be returned to exhibitors at the recent Electrical Exhibition at Olympia. A report by the Organising Managers suggests certain modifications in policy for future exhibitions. (Page 625.)

A Paper was read by Mr. R. J. Roberts on the mechanical design of D.C. turbo-generators before the Manchester Local Section of the Institution of Electrical Engineers, bringing out a number of points in connection with ventilation, commutator construction, and general design. (Page 626.)

The Edison and Swan Co. are now making metal filament lamps under licence from the Osram Lamp Works. (Page 627.)

At the Annual Dinner of the Birmingham Section of the Institution of Electrical Engineers, Mr. Ferranti acknowledged that the Council had done "something foolish," but said that they now intended to take full advantage of the "contentious interest" which had been awakened in the affairs of the Institution. Mr. Patchell mentioned the serious effect which the Coal Mines Bill would have on the electrical industry if it were passed as it stands at present, and Mr. Chattock pointed out that electric supply Authorities must be prepared to hire out cooking apparatus. (Page 627.)

A new flexible insulating material has been patented by the British Thomson-Houston Co. Two other patents published by the Patent Office last week include one for an arc lamp with means for keeping the arc from creeping up the carbons, and another for a method of supporting metal filaments. An improved construction of vibrating armature, for use with diaphragms, is also protected, as well as an electrically-heated vessel, in which the heating coil is arranged round the base and sides. A specification relating to arc furnaces for the treatment of gases has been restored, and a patent for a fusible cut-out has expired after a full life of fourteen years. (Page 628.)

The appeal in connection with the substitution of

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Parsons turbines for Westinghouse turbines at the Lot's Road generating station was concluded in the High Court on Thursday, judgment being reserved. The case for the Underground Railways Co. is that by the installation of the Parsons machines they brought to an end a very heavy bill of damages for breach of contract against the Westinghouse Co., and that, therefore, they were entitled to the full cost of the Parsons machines. (Page 627.)

In our "Electric Traction Notes" we give the Board of Trade's report upon the Lewisham tramway accident in September. The driver of the car is partially blamed for the accident. A tramway collision occurred on the Rawtenstall tramways on Saturday, in which two cars were smashed and 16 passengers injured. A proposal of the L.C.C. to dispense with the consent of the Borough Councils in regard to the use of the overhead system is to be strongly opposed. The L.C.C. is to be asked to urge the Government to constitute a Traffic Board for London. The use of trolley omnibuses is being considered in various parts of the country. (Page 630.)

Under "Telephony and Telegraphy (Including Wireless)" we refer to an injunction restraining the Hythe Corporation from interfering with the National Telephone Company's pole lines, and to a report upon the Melbourne telephone system, in which carelessness is attributed to the operators. (Page 631.)

The Board of Trade have recommended the Belfast Electricity Department to ventilate their 2,300 street boxes.—The Finance Committee of the L.C.C. have refused a loan for electric lighting extensions at Bermondsey on account of the refusal of the Borough Council to furnish certain financial information.—The Marylebone Council propose to continue the experiment of lighting small property at a fixed charge per lamp per week, and all wiring in connection with it is to be given to contractors.—The Finance Committee of the L.C.C. recommend that the Highways Committee should report as to the policy of the Council with regard to electrical loans, having in view the purchase of the London companies' undertakings. (Page 631.)

The Blackpool Corporation require a 1,500 kw. and an 800 kw. turbo-generator, and a jet condenser. Loans of £8,500 are to be taken up at Dartford, £3,000 at Dolgelly, and £6,316 at Islington. Two 1,000 kw. D.C. turbo-generators are required at Salford, and an electric lighting, tramway, and power works at Napier (N.Z.). The North Eastern Railway Co. require electrical stores; the Islington Council contemplate an expenditure of £2,400 upon pressure testing stations, and the New Zealand Government have in view considerable extensions of the telephone system. (Page 632.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, NOVEMBER 16th.
Institution of Electrical Engineers.
8 p.m. Informal meeting to discuss proposed alterations to Articles of Association.

FRIDAY, NOVEMBER 17th.
Northampton Institute Engineering Society.
5.45 p.m. At the Institute. "Design of Electric Power Stations," by A. H. Perrett.
Illuminating Engineering Society.
8 p.m. At Royal Society of Arts. "Notes on the Design of Motor-Car Headlights," by Dr. R. H. B. Hickman.

MONDAY, NOVEMBER 20th.
Electro-Harmonic Society.
8 p.m. Concert (Ladies' Night) at Holborn Restaurant.

TUESDAY, NOVEMBER 21st.
Institution of Electrical Engineers: Manchester Students' Section.
7.30 p.m. At Municipal Technical School. Debate on "Would Co-Partnership be Preferable to Trade Unionism for the Electrical Industry."

THURSDAY, NOVEMBER 23rd.
Institution of Electrical Engineers.
8 p.m. "Automatic Reversible Battery Boosters," by R. Rankin.



BUTCHER *(who has bought second-hand dynamo and intends purchasing oil-engine for driving same)*:—"What, four horse-power to work this! Why, I can turn it with my hand."

PUBLISHERS' NOTICE:—Books containing 48 Reprints of the Cartoons from Oct., 1910, to Sept., 1911, may be obtained, Price* 8d. *net (post free 9½d.).

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THE LONDON OPERA HOUSE

MR. HAMMERSTEIN'S addition to the playhouses of London, although by no means the largest, is certainly one of the most palatial. It is intended to fill a gap which has been evident for many years, and at last London is provided with a theatre which is to be devoted solely to the performance of Grand Opera.

Situated on the east side of Kingsway and near the south end, the Opera House presents an imposing appearance, the frontage being no less than 265 feet in length, while the total area occupied is 24,500 square feet. Portland stone on a granite base has been employed for the exterior façade, and this is decorated with statuary.

The electrical installation, with which we are more particularly concerned in this article, embodies the most modern principles, and has been carried out in strict accordance with London County Council Regulations. Energy is derived from two distinct sources, and these are not interchangeable in any way. There are five intakes altogether; at two of these the Charing Cross, West End and City Electricity Supply Co's mains are tapped, and at the others the Metropolitan Electric Supply Co.'s supply is available. The wiring is so arranged that the respective suppliers are responsible for lighting the same parts of the building, with the exception of the stage, which is supplied by the Charing Cross Co. only. Even on the stage, however, there is a special effect switchboard connected to the Metropolitan Co.'s mains, as is also the dressing-room board, and the large lighting board in the front of the house. All lighting is carried out at a pressure of 100 volts. there being a pressure of 200 volts between the outers of the three-wire system, and this latter pressure is employed for power purposes.

Starting from the Charing Cross intake, vulcanised, rubber-insulated, lead-covered, steel-armoured cables, each of 0·9 sq. in. cross section, are taken to the stage switchboard. The board itself is situated on a platform above the prompt corner, and gives one the impression of being allotted much too small a space. It consists of black enamelled slate panels mounted on an iron framework, and divided into four circuit panels, and one "black-out" panel, the latter carrying switches for stage and a portion of the auditorium lighting. All connections are made on the front of the board, the total number of circuits controlled being 78, while the capacity approximates to 1,500 amps. Each circuit is provided with a single-pole knife switch and a "Zed" fuse in each pole.

On the same platform as the switchboard are the dimmer regulators of Siemens Brothers Dynamo Works' special metallic type. These are arranged in three horizontal rows, one above another. Each wheel can be rotated independently of the others, or they can all be locked on to the shaft and rotated slowly by means of worm gear, or rapidly by a lever. All are provided with scales which enable the operator to tell exactly how many volts are absorbed by the resistance and how many are across the lamp terminals. It was originally intended to fix the dimmer resistances on the same horizontal level as the regulator wheels, but lack of space prevented this, and they are therefore arranged in two sets above the switchboard platform. This has resulted in a certain amount of complication with the tracker wires, and the arrangement possesses few features to recommend it. Liquid resistances are not used, but asbestos-covered resistance wire is connected to a number of small copper contact pieces, each insulated from the next by mica, the whole presenting the appearance of the developed surface of a commutator. Over these contact pieces there moves a switch blade carried on a vertical rod. When the switch blade has moved to such a position that practically all the resistance is in, and the lamps are therefore black, it actuates a small

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switch which, on opening, breaks the circuit, and thereby prevents overheating of the resistance. An interesting feature of the switch is a magnetic blow-out for extinguishing the spark. There are altogether 25 regulators, and these control 32 circuits on the stage, and 20 in the auditorium. In addition to these, the stage-board carries twelve circuits for stage arcs and fourteen circuits for the general lighting of the stage.

Arc lamp resistances are all permanently fixed under the stage, and the old system of carrying about a portable resistance with every lamp is entirely abolished. Each horizontal row of regulating wheels controls a particular colour of lamp, there being fifteen wheels for white lamps, six for blue and red lamps, and four for amber lamps.

Quite apart from the main stage switchboard there are also power and "special effect" boards on the stage. Cables from the Metropolitan Co.'s network are carried to a main power board itself, situated in the intake room, and there the following distribution takes place: two 100-amp. and one 25-amp. circuits, through double-pole fuses and cut-outs to ironclad distribution-boards in various parts of the building.

One of the 100-amp. circuits supplies the motor-driven deep-well pump, situated at the north-east corner of the building. An artesian well of 450 ft. in depth has been sunk, and water is pumped from this into two 800-gallon tanks on the roof, one at either end of the building. From these tanks water is conveyed to two 500-gallon tanks at the Portugal Street end, one being for the lavatories and the other for the heating installation, and to two 200-gallon tanks for supply to the dressing-rooms. Three armoured cables are carried from the same intake room to the "special effect" board situated at the back of the stage. This board has a capacity of 250 amps.

Apart from arcs and special effects, the lighting of the stage is done entirely by metal filament lamps, mostly of 32 c.p., the total number employed being about 2,500. There are eight battens in all, and they are probably among the longest in the metropolis, being no less than 60 ft. in length; each carries 200 lamps. Two have white lamps only, while the remaining six each have 100 white lamps, 34 red, 33 blue, and 33 amber. In the float are 250 lamps of four colours, while the proscenium is provided with 50 of three colours. Each hanging length, of which there are fourteen, carries 25 lamps, and there are besides bunch lights, projector lamps, and perch lamps. A feature of novelty arises in connection with the lightning arcs. These are six in number, and consist of small open arc lamps situated at various points on the stage. They are worked from the prompt corner by means of a rotary switch, and the stage manager is thus provided with absolute control over the elements.

All wiring on the stage is carried in screwed solid-drawn steel barrels, fitted with special draw boxes and inspection boxes at intervals. The barrel was all fixed first, and the wires were drawn in afterwards, the total amount of barrel used being upwards of 30,000 ft.

Coming now to the auditorium, it must be said that considerable skill and ingenuity have been displayed in dealing with the problem. Those responsible have realised to the full the enormous advantage of concealed lamps, and we know of no theatre in London where there is less direct lighting. In the centre of the ceiling is a large glass sunlight disc which covers a four-tier fitting, specially designed by Verity's, Ltd., to accord with the style of decoration, and over 9 ft. in diameter. In this large centre fitting are fixed 160 lamps, and the whole, which weighs about a ton, can be lowered to the ground. Special precautions are adopted to prevent falling glass in event of breakage of a panel. Surrounding the disc is a large oval expanse of ceiling, beautifully painted, and this is bordered by a spacious cornice. On the cornice are fitted 400 lamps, with Siemens' reflectors, but none of these lamps are visible from the auditorium. In addition, there are numerous fittings and flambeaux of exquisite design, also by Verity's, Ltd. For the control of a good deal of the front of house lighting, a large switchboard is fitted in a room on the left of the main entrance, provision being made for 78 circuits on the board. Some 3,000 lamps are installed in the front of the house. The ante-rooms, &c., are all fitted with dish lights.

The wiring of the dressing-rooms, workrooms, and auditorium staircases is carried out on the Stannos system, and is very neat and effective. Two distinct wires are used for each circuit, and the metal covering is not employed as a return conductor.

For purposes of ventilation the Plenum system has been installed, the fan being driven by a 20-kw. motor. A main duct is formed at each side of the house below the level of the stalls floor. From these ducts branches are worked in with the concrete partitions, or are constructed of galvanised iron, and carried to all parts of the house. Extraction is effected by four electrically-driven fans fixed in a horizontal position in the roof.

The various pendants, brackets, and fittings were designed and supplied by Verity's, Ltd., and are notable for their excellence from the æsthetic point of view. Siemens Brothers Dynamo Works, Ltd. supplied the switchgear, &c., while Messrs. Malcolm and Allan, to whom we are also indebted for much of the information in this article, were the electrical contractors.

ELECTRIC LIGHTING OF MOTOR CARS

A GOOD deal of progress has been made during the last two or three years in the application of electric lighting to motor-cars, due largely to the appearance of the metal filament lamp, which has much reduced the size of the apparatus required, and not the least interesting of the exhibits at the Motor-car Exhibition, which closed its doors at Olympia last Saturday, was the collection of car-lighting dynamos in the accessory section in the gallery. In these a variety of different devices are employed to enable a reasonably constant voltage to be applied to the battery for charging, irrespective of the speed of the engine, and to disconnect the dynamo when it is not giving a suitable voltage.

One of the best-known lighting dynamos is that of Messrs. C. A. Vandervell, Ltd., the latest form of which dispenses entirely with electrical or mechanical cut-in or cut-out devices by providing the armature with a free wheel clutch, allowing it to run light as a motor off the battery when the speed of the driving pulley is too low for a sufficient voltage to be generated. A nearly constant voltage over a large speed range is given by a combination of permanent and shunt-excited field magnets. A combination of permanent and wound magnets is also used in the Ducellier machine, shown by A. A. Godin, but this is used in conjunction with a simple electromagnetic cut-in switch. Messrs. Lodge Bros., Ltd., who are famous for their ignition apparatus, were showing a lighting outfit for the first time. This employs a magneto machine, in which the armature reaction is relied upon to prevent the voltage rising at high speeds, the only auxiliary apparatus being a simple electromagnetic cut-in switch. The firm also showed lamps with filaments specially arranged not to throw shadows on the reflector. Another permanent magnet machine is the Mira Magnetolite, but here the cut-in contact is worked by a centrifugal arrangement inside the driving pulley.

A new machine is that of Trier & Martin, Ltd. This gives a very constant voltage owing to an arrangement of auxiliary circuits and extra brushes, but the principal feature is a device which is practically a centrifugal mercury switch, which cuts the dynamo out of circuit when the speed falls. The Blériot dynamo is also a special constant-voltage machine with a large speed range, and employs an electrically-actuated cut-in switch. Another constant voltage machine requiring only an electromagnetic cut-in switch is the Leitner car-lighting dynamo shown by the Rotax Co. Messrs. Peto & Radford use a machine with no special electrical features, and prevent the speed rising by a centrifugal slipping clutch, but the usual electromagnetic cut-in is employed. Messrs. J. Lucas & Sons also employ a plain shunt-wound machine with an electromagnetic cut-in, and rely on a slipping clutch to prevent the speed rising above 1,500 r.p.m. A somewhat different principle is embodied in the "Magician" dynamo of United Motor Industries, where the field system is pivoted and pulled round by the torque of the armature against a spring, this working the cut-in switch and regulating the voltage by the equivalent of shifting the brushes.

We have already illustrated and described the car-lighting dynamo made by the British Thomson-Houston Co. on Messrs. S. Smith & Son's stand, and it will suffice to say here that its method of control is entirely different from any of the foregoing, depending on what is virtually a miniature form of the well-known Tirril regulator, in which a vibrating tongue short-circuits for a greater or less portion of the time a resistance in the field circuit. A form of automatic field regulator is also used in the machine shown by Seabrook Bros.

Other electrical accessories shown included lamps, electric horns, signalling devices to the driver, &c., and, of course, a vast display of ignition apparatus was made. This did not present so much novelty as in previous years, although the total volume of exhibits was greater, mainly owing to the fact that high-tension magneto or "dual" ignition is now almost universal, the bright exception being the Lodge battery and coil system, which is as prominent as ever. Among the closely packed rows of complete cars in the hall and annexe we failed to find a single example of an electric car or even one with electric transmission, but it is only fair to say that the exhibition does not pretend to represent the fields that these forms of traction are specially suited for. Petrol-electric systems are making great headway in several quarters, but more especially in connection with heavier work than is represented here.

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"Smoke Prevention and Fuel Economy," by W. H .Booth and J. B. C. Kershaw. 231 pp., 8½ by 5½ in. 79 figures. Second edition. (London: Constable & Co., Ltd.) 6s. net; abroad, 6s. 5d.

"The Mathematical Theory of Electricity and Magnetism," by J. H. Jeans. 584 pp., 10¼ by 7 in. About 130 figures. Second edition. (Cambridge: The University Press.) 15s. net; abroad, 16s.

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"Fortschritte der Elektrotechnik," by Dr. K. Strecker. 9½ by 6½ ins. 1910. Number 4. (Berlin: Julius Springer.) 15s. net; by post, 15s. 6d.

"The Steam Turbine," by Sir Charles A. Parsons, K.C.B. (The Rede Lecture, 1911.) 57 pp., 7½ in. by 5 in. 51 figures. (Cambridge: The University Press.) 1s. 6d. net; by post, 1s. 8d.

"A Course of Elementary Workshop Arithmetic," by H. A. Darling. 172 pp., 7¼ in by 5 in. 165 figures. (London: Blackie & Son, Ltd.) 1s. 6d.; by post, 1s. 9d.

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REVIEWS OF BOOKS

Illumination: Its Distribution and Measurement. By A. P. Trotter. 292 pp. 8¾ in. by 5¾ in. 210 figures. (London: Macmillan & Co.) 8s. 6d. net; abroad 9s. 2d.

WE have no ordinary book to deal with in this case, and the volume before us fills a position long vacant in our list of standard works.

The art of illumination may be said to have commenced in the last century, and as the rapid improvements in recent years of the sources of artificial light have resulted in a general desire for increased illumination, it is somewhat extraordinary that the subject has not received more attention, and that definite standards have not been universally accepted. If light is defined as the absence of darkness, or darkness as the absence of light, any recent improvement, say in street lighting, might be described as "not so bad as it used to be," and illumination might be expressed in terms of degrees of darkness. We are accustomed to hear that a certain street or hall is well lighted, but we seldom hear that the illumination is good. We read daily accounts of street accidents, and although the drivers of vehicles are always going dead slow—on their own estimate—they frequently blame bad lighting. There is, therefore, an urgent need for the public recognition of some standard of illumination. The speed of street traffic will not be reduced, but, on the contrary, the tendency will be for all vehicles to move faster and to take crossings and corners at a speed which would send any ordinary horse off its legs. The illumination, however, of minor streets, and even main streets, remains much the same as it was before the advent of petrol propulsion, and certain places in each street have been held sacred to the erection of a post which frequently serves as a monument to the past and is provided with a beacon to indicate its presence at night. In the early years of last century such lighting was doubtless considered to be good, but no attempt was made to define it as illumination, and in now describing it as bad, we can adopt standard measurements of illumination to define what we mean. The savage emerges into civilisation as soon as he can express his sensations in some quantitative standard, for it is then possible to say how much of a savage he still remains, and without a standard treatise on the great subject of illumination we should have continued to remain in the dark.

This good work has been undertaken by an author well qualified for the task, for he deals with the subject with the zeal of the student combined with the thoroughness of the expert. In 1892 Mr. A. P. Trotter read an historic Paper before the Institution of Civil Engineers, and in the preface to the volume now before us he modestly describes his work as an expansion of this Paper. At that time the subject was new to most of his audience, and although this Paper still remains a bright spot in the proceedings of the Institution, it is a matter of regret that 19 years have elapsed before we have been able to welcome a complete treatment of this important matter. The book will prove of fascinating interest to all who appreciate

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successful efforts to remove darkness, and being written in an easy conversational style, the author talks and the book speaks with a clear authority free from mathematical gymnastics. The author states that the scope of this book is limited to the principles and methods of distribution and the measurement of illumination, and he approaches the subject by easy stages from standards of candle-power to units of illumination. After dealing with distribution we have a description of various forms of photometers and accessory apparatus, followed by a short chapter on distribution of light from a source, and then further chapters dealing with the photometry of coloured lights, and the measurement of illumination with practical examples; the concluding chapter is on the subject of dioptric distribution and reminds us of much early work of the author, which reappears from time to time in modern apparatus.

Mr. Trotter has taken great trouble not only in referring to previous authors on kindred subjects but also in preparing a useful index to the works of other writers.

This book will be welcomed for its opportune appearance at a time of the greatest need for the information it contains, and as a standard work of reference it will be an invaluable addition to every library.

FRANK BAILEY.

The Law Relating to Electrical Engineering in India. (The Indian Electricity Act, 1910). By J. W. Meares. 426 pp. 9½ in. by 6¼ in. (Calcutta: Thacker, Spink & Co.) 15*s*. net.; abroad 15*s*. 11*d*

WE commend this book to the lawmakers of the mother country. It was our first intention, in reviewing it, to make a complete comparison of the law governing applications of electricity in India and in this country, and to investigate to what extent the differences in the two were the outcome of the different social, administrative and climatic conditions, and to what extent they were due to the fact that the Indian Government, guided by Mr. Meares, has actually improved upon the patchwork legislation by which electric lighting, power, and traction in Great Britain is controlled. Space will not permit us to do this, however, but we may say that there is much in the Indian Electricity Act of 1910 that might well be copied at home. Mr. Meares' explanation of the Act and its application, as well as the reasons for and effect of its various provisions, are not only clear, but afford most interesting reading. To those who are interested in important electrical work in India the book is indispensable.

The Electric Propulsion of Ships. By H. M. Hobart. 167 pp. 8¾ in. by 5½ in. 43 figures. (London, Harper Brothers). 5*s*. net., abroad, 5*s*. 4*d*.

THE desirability of employing higher turbine speeds and lower propeller speeds than those necessitated by direct coupling if the highest efficiency is to be obtained from steam turbine drive for marine propulsion is very generally admitted, and the author sets out to investigate the capabilities of electrical gear for supplying this want. He also describes a good deal that has been done in the application of mechanical gear to this purpose, but insists that however efficient these may be there are other advantages which can only be secured by electrical systems. These include the possibility of still running the turbines at their most efficient speed for all propeller speeds, better manœuvring power owing to ease of starting, stopping and reversing the propellers and avoidance of separate reverse turbines. The first half of the book lays a thorough ground work by setting forth the mechanics of ship propulsion generally, after which various aspects of the improvement in efficiency which electrical gear can introduce are discussed, and reference is made to its special suitability for use with internal combustion engines. Passing on to electrical detail, Mr. Hobart gives his views as to the relative merits of continuous and alternating systems, preferring the former for moderate generator speeds such as those given by gas and oil engines, and the latter for very large units and steam turbine speeds. Various patented systems of control are then described, including several where the speed variation of the squirrel cage induction motors is obtained by alterations of frequency, alterations of effective motor pole numbers, alterations of the phase system, or combinations of these methods. Mr. Hobart's clear exposition of the subject should be of considerable use in paving the way for the realisation of the hopes of the little band of engineers who have so persistently advocated electrical transmission gear for the propulsion of ships.

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Shop Management. By F. W. Taylor. 207 pp. 8¾ ins. by 5¾ ins.; four figures. (London: Harper Bros.) 5s. net; abroad, 5s. 6d.

THE author is a well known American engineer, and the joint-inventor of the Taylor-White self-hardening steel of eleven years ago, which gave rise to the important development of the new industry of high-speed tool steels. From beginning to end, the book treats only of the human side of the workshop, and it is, we believe, the first systematic treatise on the important question of "speed up" production. Various devices known as "premium bonus systems" are carefully dealt with, and the importance of accurate time records for every kind of work, no matter how complex, is insisted upon. Examples are given of records in such widely divergent fields as checking bicycle balls, drainage work, and building operations, and some of the investigations have taken over six years to complete. The ideal workshop, the author pictures, is certainly a very grim one of strenuous life, in which the worker of moderate attainments and the aged have no place.

The examples given of increased output due to the author's methods are certainly remarkable, as the following illustration will show:—

Original Output.	*Output under Taylor's System.*
120 girls sorting and checking bicycle balls.	Reduced to 35 girls for same output.
Working hours 10½ per day.	Reduced to 8½ hours.
Average weekly wage, 3½ dollars to 4½ dollars.	Increased to 6½ dollars to 9 dollars.

The author considers in turn most of the premium bonus systems in use, and finally recommends his own, whereby a very energetic workman at his maximum rate may earn double the ordinary rate of pay. The book is an interesting one, and should be read by all engineers dealing with cheap production. Its arrangement, however, is rather curious, as the whole 202 pages form one long chapter, undivided into sections in any way; apparently the work is to be read at the same rapid rate as recommended for workshop production, and the division into chapters might be an excuse for useless loitering on the way.

Mill and Factory Wiring. By R. G. Devey. 197 pp. 6½ in. by 4¼ in. 128 figures. (London: Constable & Co., Ltd.) 2s. net; by post, 2s. 2d.

WE congratulate both the author and the publisher in having provided a book which was really needed. It is evidently the work of a practical man who has had experience in the subject with which he deals. He assumes that the wireman or wiring contractor for whom it is intended knows the fundamental principles of his trade, and explains, without unnecessary introduction, the essentials of mill and factory work. He has not succumbed to the temptation, which most writers on wiring cannot resist, of filling his book with long extracts from wiring rules and manufacturers' catalogues, and there is hardly a page in the book which is not of direct practical utility. Apparently the book, although only published last month, has gone to press before the issue of the latest edition of the Wiring Rules of the Institution of Electrical Engineers, and the old wiring table is embodied, but we do not doubt that the author will very soon have the opportunity of remedying this in a new edition.

Electrical Mining Installations. By P. W. Freudemacher. 118 pp. 6½ in. by 4¼ in. 36 figures. (London: Constable & Co.) 2s. net; by post, 2s. 2d.

THIS is another useful volume of Messrs. Constable's "Electrical Installation Manuals"; it should be serviceable to workmen and junior engineers engaged in the electrical departments in mines. A small handbook of this kind cannot cover the subject completely, but a good idea is given as to the nature of the material required and the methods of installing it. A chapter on repairs, maintenance, and systematic supervision and inspection would enhance the value of the book. We notice that the maximum permissible currents given in the conductor table are not those in the last edition of the I.E.E. Rules, but are those of the previous one; this is, however, not serious, as the new rules permit maximum current densities higher than would be suitable in the majority of cases in mines.

Treatise on the Gas Engine. By H. Haeder. 317 pp. 9½ in. by 7¼ in. 23 figures. (London: Crosby, Lockwood & Son.) 18s. net; abroad, 18s. 5d.

A WORK embodying German gas engine experience appears here in a translation, and the scope of the work is best expressed in the translator's words as being to assist those engaged in the application of scientific principles to internal combustion engine design. Considerable trouble has been taken in adding equivalent dimensions in inches for the benefit of those who are not yet able to think in millimetres, and the completeness of the original has been extended by the addition of various tables. Long chapters are devoted to the mechanics of the subject, and the effect of inertia of the reciprocating parts on the crank effort diagram is discussed at considerable length. The construction of the various engine parts is then dealt with very practically, and many useful dimensions are given and methods of calculation set forth. A short but interesting final chapter deals with working costs, and in an appendix a description is given of the Humphrey gas pump. The whole book is for the practical designer, and is quantitative rather than qualitative throughout.

The Steam Turbine. By Sir Charles A. Parsons, K.C.B. (The Rede Lecture, 1911.) 57 pp. 7½ in. by 5 in. 51 figures. (Cambridge: The University Press.) 1s. 6d. net; by post, 1s. 8d.

A REPRINT is here given of a "Rede" lecture given by Sir Charles A. Parsons at Cambridge this year. Opening with some historical matter, the general principles of the reaction turbine are followed out, and the relations between steam and blade velocities are made clear. A few words follow as to the design of suitable high-speed dynamos for turbine drive, limited, however, to early experimental machines. The impulse turbine is then briefly treated, and the advantage of one or two impulse wheels as the first stages is pointed out. It is, however, insisted upon that the highest efficiency has been attained with the pure compound reaction turbine of large size where the high pressure portion is contained in a separate casing of great rigidity and short length. The latter part of the lecture is devoted to marine turbines, and in conclusion the extended use of gearing to obtain the desired speed reduction from the turbine to the propeller is prophecied. The whole is most interesting reading, even if it does not contain much with which the engineer who follows these matters is not already familiar.

Public Ownership of Telephones in Europe. By A. N. Holcombe, Ph.D. 482 pp. 8¾ in. by 6 in. (London: Constable & Co.) 8s. 6d. net; abroad, 9s. 1d.

WE trust that this book will reach the numerous self-constituted critics of the telephone system of this country. It will convince them how little they know of the subject, and yet the work, which is written by a student of economics, deals mainly with the question of ownership, broad matters of organisation, the policy as to rates, and the labour problems which arise, and touches on technical and engineering matters as little as possible. For instance, the difficulty of determining an equitable telephone tariff and the various considerations that govern it are well brought out; but as no detailed figures are given as to the cost of plant or its probable life nor estimates of operating expenses, the would-be framer or critic of telephone rates will not find what he requires. When the author does deal with technical matters he is not always fortunate. For instance, he is not to be commended for the dogmatic statement that "the determination of the conditions under which the condition of automatic switchboards will produce a saving in the expenses of operation is purely a matter of mathematical computation." The author's method, guided by the motto "Je ne propose rien . . . j'expose," becomes tedious at times, and the fact that the work deals only with countries on the Continent of Europe and not with Great Britain and America diminishes its value to the student of telephone politics.

Heat. By R. W. Stewart and J. Satterly. 480 pp. 6¾ in. by 5 in. 40 figures. (London: W. B. Clive.) 4s. 6d. net; abroad, 4s. 10½d.

THIS book is intended to provide a course on the theory of heat of the intermediate University standard. A large number of experiments suitable for laboratory work are included in each chapter. After a brief introduction, the book opens with a chapter describing the construction and use of various forms of thermometers. The next chapter is given to approximations, to bring home to the student the fallacy of using more figures than one is sure of when calculating from observed quantities. The expansion of solids and liquids are dealt with in an exhaustive manner, the former being treated graphically. The chapter on

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the expansion of gases thoroughly investigates Boyle's and Charles's laws, and a clear treatment of the phenomena of specific heat is followed by a chapter on the laws of fusion. The determination of vapour density is discussed with the practical methods of Gay Lussac (or Hoffman), Dumas, and Victor Meyer. Besides other chapters on hygrometry, conduction of heat treated graphically, and the mechanical equivalent of heat, isothermal and adiabatic curves are dealt with at great length, and an account is also given of some of the latest methods in pyrometry and the liquefaction of gases. Answers to the various examination questions appear at the end of the book.

Quaternions as the Result of Algebraic Operations. By A. Latham Baker. 92 pp. 8½ in. by 5¾ in. (London: Constable and Co.) 6s. net; abroad, 6s. 3½d.

THE author, who is head of the department of mathematics at the Manual Training High School of Brooklyn (New York), remarks rightly in his preface that beginners are apt to be bewildered by the arbitrary manner in which the subject of quaternions is developed. New magnitudes are arbitrarily assumed, subject to arbitrary laws, and the reader, although he finds the logic consistent and the results concordant with those of his previous knowledge, hardly knows why. He feels himself in a new country, but is uncertain how he got there. This small book is intended to lead the student from the known to the unknown by familiar steps.

Smoke Prevention and Fuel Economy. By H. W. Booth and J. B. C. Kershaw. 231 pp. 8½ in. by 5½ in. 79 figures. Second edition. (London: Constable & Co., Ltd.) 6s. net; abroad, 6s. 5d.

THE first edition of this work, which appeared about seven years ago, was largely based on a German work by E. Schmatolla, although a good deal of alteration was made in view of English practice. Some revision has been made for the present edition, and a new chapter dealing with the legal position, and the work of voluntary agencies has also been added. The nature of the book may be gathered from the titles of the principal chapters, which are:—The Chemistry of the Combustion Process; Present Methods of Burning Fuel; Improved Methods of Burning Fuel; and Examination of the Waste Gases. An appendix illustrates the subject by a selection of abstracts of patents of smoke-preventing apparatus.

An Elementary Course on Practical Applied Electricity and Magnetism. By D. H. Ogley. 134 pp. 7½ in. by 5 in. 68 figures. (London: Longmans, Green and Co.) 2s. 6d. net; by post, 2s. 9d.

A USEFUL treatise for the physical laboratory is provided as a guide for the student to apply his theoretical knowledge to practical purposes. There are sixty-four experiments, typical of any up-to-date laboratory, which can be studied beforehand, so that all the time in the laboratory can be usefully occupied. The last dozen experiments relate to the motor and dynamo, and the use of the photometer is also discussed.

Heat and Steam. By S. G. Wheeler. 224 pp. 7½ in. by 5 in. 85 figures. (London: E. Arnold.) 4s. 6d. net; abroad, 4s. 10d.

WE have here a collection of notes on heat and steam, arranged in condensed form, originally intended as a text-book for naval students. As mentioned in the preface, the object aimed at throughout is to present a reasoned argument to illustrate the underlying principle in the use of heat in engines, rather than a collection of facts and formulæ with which to work out problems unlikely to happen in practice. Examples are given at the end of each chapter, and suggestions are made as to the methods of tackling them. The variation of the total heat and internal energy with change of temperature and pressure are shown on charts, which can be used instead of steam tables for rough calculations.

"Mechanical World" Pocket Diary and Year Book for 1911. 388 pp. 6¼ in. by 4 in. (Manchester: Emmott & Co., Ltd.) 6d. net; by post, 8½d.

IN preparing the twenty-fifth annual edition of this popular sixpennyworth, a good deal of revision has again been made, the section on steam turbines in particular having been extended and brought up to date. New matter has also been introduced regarding milling machines, roller bearings, and other subjects; some freshly arranged tables appear, and there has been extensive revision throughout. Electrical matters are, as usual, reserved for a companion volume.

White's Engineering Pocket Book. 93 pp. 5 in. by 3½ in. Wigan: Thos. Wall & Sons, Ltd.) 1s. net; by post, 1s. 1d.

THE greater part of the contents of this pocket-book is devoted to mechanical matters, and as much as 30 pages, or about one-third of the text, deals with screw threads. There is, however, a certain amount of electrical information, including Sir William Preece's fuse tables, sandwiched in between a table of round steel wire ropes and a description of a patent water-tube boiler. There is also a somewhat lengthy exposition of the relations between E.M.F. current and resistance under the heading of applied formulæ, but much of this space is wasted in working out rather obvious examples. After a few words on efficiency and losses in generators and motors, however, the author returns to the subject of steam boilers, in which he is evidently more at home.

The "Cole" Code. 123 pp. 10 in. by 7½ in. (Wigan: Thos. Wall & Sons, Ltd.) 15s. net; abroad, 16s. 1d.

THIS code has as its basis a set of 21,000 five-letter combinations, each with a distinguishing number, some representing single words, others phrases and complete sentences. The selection is such that it is possible to code messages of any kind verbatim with surprisingly few code-words, as well as to send the more usual kind of commercial messages. Special methods for applying the code-words to the needs of any particular business form a part of the scheme, thus considerably extending its usefulness. Special code-words are employed for indicating what combination of such extra books is to be read from, and other additional code-words extend the applicability of the code to seven-figure numerals. We understand that this code is used by Messrs. Willans & Robinson, of Rugby.

Pitman's Shorthand for Electrical and Engineering Correspondence. 90 pp. 6½ in. by 4¼ in. (London: Sir Isaac Pitman & Sons, Ltd.) 1s. 6d. net; by post, 1s. 8d.

THIS is an adaptation of Pitman's shorthand to the requirements of electrical and engineering correspondence. The long list of phrases and expressions, together with the information as to specifications, contracts, &c., should not fail to be of material assistance to the young shorthand typist entering the services of a firm engaged in the electrical or engineering trade. In one or two matters strict accuracy has not been observed, as, for instance, in the list of abbreviations at the end. There is also an obvious printer's error, s.w.g. being given as representing "standard *wine* gauge."

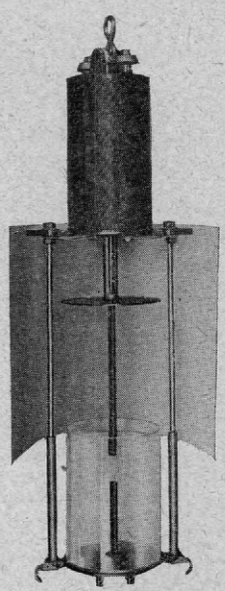
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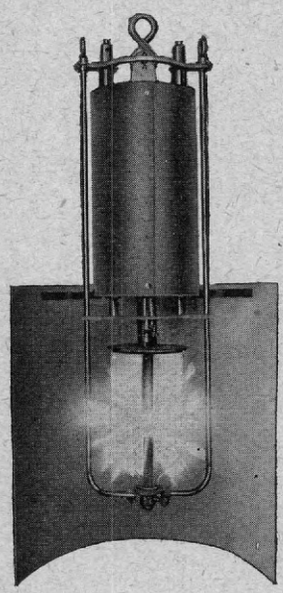
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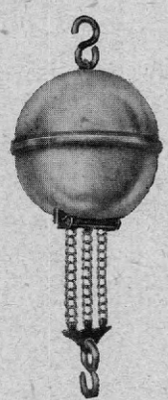
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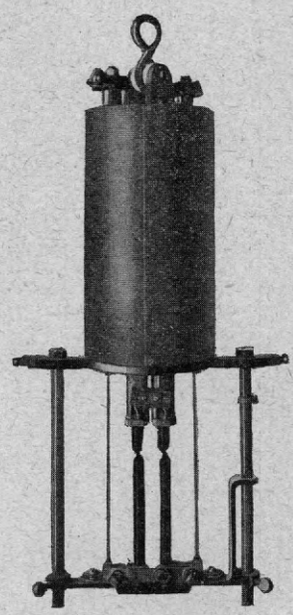
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Secondary Batteries. E. J. Wade. 10s. 6d. net; abr., 11s. 3d.
The Electric Propulsion of Ships. H. M. Hobart. 5s. net; abr., 5s. 6d. (*See Review this week.*)
Industrial Electrical Measuring Instruments. K. Edgcumbe. 8s. net; abr., 8s. 10d.
Medical Electricity. H. Lewis Jones. 5th edition. 12s. 6d. net; abr., 13s. 4d.
The Law Relating to Electricity. C. M. Knowles. *Vol. I.*, Lighting and Power. *Vol. II.*, Traction. 34s.; by post 34s. 6d.; abr., 35s. 8d. (*Reviewed May 18th*, 1911.)
The Law Relating to Electrical Energy in India. J. W. Meares. 15s. net.; abr., 15s. 11d. (*See Review this week.*)
The Patents and Designs Act, 1907. J. Roberts and H. F. Moulton. 4s. net; abr., 4s. 4d.
Rating of Electric Lighting, Electric Tramway, and Similar Undertakings. W. G. Bond. 2s. 6d. net; abr., 2s. 9d.
Garcke's Manual of Electrical Undertakings and Directors. Vol. XV., 21s. net; abr., 21s. carriage forward.
Form of Model General Conditions. Issued by the Institution of Electrical Engineers. 1s.; by post, 1s. 2d.
Lightning Conductors and Lightning Guards. Sir Oliver Lodge. 15s.; abr., 15s. 8d.
Modern Lightning Conductors. K. Hedges. 6s. 6d. net; abr., 7s. 2d.
Electric Bells. N. H. Schneider. 1s. 6d. net; by post, 1s. 8d.
Practical Electric Bell Fitting. F. C. Allsop. 3s. 6d.; abr., 3s. 10d.
Electric Ignition for Motor Vehicles. W. Hibbert. 2nd edition. 1s. 6d. net; by post, 1s. 8d.
The Electrical Ignition of Petrol Engines. J. W. Warr. 2s. net; by post, 2s. 1½d. (*Reviewed March 16th*, 1911.)
Quick and Easy Methods of Calculating: A Simple Explanation of the Theory and Use of the Slide Rule, Logarithms, &c. R. G. Blaine. 3rd edition. 2s. 6d.; abr., 2s. 9d.
The Slide Rule. A Practical Manual. C. N. Pickworth. 2s.; abr., 2s. 3d. 12th edition. (*Reviewed March 16th*, 1911.)
Logarithms for Beginners. C. N. Pickworth. 1s.; by post, 1s. 2d. 3rd edition. (*Reviewed March 16th*, 1911.)
Commercial Organisation of Engineering Factories. H. Spencer. 10s. 6d. net; abr., 11s.
Shop Management. F. W. Taylor. 5s. net; abr., 5s. 6d. (*See Review this week.*)
Pitman's Shorthand for Electrical Engineering Correspondence. 1s. 6d. net; abr., 1s. 8d. (*See Review this week.*)
A Dictionary of Electrical Engineering. Edited by H. M. Hobart. 2 vols. 35s. net; British Colonies, 45s. net; Canada, $11. Other countries carriage forward. (*Reviewed Feb. 16th*, 1911.)
Electrical Dictionary: A Popular Encyclopædia of Words and Terms used in the Practice of Electrical Engineering. T. O'Conor Sloane. 4th edition. 7s. 6d.; abr., 8s. 3d.
Technical Dictionaries in Six Languages: English, Spanish, German, Russian, French, Italian. Edited by Deinhardt and Schlomann:—
Vol. II., Electrical Engineering. Cloth, 25s. net; abr., 25s. 10d. Leather, 30s. net; abr., 30s. 10d.
List of other volumes on application.
Engineers' Pocket Dictionary, French-English. M. Lvoff. 1s. 6d. net; by post, 1s. 7d.
Forty-Eight Cartoons Reprinted from ELECTRICAL ENGINEERING, Oct., 1910–Sept., 1911. 8d. net; by post, 9½d.

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THE PROPOSED CHANGES AT THE INSTITUTION OF ELECTRICAL ENGINEERS

WE have received masses of letters from correspondents with regard to the Council's proposed changes in the Articles of Association of the Institution of Electrical Engineers, so many that it has been impossible to answer them individually.

THE SUBSCRIPTION QUESTION

While we are supported on all sides in our objections to the proposed name for the new class of members, as well as to the constitution and proposed method of nominating the Council, and to other vital alterations put forward by the present Council, there is equal dissatisfaction with the proposals for increasing subscriptions. So strong and definite are the views expressed on all sides that there is little doubt that the Council will find it necessary to keep the subscriptions at their present level so far as country Members and Associate Members are concerned, otherwise there will be wholesale resignations, and the main object of the increased subscription—viz., to obtain an immediate increase in revenue—will be defeated. From the speech made by Mr. Ferranti at the dinner of the Birmingham Local Section (reported on another page), it is clear that the Council is now anxious to defer to the wishes of the membership, and we have no doubt that they appreciate the efforts that are being made to obtain the collective expressions of views which will enable them to ascertain what the wishes of the members actually are. The Council will be represented by Mr. Ferranti and Mr. Hammond, at the open meeting to be held in Birmingham on Wednesday, Nov. 22nd., to discuss the proposals, and possibly a similar course will be taken at other centres. In the meanwhile, as already announced, there is to be a meeting at the Institution in London at 8 o'clock to-day, to discuss the matter. The Council acknowledge that a mistake has been made in their assumption that there would be so little disagreement in their proposals that their adoption could be considered a purely formal matter, and they now desire to profit to the fullest extent by the interest that has been awakened in the Institution and its organisation, so that the changes eventually made shall be those which have the approval of the Institution as a whole. It appears probable, therefore, that the new draft Articles will be considerably modified before they are again laid before the Members for formal adoption at the Extraordinary General Meeting, which was adjourned to a date "not earlier than Nov. 30th." To obtain and collate all the proposals will entail a considerable amount of labour, and although the Council will naturally desire to hold this meeting, and the subsequent necessary confirmatory meeting, as soon as possible, so that any increases in subscription that are agreed upon may come in force from the beginning of next year, it is doubtful whether it will now be possible to hold the first of these two formal meetings before Dec. 7th.

STRONG SUPPORT OF OUR AMENDMENTS

As announced in our last issue, we invited Members and Associate Members to signify their concurrence in the following amendments:

(*a*) Only Members and Associate Members must be permitted to use the Official Abbreviations.

(*b*) "Associates" must henceforth be called "Affiliated Members." [Members of this class, not being engineers, should have a name which will avoid confusion with Associate Members.]

(*c*) The new class of Members must be called "Subscribers" instead of "Licentiates" [for this new class will be composed of men with limited qualifications and experience].

(*d*) Not more than two persons whose only qualification is eminence in science and who are not engineers, must be admitted annually as Members. [Others can be elected as Affiliated Members or Subscribers.]

(*e*) Eminence in law must only qualify for Affiliated Membership and not for Membership.

(*f*) In the case of foreign candidates for Membership, the same number of personal recommendations must be required as in the case of British subjects, and not less.

(*g*) There must be four Associate Members and only two Affiliated Members (Associates) on the Council, instead of three of each.

(*h*) The Council's proposals for new Members of Council must be sent to every Corporate Member six weeks before the Annual General Meeting, inviting further nominations within three weeks.

(*j*) Committees containing non-members of Council must be Advisory only, and must not possess the full powers of the Council.

(*k*) The Incorporation of other societies must not be effected unless allowed by a Special Resolution of Corporate Members of the Institution of which twenty-one days' notice has been given.

One hundred and fifty Members and Associate Members have attached their names to the above. The signatures received and sent in by us to the Secretary of the Institution are as follows:-

MEMBERS.

F. Ayton	T. Hesketh	A. H. Pott
H. H. Berry	E. E. Hoadley	H. Richardson
H. L. P. Boot	J. E. Hodgkin	N. B. Rosher
H. Brazil	H. L. Howard	M. Ruddle
A. Bremner	Frank Johnston	E. T. Ruthven-Murray
Frederick Brown	E. L. Joseph	J. Sayers
J. K. Brydges	J. W. Kempster	A. M. Sillar
I. Bulfin	E. M. Lacey	R. B. Slacke
J. Christie	T. J. Larkin	C. B. Smith
A. C. Cormack	A. J. Makower	W. J. U. Sowter
G. H. Cottam	H. Marryat	Andrew Stewart
H. W. Couzens	R. B. Matthews	A. J. Stubbs
C. W. S. Crawley	W. P. Maycock	R. R. Todd
Prof. H. T. Davidge	C. Mittelhausen	W. A. Vignoles
A. A. Day	C. C. F. Monckton	C. Weiss
A. C. Eborall	H. D. Munro	H. D. Wilkinson
R. S. Erskine	F. H. Nalder	T. P. Wilmshurst
D. J. Gadsby	M. O'Gorman	
A. G. Hansard	F. Pooley	

ASSOCIATE MEMBERS.

P. F. Allan	H. N. Fullarton	B. H. Morphy
C. E. Allen	M. H. Galsworthy	W. Napier
H. M. Anning	W. A. Gilbert	A. P. O'Brien
G. Archer	P. Good	M. C. Olsson
T. Baxendale	Harold Gray	R. L. Pearson
H. L. Bazalgette	H. C. Gray	C. S. Peel
R. Bilsland	Harry Green	W. G. Pickvance
D. H. Bishop	F. S. Grogan	P. S. Pitt
W. H. D. Bostock	A. Hamilton-Ellis	P. C. Pope
D. H. Boyd	A. L. Hamkens	B. G. Rae
R. A. Broad	A. F. Harris	F. C. Raphael
F. B. Brown	H. F. Haworth	R. L. W. Roberts
J. E. Brown	B. B. Heaviside	S. R. Roget
H. R. Burnett	W. O. Horsnaill	P. P. Sandford
John Burns	A. P. Hudson	G. J. D. Scott
B. S. Cohen	T. E. Ingoldby	H. S. Scott
A. A. Collie	P. H. Jantzen	E. Seddon
D. J. L. Coninck-Westenberg	J. H. Johnson	C. R. Shaw
	R. J. Kaula	W. Sillery
J. F. Coote	J. Kirkwood	W. F. Simpson
H. H. Couzens	Charles Lamb	A. S. M. Sörensen
W. W. B. Crompton	Harry Lamb	J. E. Tapper
C. J. Cummins	H. Tomlinson Lee	L. G. Tate
J. E. Dawson	H. Lees	T. R. H. Tetley
J. Dubbin	W. S. Lonsdale	W. W. Thomas
L de R. Du Verge	R. Lund	M. J. E. Tilney
H. A. Edger	H. Luttrel-Elward	R. N. Torpy
G. G. Ewer	A. E. McKenzie	H. Vickers
W. Eynon	J. M. S. Maxwell	W. V. Waite
F. Fernie	A. E. Mayes	F. J. Warden-Stevens
S. K. Ferrier	L. B. Miller	H. Whittle
L. L. Foster	W. F. Mitchell	J. H. Wright

If any more of our readers (who are Members or Associate Members) desire to have their names added to the list, we shall be pleased to send them forms for signature.

The Local Sections are acting independently, and are each drafting a set of amendments. They are all, we believe, taking exception to an increase in subscriptions, and their objections on the other points are to a large extent similar to ours.

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CORRESPONDENCE RECEIVED

Extracts from a few of the letters we have received are given below. We have, however, been inundated with correspondence, and many exceedingly interesting letters must remain unpublished.

Mr. Frank Bailey, M.Inst.C.E., Engineer-in-Chief of the City of London Electric Lighting Co., Ltd., writes: The draft is so unsatisfactory that I am convinced no small amendments can make it acceptable. The whole thing requires re-modelling on modern lines so as to meet the present and future requirements of the Institution. The proposed alterations are ridiculous, and no attempt has been made to bring the thing up to date. I therefore propose that all Members should negative their adoption, and not attempt to amend them in any way. The Revising Committee have not shown any aptitude for the work, and to submit a re-draft for their consideration would be absurd.

Mr. Percy Still, M.Inst.C.E., Chief Engineer to the Chelsea Electricity Supply Co., Ltd., writes: I am prepared generally to support your objections to the proposed new Articles of the Institution of Electrical Engineers, but am inclined to object altogether to the formation of the suggested new class of "Licentiates." I fail to see why the old class of "Associates" should not be sufficiently comprehensive to include all persons who are not students or who have not the qualifications for admission to the class of "Members" or "Associate Members." But if, for reasons which I do not at present appreciate, it is thought desirable to create a new class, the designation "Licentiate" is, I think, most objectionable, as it would certainly convey to the public the idea that the person in question is a duly qualified electrical engineer licensed by the Institution. The term "Subscriber," which you suggest, would be more appropriate, but I can understand that it would not suit the purposes of the Council, as there would probably be no great amount of competition to become mere subscribers to the Institution if such subscription did not carry with it the right to use the designation "Licentiate" with which to dazzle the eyes of the public. In my opinion the present "Associates" should include the proposed new "Licentiates," and they would all be better described as "Subscribers." I agree with you that the official abbreviations should be confined to "Members" and "Associate Members." With regard to the subscriptions, if it is shown to be necessary to increase these slightly, it is not likely that many "Members" or "Associate Members" would object, provided that their views are met in regard to other suggested alterations. The formation of a class to be termed "Licentiates" in the manner which is suggested would very probably lead to a certain number of members discontinuing their subscriptions altogether.

Mr. W. A. Vignoles, Borough Electrical Engineer, Grimsby, writes: A strong protest should be made against the increase of country members' subscriptions from three to four guineas. This increase would make the subscription considerably higher than that of the Civils, and notwithstanding what Mr. Hammond says, I am sure a very large proportion of the country members are not within reach of the Local Sections. Take, for instance, the municipal electrical engineers. I should think not one in ten could attend meetings of local sections without making a very considerable train journey. If the new building is the cause of the increase of the subscription, it seems to me that the town members who will benefit from the building should bear a larger proportion of the cost than country members who cannot use it.

Another leading municipal electrical engineer in one of the eastern counties writes: Before I can agree to sign the printed form you have enclosed, I must know that some stand is going to be made on the question of raising subscriptions; that is, that there should be a difference between the subscriptions of town and country members. If I attend a Local Centre meeting I not only have railway fare to pay, but in addition stay at an hotel for the night, as there are no late trains back. The consequence is that I have only attended one meeting of a Local Centre and one in town during the years I have been a Member of the Institution.

A Borough electrical engineer in the north-west of England writes: It certainly seems to me that the alterations proposed by the Council would not tend to raise the status of Members of the Institution, and unless some attempt is made to do this I feel sure that a considerable number of existing Members will begin to consider seriously whether it is worth while continuing their Membership at the increased subscriptions which are now proposed, when probably the only advantage which many of them derive is receiving a copy of the *Proceedings*.

A Borough electrical engineer on the south coast says: If the suggested rules are not very materially modified, quite a dozen of my friends in the provinces and myself intend to tender our resignations, as we get no value whatever for the money we pay. I have never been to a meeting of the Institution since I have been a Member, and the *Proceedings* are pretty dear at the price charged for our subscription.

A Bradford correspondent writes: I know a number of good men in Bradford who have not joined the Institution because they consider the benefits inadequate under the present terms.

A Reading correspondent expresses his views as follows: Surely the new building is regarded as something in the nature of a club, and hence either town Members are getting too much for their money or country Members are getting too little. It seems quite reasonable that the former should now be asked to pay an increased subscription, but the latter are asked to pay something for nothing. Have you also observed, from the last annual report, that the income from subscriptions is now rather more than *double* what it was ten years ago? I hope your efforts will be successful in hindering this hasty legislation and in preventing the passing of so much power from Corporate Members to the Council.

The General Manager of a large Electrical Manufacturing Firm in Northumberland says: I have often thought the confusion between Associates and Associate Members very unfortunate, as in the mind of the general public there is practically no distinction. I return herewith your paper duly signed.

A Glasgow correspondent says: It seems to me that the Institution has been made altogether too cheap. Many men are Members who are really not qualified to be even Associate Members.

A Dundee correspondent writes: A few of us here had a meeting as soon as possible, and some of us are signing the sheet and returning same herewith. Discussion on the matter has brought out many rather interesting, if somewhat depressing, views. Even those of us who have signed the enclosed are of opinion that it does not go far enough, although on the right lines. The general opinion is that it is very little use to an engineer, of whatever grade, to belong to the Institution; with the exception of occasional Papers, there are no other benefits arising from membership. The Juniors are evidently particularly exercised from this point of view. They say, and many of us agree with them, that it is absolutely useless joining the Institution, as it carries with it no prestige such as some other Institutions afford, with the result that many of the younger men in this district, who should have been joining the Institution of Electrical Engineers, have joined by examination or are preparing to join the Institution of Civil Engineers; and our little meeting yesterday fully bore out the increasing popularity of this attitude. Another remark that was made by several was that they would be prepared to join the Institution more readily if there were really advantages to offer, even had they to pay as much as double the present subscription. We are going to try and get up another meeting of men who either are Members or ought to be connected with the Institution.

A Member in Wolverhampton says: I am strongly opposed to the new Articles of Association proposed by the Council of the I.E.E. The alterations that you suggest do not, in my opinion, go anything like far enough.

An Associate Member in Wrexham says: I consider the list of alterations to the Articles as submitted by you are excellent indeed—far in advance, much more adaptable, than the Council's proposals.

Mr. Frank Ayton, Chief Engineer and Manager of the Ipswich Corporation Electric Supply and Tramways Departments, writes: I am very glad to find that you are opposing the apparently autocratic methods which the Council of the Institution have adopted. I sincerely hope that the opposition which is being shown will teach the Council that they must not trifle with the general body of Members in this way. Immediately on receiving the notice of the meeting, I wrote to the Secretary recording my objection to the proposal to increase the subscription.

An Associate Member in Ipswich suggests: Members, or, at any rate, Associate Members, who are situated at a considerable distance from headquarters or a branch association, should have their subscriptions *reduced* instead of being increased.

A Dublin correspondent writes: The Institution, by its unfortunate purchase of the lease of the Embankment premises, has locked up over £70,000 in a building which is quite useless to all but London Members, and—the deal having apparently turned out more costly than was anticipated—finds itself short of funds. The proposed Articles of Association tend to lower the qualifications accepted, and at the same time to increase the fees of those already qualified. They offer, in fact, *less* value for *more* money in order to raise funds to keep up a building which is of no earthly use to at least nine-tenths of its Members. I do not think the Institution is housed one cut stone beyond its deserts, but I am afraid it is housed several storeys beyond its means. If it really is—as I believe it is—a question between belonging in the near future to a profession in the real sense, or belonging to an Association which has a grand building on the Embankment, and little else—and paying more for the latter than for the former—then I am for the profession. The new Articles of Association propose to sacrifice the profession to the building, and are, I think, professionally disastrous, though possibly financially sound; therefore I oppose them. The amendments which you have sent me for signature would make for the raising of the status of the profession, but this does not meet the question of finance. You want *both* the raised status and the building on the Embankment. I doubt if both are possible in our time. You could not expect the Associates to continue paying, and it would almost require a police-regulated queue of

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altruistic gentlemen begging for admission as "Licentiates," or whatever name you suggest, to save the financial situation. Now, what is to be done? What would be the wisest course of action for a gentleman of ample means who yet found himself in straitened circumstances through the possession of a mansion in Park Lane? Sell it and move into Kensington.

A Belfast Member says: The proposals would seem to me to emanate from the fertile brain of a treasurer who is anxious to improve the immediate finances of the Institution, without too scrupulous regard for its ultimate best interests, in the sense that the new rules will tend to open the door to a number of very estimable persons who will not be associated very closely with, or rank highly in, the profession.

Another Irish Member writes: It appears that the necessity of increasing the income is solely due to the fact that the Institution has acquired new premises. We country members feel that we are now being asked to pay for privileges which can only be enjoyed by members resident in London or adjacent thereto. It seems rather unreasonable in these hard times, when many of our members find a great difficulty in earning a livelihood at all, and that the cost of living has advanced in every way, that our own Institution should also be the means of increasing our professional expenses. I think that the proposed increase should only apply to new members elected after the new Articles become an accomplished fact. I hear that many of our local members will resign rather than pay an increased contribution. I hope that, in making representations to the Institution, you will not fail to mention this matter.

An Electrical Engineer of one of the Railway Companies says: I have signed the amendment, and return it herewith. I notice no amendment dealing with the necessity for extending the minimum notice for a meeting empowered to deal with the Articles of Association, which has led to the present trouble. It seems to me that three months is quite a short time for notice of a meeting of this kind, and that the meeting should be held in the evening.

Another correspondent says: The point I feel is wrong is the Institution breaking faith with its old members by altering the subscriptions. Even a golf club does not do this in such a barefaced way!

"One who has belonged for 28 years" writes: I agree with all your points; but there are others. It is not the slightest use to pretend that the increase of subscriptions all round is not directly caused by the absurd white (marble) elephant that the Council have invested in, in such a hurry that the body of members, who objected to it, could not prevent it. Those new and in most ways admirable objects of expenditure which are referred to in the Chairman's speech have been just as admirable and just as urgent for many years past. The Council, instead of carrying out these things, appropriated our balance each year to the building fund. *Now* there is no yearly balance, as it is swallowed up by the extra expense of that building, and the Council ask us all to raise our subscriptions in order to provide funds for their doing, now, what they neglected to do all the years that they had ample funds for the purpose.

The following suggestion has been received from another correspondent: If it is absolutely necessary that the subscription should be raised, I certainly think opportunity should be given to members who have to work all day to have some chance of using the new buildings. To the best of my knowledge, they are closed at about 5 or 6 p.m., except on meeting nights, which, of course, gives the majority of members no opportunity whatever of getting any benefits from membership except from meetings and the printed matter which comes by post.

A Westminster consulting electrical engineer has sent us a long letter, in the course of which he says: The proposed Articles as to "Professional Conduct" are quite insufficient for the purposes indicated. Subsection (*c*) of Clause 42 obviously does not go far enough. A consultant who is a shareholder in a contracting firm may have a remote personal interest in the placing of contracts, but such interest is not comparable with that of the official of a company who is allowed to practice as a consultant, although his directors, whose servant he is, are also directors of large contracting companies. There is nothing to prevent him from advising clients regarding the placing of contracts, &c., with companies of which his own directors are principals, and he can do this without disclosing the fact. As another example, I would mention the issue by the boiler and plant insurance companies of printed circulars with the names of their engineers in large type. Not only do these circulars enlarge on the qualifications of the companies to act as "consultants," but in addition their officials or agents personally canvass clients on the plea that as their company may insure the works, the company's engineers are the proper people to specify them. May I suggest the following additions to subsections (*c*) and (*e*) of Clause 42:—(*c*) He shall not, without disclosing the fact in writing to his client, be a salaried official to any company, having a board of directors, which includes directors or members of contracting or manufacturing firms, with which he may have to deal on behalf of his clients. (*e*) He shall not allow his name and degree to be published by any company or firm which issues circulars or employs or permits officials or agents to canvass for professional work.

Another consulting engineer with a large practice says: While I remain a Member of the Institution of Electrical Engineers, I have long since ceased to be interested in the organisation, not because I am not actively interested in all electrical matters, but because of the wide divergence of views as to what an institution representative of professional men should be.

Another consulting engineer suggests that an Article should be added under the heading "Professional Conduct," which prohibits manufacturing or insurance companies, or consulting engineers, from undertaking work of an advisory nature without charging the recognised fees, and that minimum fees should be specified.

Considerable objection is also being raised, by this correspondent and others, to Article 66, which gives the Council powers to borrow money without first obtaining the consent of the Members.

Another Westminster Member says: As to the incorporation of other societies, I think that is too important a matter for a twenty-one days' notice to suffice. I would rather say three or six months.

Another old Member writes: We are called upon to pay an increased rate of subscription for the privilege of belonging to an Institution, the professional standing of which is bound to be depreciated by the proposed changes. On the other hand, this unsatisfactory position is solely due to the apathy of the general body of Members and Associate Members at the time the lease of the present building was purchased, because the purchase involved heavy commitments and liabilities. I fear there is no other practicable alternative. Being committed to the building, and an increased revenue being a matter of absolute necessity, the increase in the subscription has got to be faced, together with additional—as you very aptly said—subscribers. And we can only hope that the decrease in the present Membership which will certainly ensue, will not turn out to be a serious matter. With regard to the inadequate representation of Associate Members, this is a great injustice to that class, and I hope that you, and the other technical papers, will drive this home. Similarly, the proposed change in the rules governing the nomination of Members of Council is exceedingly objectionable, and ought to be strongly resisted. If we are to judge from what we heard at the last meeting, certain Members of the Council consider that the dignity of the Institution is inseparable from the possession of a large building. How fallacious this argument is becomes apparent when one considers the position of, for instance, the Iron and Steel Institute, which is very modestly, but sufficiently, housed in Victoria Street. Yet that Institute represents one of the most powerful industries in the country, and is of international reputation and utility.

Mr. Percy Good writes: It seems desirable to make a ballot essential for all future alterations. It would also be advisable to alter the Articles so that for the election of the Council the nominees of the retiring body must be in excess of the requirements, and any nominations sent in by private members to be added to the list without any distinguishing mark.

Two Manchester Students have written us at great length, One of them, Mr. A. R. Stelling, objects to the more stringent rules as to admission of Students, and contends that the transfer to Associate Membership should be made easier by omitting the examination in the case of Students whose Papers have obtained premiums or have been accepted for publication in the *Journal*. He also suggests that present Students on being transferred should not be called upon to pay the higher entrance fee, and should be treated as old and not new Associate Members as regards subscription. The other Student correspondent, Mr. H. A. Carney, who has been a Student since 1905, deals with a number of other points, to most of which reference has already been made.

The Institution's Thanks to the Civils.—At the opening meeting of the session of the Institution of Civil Engineers last Tuesday evening, a deputation consisting of Mr. S. Z. de Ferranti, President of the Institution of Electrical Engineers, Mr. R. K. Gray, Past-President, Messrs. W. Duddell, F.R.S., W. H. Patchell, J. F. C. Snell, and Major W. A. J. O'Meara, C.M.G., Vice-Presidents, Mr. Robert Hammond, Honorary Treasurer, and Mr. P. F. Rowell, Secretary, presented to the Council and Members of the Institution of Civil Engineers an illuminated address of thanks, as follows, on behalf of the Institution of Electrical Engineers:—

"We, the President, Council, and Members of the Institution of Electrical Engineers, desire hereby to express to the Institution of Civil Engineers our deep sense of gratitude for the privilege so generously granted to us from February, 1872, to April, 1910, of holding the ordinary meetings of this Institution, more than five hundred in number, in the hall of the Institution of Civil Engineers. The hospitality extended to us during this long period of thirty-eight years has conferred a material and lasting benefit on the development of the Electrical Profession, and will always be held in our memories with sincere appreciation and thankfulness."

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HIGH-VOLTAGE TRANSFORMERS

A PAPER by Mr. W. T. Taylor on modern high-voltage transformers was discussed at the meeting of the Institution of Electrical Engineers last Thursday. In the absence of the author, an abstract of the Paper was read by Mr. J. F. C. Snell. Opening with some figures showing the magnitude of the subject, the Paper proceeded to outline generally some of the conditions which transformers have to fill, and pointed out the superiority of water-cooled oil-immersed transformers over those of the air-blast type. The relations of core and copper losses, temperature, regulation, and efficiency were then considered at some length, and their influence on operating costs was discussed generally. Tables of efficiencies, oil and water quantities, &c., were also given of a range of typical oil and air-blast transformers. Indifferent frequencies and the recent introduction of transformers with forced-oil circulation and oil-cooling apparatus in a separate compartment was referred to.

Constructive details were then dealt with, and the method of building up a particular design of three-phase core-type transformer was first followed through. A few details were then given of the method of assembling shell-type transformers, which, it was remarked, are built in larger sizes than the core type. The large number of edges and sharp corners, however, render them more difficult of insulation, and a lower space factor than with core-type results. The author then gave some practical hints on the installation of transformers, dwelling particularly on the advisability of placing them where a burn out of a coil, or boiling over or burning of the oil in one unit will not affect the continuity of the service, simplifying the H.T. wiring as much as possible, earthing the tank, allowing plenty of space for access and great care in the drying-out process. Several methods of drying out were described, including passing sufficient current with one winding short circuited to raise the temperature to 80° C., while the transformer is out of the tank, making the tank air-tight and applying a vacuum pump or causing heated air to circulate in the tank. Methods of getting rid of moisture in the oil by the vacuum system or by blowing heated air through it were also referred to. The qualities required of a good transformer oil were briefly alluded to.

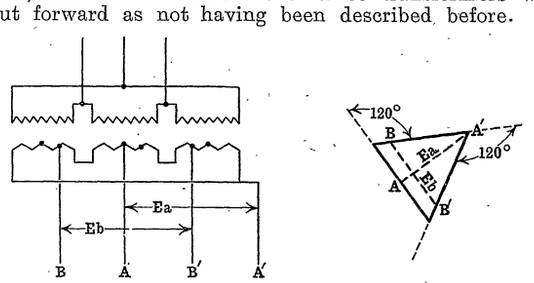
The vexed question of the relative merits of core and shell designs was next taken up, the author showing a strong preference for the latter, setting out its advantages as follows:—Greater radiating surface of coils; interlacing of coils, resulting in closer regulation; mechanically stronger and more able to withstand the electromagnetic stresses; satisfactory series-parallel operation. The only advantage admitted for the core type was the greater ease of removing a coil for repair, whereas the following disadvantages were urged for the core type:—With low-voltage winding designed for 22,000 volts and above, the amount of insulation next to the core means a larger mean turn of winding, the temperature and the I^2R loss being increased; radiating surface on the low-voltage winding very poor, resulting in higher temperatures; the concentric arrangement of coils results in poorer regulation and higher reactance voltages; less mechanical bracing; not possible to operate a three-phase (delta-delta) transformer when one winding becomes damaged.

In dealing with practical points in transformer operation, the author referred to the difficulties met with due to corona discharge within the transformer itself. He put the main requirements in the following order: reliability, safety, and efficiency; and suggested automatic alarm appliances for signalling an excessive temperature rise or a stoppage in the flow of cooling water. Passing on to different methods of connection, the advantage was claimed for delta connections that with one grounded conductor the service need not be interrupted, except perhaps if the ground is an arcing one, which might set up continuous high-frequency surges, producing high-voltage stresses on the transformers in circuit. A table of transformers working in America at above 62,000 volts showed that the star and mesh connections are about equally favoured. The author expressed the view that three-phase transformers would ultimately be as usual as groups of single-phase transformers, but admitted that the single-phase transformer is at the present time preferable where only one group of transformers is installed, and the expense of a spare transformer would not be warranted as in the delta-delta connected system. The three-phase transformer possesses the advantage of requiring less material, and is more efficient than any other single-phase combination of transformers of the same kilowatt capacity.

The relative merits of delta-delta and delta-star connections were summed up as follows:—Delta-delta (non-grounded): When one phase is cut out the remaining two phases can be made to deliver approximately 58 per cent. of the full load rating of transformer (in case of a three-phase shell type) or transformers. Delta-star (neutral grounded): Advantage of reducing the cost of high-voltage line insulators for equal line voltage, as their size need be only 57 per cent. of those used on a line with transformers connected in delta. It is possible, under such conditions, to operate and deliver three-phase current when either one-phase or one-line conductor is cut out. Delta-delta disadvantage: larger transformer or transformers and larger line insulators for the same line voltage. Delta-star disadvantage: Not always in a position to operate when one phase or one line conductor is cut out.

The question of running differently connected installations in parallel for consolidations of large power schemes was discussed, and some of the conditions were laid down by the aid of diagrams of several alternative arrangements.

The Paper then discussed methods of converting from three- to two-phase, describing the well-known "Scott" (or, as the author preferred to call it, "T") connection with two transformers, and a modification with three transformers which he put forward as not having been described before. This



THREE TRANSFORMER CONNECTION FOR CONVERTING FROM THREE TO TWO PHASE.

arrangement is shown in the figure and is coming into use extensively in America. The following advantages are claimed over the two transformer Scott connection:—Larger factor of safety for continuity of service; with one transformer disabled the system can still be operated; a spare transformer need not necessarily be kept as a spare; a spare transformer need only have a rating of about 67 per cent. of that of a spare transformer for the two-transformer system; able to obtain symmetrical two-phase and three-phase voltages from the same winding; improved regulation and efficiency; better balancing of voltages under load; for the same total kilowatt rating, only a ratio of 100 to 108 in favour of the three-transformer system is required. Its disadvantages from the standpoint of first cost and available connections for apparatus are:—The first cost is higher; it is not possible to operate interconnected motors and generators on the two-phase secondary system; greater floor space and wiring are required.

In conclusion, the author writes:—"The experience of recent years seems to point out that the larger we build our stations, machinery, and apparatus, the better results we get. Not very long ago the economical limit placed on the size of a station was in the neighbourhood of 20,000 kw., but to-day there are stations equipped with machinery and apparatus of practically 200,000 kw. Transformers of 10,000-kw. capacity are more economical than units of 5,000 kw., and a system using ten 10,000-kw. transformers is more economical than another using twenty 5,000-kw. transformers."

DISCUSSION.

Mr. W. B. WOODHOUSE (Chief Engineer, Yorkshire Electric Power Co.), in opening the discussion, pointed out and severely criticised several errors and inaccuracies in the Paper, as did several subsequent speakers. Dealing with the subject of the Paper, he said that the most important losses to consider are no-load losses. The author considered efficiency one of the most important points, and rather underrated the importance of pressure regulation. It had been more or less general experience that a transformer with close regulation is not robust enough to stand heavy overloads. At the same time, close regulation was desirable, but over long distances he suggested that the best course was to use a transformer with poor regulation with some external means of regulating the pressure, such as a synchronous motor. With very big units, local heating was an

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important element, and whilst three-phase transformers had certain considerable advantages, the single-phase transformer did not have such a large bulk of metal, and consequently the difficulties of cooling equally all through the core and all through the winding were not so great. There was room for enormous development in the cooling of large oil-insulated transformers. Some makers arranged that part of the cooling was carried out in a separate tank. One very good measure of ascertaining whether a transformer was thoroughly dried out was to take periodical readings of the core losses, which were very much increased if the core was damp. The comparison between the shell and core types of transformer was rather like flogging a dead horse. It all depended upon what one was prepared to pay. He saw no difficulty in obtaining equal good examples of either type. The interconnection of the phases of a transmission line where they stepped up and stepped down was a most important point. There was considerable diversity of opinion, but the balance was apparently in favour of star connection of the high-voltage line. At the same time, with long transmission lines at high voltage the earth neutral seemed to be of doubtful value. During the dry weather this summer there was an enormous change in the resistance of the earth.

Prof. S. P. Thompson, F.R.S., objected to the misuse in the Paper of the term "regulation," and pointed out the absurdity of the expression "good regulation" for a low percentage of voltage drop when the best "regulation" was no "regulation" at all. He asked for opinions as to the advantage or disadvantage of putting in a resistance between the neutral point and earth with a view to avoiding difficulties for a rush. The method of connecting from three to two phase described by the author as the "T" connection with two transformers, was no different from that known by the name of Mr. Scott, of the Westinghouse Co. He was rather surprised to find the three-transformer method spoken of as a novelty. It had been publicly described in this country as far back as 1892, in Prof. Arno's book, and it certainly was used in some high-voltage power schemes in Italy. The advice in the Paper to use units as large as possible ought to be passed on to those people who, in a little congested district such as Bethnal Green, were arguing whether they should set up a station for themselves or take a supply in bulk. [Bethnal Green is the only London borough in which no supply of electricity is available. Many years ago Mr. Robert Hammond reported to the Council, but no definite steps were taken. During the past few weeks, the Council retained Mr. J. F. C. Snell to report upon the advantages of erecting a power station or taking a bulk supply.—Ed. *E.E.*]

Mr. C. H. Merz said one of the chief difficulties was to make a transformer that would stand the mechanical shocks sustained in working and at the same time to give good regulation. It was in the distribution system that good automatic regulation was essential, unless they wished to have attendants in every sub-station. He emphasised the necessity for designing transformers so that there shall be no hot spots. In America he did not think they had such a high standard as was the case in England, on account of the intense competition in this country. Here we aimed at getting a transformer which would operate for years without requiring cleaning, whereas in America it was not unusual to clean them once in six months or once a year.

Mr. J. S. Peck (British Westinghouse Co.) said that whilst the practical part of the Paper was all right, there were many points in connection with the design and internal arrangements of transformers with which he entirely disagreed with the author. There were also many inaccuracies. It was said that hysteresis was greater in hard steels, whereas it was known that many steel alloys which were very hard had a very low hysteresis loss. The author's descriptions of a core-type transformer related to a design which he did not think would be accepted in this country. Again, the efficiency of an air-blast transformer was not as good as that of an oil-cooled transformer on account of the greater amount of insulation required and on account of the larger air ducts, but the author suggested just the opposite. That might be so, but if the air-blast transformer had a higher efficiency, it was made with a higher efficiency in order to enable it to dispose of its heat. The real reason why oil with a lower flash-point was used for water-cooled transformers was because they had much less tendency to throw down deposit when heated. Some of the three-phase transformer connections shown in the Paper were impossible. He was surprised that the author advocated two-phase distribution, as this had been gradually displaced here by three-phase. With regard to the so-called "T" system with three transformers, this had been known for many years, but it had not come into general use because it had many disadvantages. The author's argument was fallacious, and was based on the assumption that there was no greater loss in these transformers than with three single-phase transformers operating star to star or delta to delta. That was not the case. The loss was considerably increased by the connection, and was about 16 per cent. above that in the ordinary three-transformer star or delta connection.

Mr. J. F. C. Snell said he would see that the author's attention was called to the very trenchant criticisms which had been made. To some extent, he admitted, he personally was responsible for some of the errors which had been pointed out, in that he had partly edited the Paper. But he was in no way responsible for the Paper. In defence of the author, with whom he was not acquainted, he said that he was a practical man with a wide experience, and there was much in the Paper which would be found of value on this side.

Mr. W. E. Burnand also criticised the Paper. He referred to the influence of the very high frequencies of the superposed current rushes at the time of switching on transformers in limiting the strain on the insulation practically to the end turns. The shock to the end turns was practically in proportion to the square of the voltage. Increasing the reactance entailed an increased leakage field, and although decreasing the short-circuit current did not lessen the destructive mechanical forces as much as might be expected.

A communication was received from Mr. C. J. Hopkins, who described a method of taking the H.T. leads through the cover in which these consisted of bare copper rods supported in cylinders of oil at a point near their centre in the cover of the tank. The cylinders were built up of sections of varnished cambric and press-board collars.

THE ELECTRICAL EXHIBITION

At the last meeting of the Executive Committee it was agreed that, subject to the accounts being audited, approximately 20 per cent. of the space money is to be returned to all exhibitors.

A report to the Executive Committee of the Olympia Electrical Exhibition by the Organising Managers has been issued, and deals with the various criticisms and suggestions which were made during the Exhibition by exhibitors and in the Press. The managers point out that they spared no endeavours to obtain more exhibits of machinery in conjunction with electrical apparatus, more exhibits of popular interest, or collective exhibits, but did not meet with much support. They also complain that the exhibitors themselves did not support the management in the matter of advertising. In conclusion, the management advise that for future electrical exhibitions the policy of the recent Exhibition might be modified in the following terms:—

That the half-crown days be abolished. That exhibitors be supplied with tickets in unlimited quantities, with the liability that all such tickets as reach the management through the turnstiles of the Exhibition shall be paid for at the rate of sixpence each. This probably, however, would tend to a reduction of revenue on ticket account. That the duration of the Exhibition be restricted to three, or conceivably two, weeks only. This is specially recommended in view of the small amount of heavy machinery that is exhibited. That before another Electrical Exhibition is decided upon, definite arrangements should be made with the Supply Authorities to ascertain exactly the amount of support by way of purchase of tickets they are willing to accord, it being recommended that for a large Exhibition such as that recently held this purchase of tickets should be not less than one hundred and fifty to two hundred thousand. It is further recommended that the arrangements with the Supply Authorities should be for the sale to them of tickets outright at threepence each. Were arrangements made with the Supply Authorities that they would be liable to pay for all tickets used at the rate of sixpence each, it is most probable that such a method would considerably curtail a large distribution of tickets.

Electrical Contractors' Association.—The inaugural dinner of the East Yorkshire and District Branch of the Electrical Contractors' Association was held on Friday at Hull. The chairman of the branch, Mr. W. L. Harrison, presided, and among those present were representatives of the Hull Corporation and the officials of the Electric Supply Department. Mr. E. M. Parsons, the Local Secretary, in proposing the toast of "The Mayor and Corporation," congratulated the section upon the manner in which they were working together amicably with the Corporation. They ought, he said, to congratulate themselves that they were not governed by a Corporation like that at Sheffield. Mr. H. Hyde, who proposed the toast of "The City and Trade of Hull," urged the Electricity Committee to reduce the charges for power in order to encourage the day load, and incidentally give contractors a little more encouragement in pushing the use of electricity for cooking and heating.

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THE MECHANICAL DESIGN OF D.C. TURBO-GENERATORS

A PAPER on this subject by Mr. R. J. Roberts was read at a meeting of the Manchester Local Section of the Institution of Electrical Engineers on Tuesday of last week. The most common defects of such machinery not arising from electrical causes was found in the collector gear due to unsuitable brush gear, want of balance generally, or unstable construction of the commutator. Another common defect was in the possibility of accumulation of dirt bridging the creeping surface where conductors were exposed, and a further source of trouble was in the armature bands. The stators gave less trouble than in the case of A.C. machines, as the forces acting on the conductors on short circuit were not so great. The stator construction most favoured in this country was a solid cast magnet system, with laminated pole-shoes, which carry the compensating windings in slots. The general design is largely settled by the scheme of ventilation used. The ventilating scheme usually met with entails the entrance of air at the back end (away from commutator) by means of fans affixed to the rotor at that end. Part of the stream of air goes direct to the stator and thence out through the top outlet; whilst the greater part goes through into the rotor by axial ducts in core along the shaft. Part of this stream goes out through the radial ducts in rotor and stator and thence out; whilst another is drawn through the rotor core right to the commutator, whence it is driven by some fan up to the stator end windings and so out through the top outlet. The author was, however, in favour of employing axial ducts only. Dust screens are usually fitted to the air ducts and the quantity of air used is from 80 to 100 cu. ft. per minute per kw. loss.

After some remarks on shafts and balancing, including a word of warning against allowing excessive vibration during the balancing process, the author passed on to the rotor core. This, he said, is always of stampings, and in complete circles. Neglecting tooth stresses, the stresses occurring in these discs are similar to those occurring in disc flywheels, and are capable of similar treatment. The maximum stress is always at the centre next to the shaft, and if this stress is appreciable there will be a tendency for the whole core to be loose at full speed. The core should therefore be so fixed to the shaft that it cannot become loose. Shrinking the plates on to the shaft may increase the core losses, and the stampings cannot satisfactorily be pressed on. However, this may be overcome by suitably designing the shaft and core so that the diametrical strains of shaft and core are equal. In speaking of the wedges for holding the conductors in the semi-closed slots that are now universal, the suggestion was made that the disadvantages of wood and metal wedges might be avoided in a combination of metal and insulating fibre after the manner of reinforced concrete. Some notes were given on insulation of end connections and the necessity for equalising rings. Sometimes they are built in as part of the commutator, and sometimes arranged under the commutator end winding with connections taken to the commutator risers. The best position, to the author's mind, is at the back end under the band. The equalisers are made of complete rings of copper with projecting tags that are sweated on to the armature conductors. The whole is first firmly packed up with insulating strips of presspahn or fibre and then banded, which holds everything absolutely rigid and well covered up.

The rotor end-plates and winding supports should be of some non-magnetic material, to reduce eddy currents set up by the field around the armature conductors. The author expressed a preference for wire bands to solid metal rings for taking the centrifugal forces of the end armature winding.

High-speed commutators are usually of the shrink-ring type, and their construction calls for great care in workmanship. The segments, after proper preparation, are assembled in jigs in the usual manner, whilst care is taken that the segments lie parallel to the axis of the cylinder. The insulating segments contain as a rule a quantity of superfluous varnish, and this is got rid of by successive bakings and tightening of clamps. The whole, whilst still in clamps, is next turned for the insulating bands under the rings, and banded with temporary bands of steel wire upon that portion of face where the shrink rings do not come. These bands must not be thick enough to prevent the shrink-rings passing freely over them. The insulating bands are next built up in place, banded with fine steel wire, and the clamps removed. The shrink rings are then shrunk on and the whole cylinder is machined where needed and mounted upon the rotor. For insulating commutator segments, there has recently been put upon the market a form of micanite that has no varnish in its composition, and although dearer, is much to be preferred to the ordinary quality. This micanite is stoved at a red heat during its process of manufacture. The micanite insulating bands under the shrink rings should preferably be built of strips of segments of pure mica of 20 or 30 mils thickness.

The Paper then passed on to an investigation of the mechanical theory of commutator construction, and it was pointed out that with some designs of commutators it is not possible to have sufficient shrinkage allowance on the rings. This difficulty may be overcome by using a hydraulic press to make the rings smaller while still hot and in place on the commutator. Although these presses are reported to be in use on the Continent the author has not heard of them being used in England.

Some notes were then given on commutator risers, commutator cooling, and brush gear, and the curves reproduced here were suggested for current density and brush pressure.

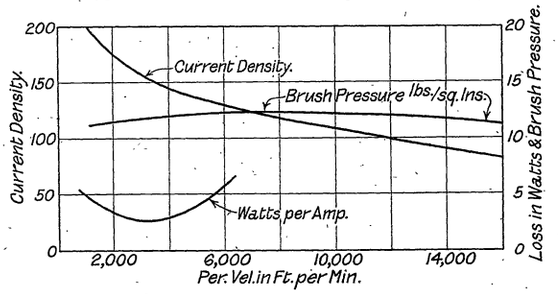


FIG. 1.—CURVES OF BRUSH DENSITY, &C.

The Paper concluded as follows :—To look forward to probable improvements of construction we see that one of the ultimate aims is the decrease in span between bearings. This may lead to a reversion to the Eickemeyer or butterfly winding for armature, with the equalisers possibly combined in the end connections. The core may be mounted and the slot wedges constructed as suggested above, or some new material of construction may be found. The radial type of commutator is possibly the ultimate general design, but it will be some years before this type is generally adopted, and in the meantime we may effect great improvements by the use of higher brush pressures and higher current densities and peripheral speeds. A suggestion for mounting of commutator is shown in Fig. 2. The brush-holders are yet very

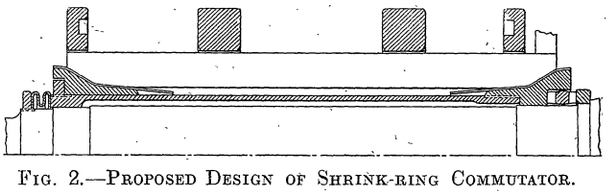


FIG. 2.—PROPOSED DESIGN OF SHRINK-RING COMMUTATOR.

far from perfect, and possibly the present almost universal box-type holder will disappear for some form of the old lever-type holder. The present ventilating schemes need much improvement, and an air-cooling system with a separately driven circulating fan is a probable solution. The author is far from taking a pessimistic view of the future of direct-current turbo-generators, and he believes that it is possible to make them as reliable as any other electrical machine. He is of opinion that their mediocre performance in the past has been caused by an inadequate comprehension of the mechanical problems.

DISCUSSION.

Mr. R. LIVINGSTONE (Dick, Kerr & Co.) mentioned troubles occasioned by bad design of oil-throwers, and pointed out that more efficient speeds could be used with independent than with rotor fans. He also raised some points connected with shaft and rotor core design, and did not see that it was possible to so design them that the diametrical stresses were equal. He suggested the use of laminated brass wedges in the slots, and expressed a preference for solid-end bells to binding wire.

Mr. J. K. CATTERSON SMITH (Liverpool University) took up the question of shaft design at some length, and said that the curves of brush densities given were misleading, as they were based on results for brushes on a steel ring and not on a commutator, and gave current densities too high for commutation

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conditions, where the figure should not exceed 45 amperes per sq. in. He also gave some estimates of the size of apparatus for artificially cooling the air used for ventilating turbo-generators. He preferred thin steel bands to binding over the mica for the reception of the shrink rings.

Mr. A. R. EVEREST (British Thomson-Houston Co.) pointed out that the filtering of intake air was as important in D.C. as in A.C. machines. He thought that the author had exaggerated the looseness which could occur in a rotor due to expansion of the plates from centrifugal force.

Mr. W. HOULT (Siemens Brothers Dynamo Works) emphasised the importance of keeping the commutator cool, and thought that an entirely separate supply of air for this purpose was desirable. Filtering the air was most important, and he suggested the cooling of the air by a fine water spray, which would at the same time remove the dust. He agreed with a previous speaker in preferring solid end-covers to banding.

Mr. G. W. WORRALL (Liverpool University) said that the mechanical problems of commutation depended largely on the friction tending to tilt the brush on to its rear tip. There was also a temperature effect. The rear tip was cooled by the air drawn round by the commutator more than the front tip, and the expansion of the contact surface caused it to lift and to set the brush vibrating. He also referred to trouble with mica segments rising.

Mr. F. H. WHYSALL (Manchester Corporation Electricity Department) advocated reduction of the mica to slightly below the commutator surface, and referred to the very satisfactory running of the D.C. turbo-generators at Dickinson Street.

Mr. F. H. CLOUGH (British Thomson-Houston Co.) was not quite clear whether the author desired to design shafts so that the critical speed was not passed through, and commented on the theory of commutator stresses put forward. He advocated preventing the mica from becoming displaced by making it slightly wedge-shaped or by roughening the bars by grooves, the first of which could be so situated that it formed an indication when the commutator had been turned down to a safe limit.

Mr. R. HARRISON discussed methods of calculating stresses in a revolving disc, and criticised Mr. Roberts' arrangement of equalising rings as lengthening the distance between bearings unnecessarily. He also thought the author's enclosed soldered joints would get hot. The equalisers must be fitted before any tests were carried out. The stresses in a commutator were a little uncertain, because the rings have to be shrunk on to mica, and it was impossible to judge the amount of mica so that it would compress exactly to the calculated figure.

The author replied briefly, reserving his full reply for the Journal.

OSRAM AND EDISWAN LAMPS

OUR readers will be interested in an announcement in our advertisement columns that the Edison & Swan United Electric Light Co. Ltd., have recognised the validity of Patent No. 23,899/1904, and others owned by the Osram Lamp Works, Ltd., and are now manufacturing under licence. The above patent has frequently been referred to in our columns; it is one of those which figured in the action against G. M. Boddy & Co., who were then agents for the Philips lamps.

The patent, which is in the names of Dr. A. Just and F. Hanaman, of Vienna, describes a process of manufacturing filaments of pure tungsten by mixing finely divided tungsten or tungsten compounds such as tungstite, tungstic acid, or tungstic sulphide with an organic binding medium such as collodion, or a solution of cellulose in chloride of zinc or cupreous ammonia oxide. The filaments squirted from the resulting paste are then carbonised (in some cases after denitration), and the carbon is then removed by passing current through the filament and raising it to a high temperature in an atmosphere of steam and hydrogen. The carbon is oxidised to form carbonic oxide, and a filament of pure tungsten is left. The filaments are then rendered uniform by submitting them to the action of current in an atmosphere of volatile tungsten compounds in the presence of a large quantity of hydrogen, whereby the tungsten deposited equalises the filaments.

The patent was published in full in ELECTRICAL ENGINEERING of Sept 9th, 1909, after the grant of an amendment by the Comptroller.

The agreement between the Osram Lamp Works, Ltd., and the Edison & Swan Co. was signed on Monday. We understand that besides dealing with the question of licence, it covers certain arrangements which will ensure that the latter company comes into line with the General Electric Co., and the other lamp firms who are in agreement, on the question of price.

DINNER OF THE BIRMINGHAM SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS

The Council's Attitude on the Opposition to the New Articles

Mr. Patchell on the Coal Mines Bill

THE Council's proposed alterations in the Articles of Association were referred to at the annual dinner of the Birmingham Section of the Institution of Electrical Engineers on Friday, and an important announcement was made by Mr. Ferranti

The CHAIRMAN of the SECTION (Mr. Max Railing), who is chairman for the second year in succession, in proposing the toast of the Institution, said that he was convinced that the Council would welcome any practical method by which they might keep continuously in closer touch with the feelings of the members of the Local Sections. It had just been arranged that a meeting of the Birmingham Section should be held on Wednesday, November 22nd, for the purpose of discussing the proposed new Articles of Association, and that Mr. Ferranti and Mr. Hammond would be present at it. Mr. Railing urged the members to consider the welfare and aims of the Institution as a whole, and not to consider the question merely as it would affect their district or their own pockets.

Mr. S. Z. DE FERRANTI, in his reply, lost little time in coming to the subject upon which he had been expected to speak. He admitted that in giving only a week's notice of their proposals the Council had done something foolish, but said that what it had done was not so silly as it looked, as it was the first time the members of the Institution had taken a real interest in anything. It was the endeavour of the Council to make the Institution more valuable than it had ever been in the past. The Institution should be so organised that it could make representations to Parliament which could not be neglected, and that it should be a means by which the industry could come in contact with the Government. He wished to have a means of getting into the Institution business men who, although not qualified to be electrical engineers, are yet very much connected with the industry, and would be of use to strengthen the position of the members—for instance, it would be desirable to have a representative in the House of Commons. A switchboard attendant could at present be an Associate, and it would be hard to ask his manager to be in the same class. The Council gladly accepted the awakening of a "contentious interest" in the affairs of the Institution which had been brought about by their mistake, and they desired to take full advantage of it.

Mr. W. H. PATCHELL, in the course of his speech proposing "The Birmingham Local Section," referred to the Coal Mines Bill. As it stands at present, he said, the use of electricity is actually prohibited in positions where naked lights are permitted. The number of fatal accidents due to electricity was only 1½ per cent. of the total number of accidents in the year. If electricity were turned out of the mines so that there was more of the manual work which was responsible for 98½ per cent. of the accidents, the number of fatalities would, of course, increase and not decrease. He hoped that the Local Sections would create a more active interest in electrical engineering matters, and would send up electrical engineers to Parliament.

Mr. A. M. TAYLOR responded.

Mr. R. A. CHATTOCK proposed the toast of "Electrical Industries and Our Guests." As an instance of the growth of the industry, he mentioned that the annual output of the Birmingham Corporation generating station had risen from five million units to thirty-three millions since the year 1904. He next referred to the fine display of cooking apparatus at the recent Electrical Exhibition at Olympia, and said that supply authorities must be prepared to follow the example of the gas companies, and must hire out this class of apparatus to consumers. Lastly, he said that, as a purchaser of plant, he welcomed the reorganisation of the Manufacturers' Association and the campaign it would commence against cut-throat competition. Such competition must result in dangerous economies in manufacture, which would increase the probability of breakdown and threaten continuity of electric supply. He hoped, however, that the formation of so many associations within the industry did not mean the formation of mutually antagonistic groups.

Mr. ROBERT HAMMOND and Mr. J. E. KINGSBURY briefly responded.

Mr. MAURICE SOLOMON, in proposing the health of the Chairman, quoted a passage from Mr. Railing's speech a year ago, in which he had emphasised the fact that the electrical industry was not prosperous. He was glad to see that things had changed so much for the better during the year that the Council had come to the conclusion that Members of the Institution could afford an increase of 33 per cent. in their subscriptions.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Nov. 9, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

24,272/10. **Vibrating Armatures.** W. D. KILROY, J. C. NEEDHAM, and EVERSHED & VIGNOLES, LTD. An armature for attaching to a diaphragm for use with magnets is made, in one form, by riveting together, between iron cheeks, a number of soft iron laminations insulated with thin sheets of mica, which is set in a recess in a thickened portion of a diaphragm by brazing, welding, or hard soldering. It is found, by this method, that the mica is not damaged by the heat used, so that the laminæ maintain the insulation at their faces. The laminations can be formed with key projections to fit a slot in a standard, which is rigidly secured to the vibrating body. Four figures.

27,401/10. **Metal Filament Supports.** S. HORVATH. The filament lengths are passed through closed links, which are freely suspended on the usual supporting arms. The link can be made of carbon, tungsten, &c., in which case the arms are connected in the usual way to the central glass stem. If, however, as can be done by this method, the arms are taken through a hollow glass stem bunched together, then the link must be made of mica or other insulating material. Two figures.

5,165/11. **Insulating Material.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*). This comprises a sheet of fibrous material, which is impregnated with a composition containing a phenolic aldehyde condensation product, and a stearin pitch. These are dissolved in a common solvent, such as amylacetate, the solvent being allowed to evaporate after impregnation. This gives a flexible material, which maintains its resistivity.

14,127/11. **Arc Lamps.** SIEMENS BROTHERS DYNAMO WORKS, LIMITED. With non-combustible electrodes to prevent the arc climbing up the carbons, the upper electrode is formed with a rim overhanging its projecting tip, so that when the lamp is in operation, this rim deflects the ascending gases sideways, forming eddies, which keep the arc steady. Two figures.

14,222/11. **Electrically-heated Vessel.** H. MIETH. This comprises an inner and outer casing between which a continuous heating coil is double wound on the surface of the inner casing, from which it is insulated. It commences at the centre of the base, and is coiled up the sides to two terminals near the top. The turns are insulated from one another, and the space between them and the outer casing is packed with a heat non-conducting material. Three figures.

Amendments

12,790/09. **Radio-telegraphy.** A. W. SHARMAN. As a result of the extended investigation under Section 8, the above-mentioned specification has been amended by way of disclaimer. It describes a method of producing a periodic variation in the amplitude of high-frequency alternating currents suitable for musical signalling, in which an oscillating circuit, tuned to a frequency within the limits of audible sound, is coupled to a circuit feeding a second high-frequency oscillating circuit connected to an aerial.

Restoration of Patents

4,557/03. **Arc Lamps.** F. M. LEWIS. An application has been made for the restoration of this patent, which expired last February owing to the non-payment of the renewal fee. It relates to improvements in connection with electric arc lamps.

7,320/07. **Arc Furnaces.** SALTPETERSÄURE INDUSTRIE-GESELLSCHAFT G.M.B.H. As desired by the patentee, this patent has been restored. It deals with the electrical treatment of gases. A number of high-tension spark gaps are arranged in series, and a resistance is placed between the electrodes of each of them except one. When a discharge is started across the latter gap, a high tension will be set up across the gaps on either side of it in succession, the velocity of these discharges being very high.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Distributing Systems, Cables and Wires: BRITISH THOMSON-HOUSTON Co. and WHITCHER [Distribution protective devices] 17,177/10 and 21,662/11; DOEL and CLARKE [Cable connector] 26,124/10; KAESEN [Wire terminal clips] 18,375/11.

Dynamos and Motors: SOC. ANON. "PHI." [Regulation of dynamos] 25,026/10.

Electric Ignition: BLOXAM (*Robert Bosch*) [Carbon holder for distributors of ignition machines] 8,224/11; ROYCE and ROLLS-ROYCE, LTD. [H.-T. distributors for] 17,204/11; ROBERT BOSCH [Short-circuiting device] 19,233/11.

Electrometallurgy: LAKE (*Florence*) [Furnaces] 8,998/11.

Incandescent Lamps: RITZMANN, WOLFKE, and LISSY [Electric vapour lamps] 27,163/10; SCHALLER, 9,719/11.

Instruments: CAMBRIDGE SCIENTIFIC INSTRUMENT Co. and PEAKE [Determination of low voltages] 24,457/10; SIEMENS BROS. & Co. (*Siemens & Halske Akt.-Ges.*) [Ammeters of dynamometer type] 13,801/11.

Switchgear and Fittings: ELECTROMOTOR EQUIPMENT Co. and MEACOCK [Variable-speed reversing mechanism control] 21,807/10; WILLIAMS and STEVENSON [Switch contact devices for lowering gears] 24,294/10; BAILEY [Regulating switches] 24,858/10; SPAGNOLETTI, LTD., and JOYCE [Switches] 25,076/10; STEPHENSON [Switches] 463/11; BOOTH and BOOTH [Lamp reflector] 9,806/11; LUNDBERG, LUNDBERG and LUNDBERG [Electrical terminals] 16,514/11.

Telephony, Telegraphy and Signalling: BOWMAN [Party line telephone system] 26,440/10; BOLDT [Railway signalling devices] 5,559/11; SCHIESSLER [Electric capacitative inductive couplings] 13,968/11.

Miscellaneous: PARSONS and BALL [Electric striking and chiming mechanism] 24,533/10; ROSS [Miners' safety lamps] 24,735/10; WESTINGHOUSE BRAKE Co. (*Westinghouse Air Brake Co.*) [Electrically-actuated compressors, regulating devices] 24,912/10; COCHRANE [Fastener for train-lighting accumulator lids] 26,696/10; WATMOUGH [Electric signs] 27,981/10; SIEGEL [Counter-current economisers] 28,403/10; WORSNOP [Motor lamps, connections, and focussing device] 28,457/10; FITZ [Electric lighting system] 2,727/11; JONES and DAVIES [Miners' lamps] 4,722/11; HECHT and DOWDELL [Electric signs] 4,821/11; KEITH and TUSON [Centrifugal fans] 8,776/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Signalling: HERMSDORF, 22,123/11.

Miscellaneous: SOC. ANON. FRANÇAISE DITE BANQUE DU RADIUM [Sterilising apparatus] 15,010/11.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

27,380 of Nov. 22nd, 1897. **Cut-outs.** G. M. SELLICK. This invention relates to a fusible cut-out, in which the metal pin for securing the cover is replaced by one of porcelain, which engages with a threaded opening in the bridge piece. This prevents liability to leakage or arcing after fusion, as there is no conducting material between the terminals.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: G. FORBES [Search-lights, signal lamps] 16,719/07; H. E. ANGOLD and MAXIM ELECTRICAL Co., 16,956/07; E. R. GROTE and M. V. ELY [Feeding mutually-inclined carbons] 17,059/07.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: SIEMENS BROS. & Co. and W. DIESELHORST [Conductors, preserving] 16,711/02; E. WEINTRAUB [Distribution] 16,257/04; A. G. BROOKES (*Asbestos Wood Co., U.S.A.*) [Waterproof insulating material] 16,865/07.

Dynamos and Motors: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Motors, controlling] 16,664/04.

Electric Ignition: ELECTRIC IGNITION Co. and F. H. HALL [Contact-breakers] 16,911/07, and [Electric ignition] 16,912/07.

Electrochemistry: H. C. HARRISON [Electro-deposition of copper] 16,735/07.

Incandescent Lamps: C. O. BASTIAN and G. CALVERI [Coating the leading-in wires with glass] 16,736/07.

Switchgear and Fittings: H. HIRST and F. BOYES [Conductor conduits] 15,155/01; F. R. BUTT and H. W. C. COX [Induction coil contact breaker] 16,426/04; BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Switches] 16,602/06; A. HARE [Switches] 16,862/07.

Telephony, Telegraphy and Signalling: A. J. BOULT (*A. Neelemans*) [Railway signals] 14,952/01; W. H. WHEATLEY (*Lorenz*) [Telephone systems] 16,627/06; W. E. LAKE (*Brown Automatic Indicator Co., U.S.A.*) [Electric telegraphs] 16,959/07; J. C. BARCLAY [Telephone insulators] 27,177/07.

Traction: R. BRAUN [Electromagnetic brakes] 16,793/06.

Miscellaneous: P. M. LINCOLN [Apparatus for indicating A.-C. phase difference] 14,969/01; H. S. HATFIELD [Electrolytic rectifiers] 17,193/07; N. B. LE FEVRE [Electric massage appliance] 17,254/07.

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THE LOT'S ROAD TURBINES

THE appeal by the British Westinghouse Co. against the arbitrator's award concerning the substitution of Parsons for Westinghouse turbines at the Lot's Road power-house was continued in the Appeal Court on Wednesday and Thursday last week, judgment being reserved. The previous proceedings were reported on page 610 of our last issue.

Mr. J. D. FitzGerald, K.C., for the Underground Electric Railways Co. of London, first argued that the arbitrator's award was not appealable—a contention with which the Court agreed—unless there were special circumstances. Sir Alfred Cripps, for the Westinghouse Co., admitted that an arbitrator's award could not be appealed against unless stated in the form of a special case. In this instance the arbitrator had given the decision of the High Court as to the principle upon which he should base his award as part of his award. This, in his opinion, brought it within the category of a special case. There being so much to be said on both sides, the Court decided to reserve their decision on the point, and Mr. Fitzgerald proceeded to deal with the main part of the case. He said that the breach of contract on the part of the Westinghouse Co., by reason of their machines not giving the guaranteed figures of steam consumption, had compelled the Underground Co. to purchase the Parsons machines. The purchase of these machines brought to an end a large bill of damages against the Westinghouse Co., and any advantage which the Underground Co. might have obtained could not be argued against them in mitigation of damages, especially as the Parsons machines in question were the only ones which the Underground Co. could have purchased which gave results anywhere near those originally guaranteed by the Westinghouse Co.

On behalf of the Westinghouse Co. it was urged that the Underground Co. did not purchase the Parsons machines solely to reduce the damages against the Westinghouse Co.; indeed, it was not inconceivable that, as a matter of business prudence, they would have installed them even had the Westinghouse turbines been up to contract.

"OSRAM LAMP WEEK"

THE "Osram Lamp Week," organised by the General Electric Co., Ltd., which commenced last Saturday, has been wonderfully successful. The company commenced its campaign on Saturday with a full-page advertisement of the reduced prices of Osram lamps on the front page of the *Daily Mail*, and followed this with similar advertisements in the *Daily Telegraph* and the leading provincial newspapers. They invited electrical contractors in every town to send orders for 150 Osram lamps of assorted sizes, in return for which the company undertook to insert the contractors' names in the *Daily Mail* and in one of the other advertisements as local agents, and to supply them with free advertising matter for the decoration of their windows. About 650 firms responded to this offer. The advertisements were well designed and displayed, and the result has been eminently satisfactory both to the General Electric Co. and to the contractors who are agents for their Osram lamps. We congratulate Mr. H. Clifford Palmer, the manager of the company's Publicity Department, on having arranged the most boldly-schemed and successful electric lamp advertising scheme of the year.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

DISTRIBUTING BOARDS.—A list from V. G. Middleton (Broadway Chambers, Westminster) contains particulars of the "Kartret" patent distributing switch- and fuse-boards, which are fitted with a special laminated edgewise switch and a porcelain enclosed fuse of novel design.

RADIATORS.—Some new designs of luminous radiators are illustrated in a leaflet from the Armorduct Manufacturing Co., Ltd. (Farringdon Avenue, E.C.).

FITTINGS AND SIGNS.—A handsome four-lamp ceiling fitting with cut-glass bowl, and a metal shop-window sign, are illustrated on a card from Simplex Conduits, Ltd. (Garrison House, Birmingham).

METRIC TABLES.—The Central Translations Institute (16 Eastcheap, E.C.) send us a card containing 50 metric equivalent tables arranged in convenient form.

ELECTRIC CLOCKS.—A booklet from Gent & Co., Ltd. (Faraday Works, Leicester), contains particulars of their "waiting train" movement as applied to electric clocks, with illustrations of a number of large public and other clocks erected by them.

SWITCHES, FUSES, AND DISTRIBUTION BOARDS.—Many of the "M.E.M." switches, fuses, distribution boards, &c., described and illustrated in a neat list, just received, seem to be particularly applicable to cases in which ironclad apparatus of inexpensive patterns are required. For instance, "Dot" single-pole ironclad knife switches rated at 15 amperes are listed at only 4s. 6d. (subject), and the corresponding open pattern at only 1s. 6d. Motor-control panels and house-service panels are also included in the list, and we notice a compact combined switch and cartridge fuse designed for the Bradford Corporation.

SWITCHES, INSTALLATIONS, MATERIAL, &c.—J. H. Tucker & Co. (King's Road, Hay Mills, Birmingham) include in the comprehensive catalogue of electric lighting and power accessories manufactured by them an extensive range of tumbler and other switches, bell pushes, plugs, sockets, adaptors, &c., and a number of patterns of distribution boards, fuses, and fuse boxes, lamp holders, &c., as well as many larger forms of switches, complete switchboards, &c.

ARC LAMPS.—A leaflet from G. Braulik (8 Lambeth Hill, Queen Victoria Street, E.C.) describes the Eclipse flame arc lamp, which is now sold under license under the Bremer-Westinghouse patents, as well as various accessories.

ARC LAMPS.—The Electrical Co., Ltd. (122–4 Charing Cross Road, W.C.), has issued a new list of "Sunshine" flame arc lamps and accessories, a coloured illustration of which is given.

FITTINGS.—Simplex Conduits, Ltd., send a 144-page pamphlet containing a numerous selection of well-illustrated electric light fittings. A large quantity of designs is shown, but we understand that any other special design will be submitted on application. A range of fittings for Holophane glassware, and some useful data in connection with the spacing of various reflectors, their proper application, and distribution of light are also included in their Holophane catalogue.

HEATING AND COOKING APPARATUS.—Two small booklets have also been issued by this firm. One relates to radiators and convectors, including the patent Murray type with the moving parabolic reflector for locating the heat, and the other gives some details of electric ovens, cookers, grills, toasters, kettles, hot plates, irons, &c.

FUSES.—A gaily-coloured pamphlet from Parmiter, Hope & Sugden describes by the aid of effective illustrations their "Honeycomb" fuse, of which details were given in ELECTRICAL ENGINEERING, October 26th, page 581, and includes prices of complete distribution boards fitted with this type of fuse.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

COOKING APPARATUS.—A card from the British Prometheus Co., Ltd. (Salop Street Works, Highgate, Birmingham), gives particulars of a new table cooker, comprising oven grill, omelet pan, simmering plate, and boiling plate, which they are putting on the market at a moderate price.

ELECTRICAL SUPPLIES.—A collection of leaflets from the Reason Manufacturing Co., Ltd. (Brighton), gives particulars of a new form of hand-lamp, electric clocks, outside lanterns for metal filament lamps, electrolytic meters, ironclad switches, and a combined service outfit, with sealing chamber, main fuses, and electrolytic meter all in one compact case.

AUTOMATIC STOKERS.—A very comprehensive catalogue is to hand from the Underfeed Stoker Co. (Coventry House, South Place, Finsbury), setting forth the principles upon which this firm's well-known system of stoking is founded, and giving illustrations of their underfeed stokers applied to various different types of boiler. The company were awarded a Grand Prix and two gold medals for their exhibits of underfeed stokers, air heaters, and CO_2 thermoscopes at the Turin Exhibition.

INSTRUMENTS.—A leaflet from the Allgemeine Elektricitäts-Gesellschaft describes a simple form of electrostatic potential indicator for high voltages.

TRAMWAY MATERIAL.—The same firm also send pamphlets dealing with interfall tramway motors, trolley-wire ears, and self-propelled tower wagons.

ALUMINIUM.—A leaflet from the British Aluminium Co. (109 Queen Victoria Street, London, E.C.) calls attention to the extensive use of aluminium for car-building and electric traction in general, including aluminium field coils, of which over 8,000 are in service.

TELEGRAPH APPARATUS.—British Insulated and Helsby Cables, Ltd. (Prescot, Lancashire), have issued a pamphlet describing the B.I. Pole-changer, which is capable of transmitting perfect Wheatstone signals at a speed of over 400 words per minute. These are stocked in five different patterns, and are polarised according to Vyle's patents, when they are worked direct in the line circuit. One of these is used as a sounder in connection with their new system of closed circuit working, which is also described.

WIRES AND CABLES.—Details of vulcanised wires and cables of 600 and 2,500 megohm grade, bell and fuse wire, flexible cords and jointing accessories are contained in a catalogue from the Metallic Seamless Tube Co., Ltd. (Wiggin Street, Birmingham).

TESTING SETS.—A new catalogue has been issued by Evershed & Vignoles, Ltd. (Acton Lane Works, Chiswick, London, W.), fully describing the well-known "Megger," with various diagrams of connections for measuring insulation and conductor resistances. In a separate booklet a full description is also given of the Potential Ohmmeter, known as the Ducter, the firm's latest manufacture, a full account of which appeared in ELECTRICAL ENGINEERING, March 23rd, 1911, p. 149. It is designed for measuring low resistances by direct reading, and has a range from 10 microhms to 5 ohms. We are asked to state that all previous catalogues are cancelled, and that a copy of

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the new issues will be gladly sent on application to those interested.

TELEPHONES.—We have received from Messrs. Siemens Bros. & Co., Ltd. (Caxton House, Westminster), a copy of their new catalogue of Telephone Apparatus, which supersedes previous telephone publications. This comprises some seventy pages, and deals with all classes of apparatus, including competitive battery telephones, intercommunication sets, magneto telephones, C.B. instruments, portable, loud-speaking, high-tension, and water-tight instruments; switchboards, arresters, condensers, &c., and concludes with a comprehensive telegraphic code and index. Special attention may be drawn to the intercommunication sets with metallic circuits, the metal-cased C.B. instruments, the theatre pattern loud-speaking telephones, mining telephones, and other specialities which are too numerous to note.

STANNOS WIRING.—A leaflet forming an addition to Siemens Bros. & Co.'s Stannos catalogue describes a twist or bond for concentric work and thin "biscuit" imitation wood blocks.

ALUMINIUM.—A pamphlet from the British Aluminium Co., 109 Queen Victoria Street, describes the uses of aluminium in motor-car and railway-carriage building.

ELECTRIC TRACTION NOTES

The Board of Trade report of Colonel von Donop on the tramway accident at Lewisham on September 2nd, when a double-decked L.C.C. car, weighing nearly 10 tons, became derailed on a curve at the junction of Shardeloes Road and Lewisham High Road, and, crossing the road, subsequently fell on its side, causing the death of one passenger and injuries to about thirty-five, has now been published. After giving particulars of the car and circumstances, and summing up the evidence, the inspector finds no fault with the condition of the car or the track, nor is he prepared to attribute the accident to the grooves of the rails being full of hard sand, as had been suggested. He also points out that at the speed at which the car was travelling centrifugal force alone would not account for the overturning, and attributes the accident to the sudden and forcible application of the magnetic- and hand-brake, which brought the car to a momentary stop, and locked the wheels, whilst the sudden movement of the live load to the outside of the curve under the action of centrifugal force caused the car to tilt over towards the right, so that its near side wheels were lifted off their rail; the car then skidded quickly forward for a short distance along the outer rail, and then the off side wheels also ran off the line to the outside of the curve. The car then slid across the wood pavement on its two off side wheels, gradually heeling over more and more to the right, due to the continued shifting of the live load in that direction. The forward movement of the car continued until it reached the tram rail in Lewisham High Road; at this point the car fell completely over, its final overturning being possibly accelerated owing to its forward movement being suddenly checked by the tram rail. The sudden stoppage of the car which led to this accident, he continues, was undoubtedly due to the sudden application of the brakes to their full extent, and this sudden application of brake power was in turn due to the fact that effective steps had not been previously taken to sufficiently check the speed of the car. Finally, he recommends that the position of the stop-post be altered so that it may be immediately opposite the commencement of the curve, and that steps be taken to ensure that the practice of drivers not bringing their cars to a stop before passing it be strictly prohibited.

There was a net profit of £8,485 on the working of the Norwich Tramways Co., for the year to June 30th, compared with £5,909 in the previous twelve months. The sum of £2,500 is added to reserve, and a 2 per cent. dividend declared upon the ordinary shares, carrying forward £1,013. The revenue per car mile was 8·23d., and the expenses 5·65d.

There was a net profit of £2,622 on the past year's working of the new St. Helen's and District Electric Tramways Co. After allowing a dividend of 2½ per cent. on the preference shares, a balance of £624 is carried forward.

There is a deficiency of £3,825 on the East Ham Corporation Tramways for the year's working to March 31st. The main reason for this deficit is the large expense which has had to be incurred during the year upon track renewals, and which has been met out of revenue.

There was a net balance on the working of the Preston Municipal Electric Tramways last year of £4,369, after meeting capital charges against £3,994 in the previous year. The number of passengers carried, however, decreased from 8,484,589 to 8,412,567.

The Hastings Corporation have decided to undertake certain repairs to the tramway track, and charge them to the Tramway Co., if the latter does not undertake the work itself within seven days.

The proposal of the L.C.C. to construct a tramway along the Euston Road to connect up with the lines at King's Cross does not meet with the approval of the St. Pancras Borough Council. The Works Committee of that body recommend that the proposal be refused until some decision can be come to with regard to the widening of Euston Road. The Council have adopted this recommendation.

The Parliamentary Committee of the Swansea Corporation recommend the promotion of a Bill next session for certain important tramway extensions.

The Highways Committee of the L.C.C. propose the construction of a tramway from Marble Arch to Cricklewood by Edgware Road, Maida Vale, High Road, Kilburn, and Shoot-up Hill. They also propose to introduce in the next Parliamentary session the proposal, rejected last session, for the construction of a loopline at the Finsbury Park terminus.

Notice has been given by Mr. Holland, in the London County Council, of his intention to move a resolution urging the Government to constitute a Traffic Board for London as recommended by the Royal Commission on London Traffic. Mr. Thomas has also given notice of a motion to the effect that the Highways Committee Report as to the advisability of the L.C.C. applying for Parliamentary powers to run omnibuses to link up existing tramway routes.

A tramway collision occurred on the Rawtenstall Corporation tramways on Saturday night, in which two cars were smashed and sixteen passengers injured—fortunately, none seriously. The accident was caused through a car getting out of control whilst descending the long slope into Accrington. According to newspaper accounts, the application of hand and magnetic brakes was futile. About half a mile down the slope another car was standing at a cross-over, and the runaway car, missing the points at the loop, dashed into the standing car, with the result that both cars were thrown off the lines.

Mr. J. B. Hamilton, the Leeds Corporation Tramway Manager, has visited Brighton, and has been over the routes contemplated by the Tramways Committee for the installation of trolley omnibuses. The result of his report to the Committee is that they recommend the Council to promote a Bill. It is understood that the Hove Council will not co-operate, but will oppose the Brighton Corporation running trolley omnibuses in their area.

The Stepney Borough Council is appealing to the other London Borough Councils for support in opposing a proposal by the London County Council to apply to Parliament for general powers to use the overhead trolley system without the consent of the Borough Council, who are the Road Authorities. In the L.C.C. Tramways Act of 1902 is a clause binding the L.C.C. to obtain the consent of the Borough Councils to the system of traction being adopted in any particular district. This has been found to be detrimental to the County Council as the Tramway Authority.

The arbitration to determine the price which the London County Council shall pay for the Hammersmith lines of the London United Tramways, Ltd., has been continued daily since our last issue. Mr. Stephen Sellon, the first witness for the Company, has been under cross-examination by Mr. C. C. Hutchinson, K.C., for the L.C.C. for several days. Mr. Hutchinson's questions indicate that the parties are not agreed upon any of the principles which should be followed in determining the price. The Company's method of arriving at the wear of the rails, and the price taken for the rails when new, are objected to. Similarly with the life of plant. The Company claim sixty years for ducts and twenty years for cables, whereas the County Council will only accept forty and fifteen respectively. On the question of the number of cars to be purchased, the L.C.C. officials, as the result of the examination of the Company's traffic records, say that forty and not fifty should be the number. Further, the Company's intention of handing over all open top-deck type cars was the cause of a long discussion, and it was eventually agreed that one-eighth of the number of cars ultimately determined by the arbitrator shall be covered-deck cars. The Company have put in £514 per car as the price, but the L.C.C. will not agree to more than £323.

In the same way considerable discussion is taking place concerning the Chiswick power house and depôt, the view of the L.C.C. apparently being that as these are only used

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partially for the Hammersmith lines, they should not be taken over at all. The repair shops are said to be used for the whole of the Company's rolling stock, whilst the generating station supplied lines far in excess of the Hammersmith tramways. The argument of the L.C.C. appears to be that anything "unsuitable" is to be taken over, but against this the Company's case is that everything suitable, whether excessive or not, must be purchased.

Mr. Hutchinson concluded his cross-examination of Mr. Sellon on Tuesday by suggesting that the present value of the plant in the Chiswick station was £54,024 instead of £107,704 estimated by Mr. Sellon. In re-examining Mr. Sellon, Mr. Balfour-Browne emphasised the point that the station and plant was insufficient in capacity for its present work, but was now used and was suitable for the supply of the Hammersmith lines. Mr. J. T. Wood was then examined on a valuation of the permanent way prepared by him, which substantially confirmed that of Mr. Sellon. Mr. Wood was severely cross-examined by Mr. Hutchinson as to the origin of his prices. On Wednesday Mr. Wood was re-examined, and Mr. H. F. Parshall then gave evidence for the Company.

Under "Electric Traction Notes" in our issue of November 2nd we stated, in reference to the arbitration between the Gravesend Corporation and the Gravesend and Northfleet Electric Tramways, Ltd., that "negotiations are proceeding between the parties on the basis of abiding by the existing price, on the understanding that the Tramway Company shall have a reduction on the price paid on the higher number of units taken per annum." We are informed by the Company that this is incorrect, and that up to the present no such negotiations have taken place.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

According to the *Elektrotechnische Zeitschrift*, the Hamburg Observatory has arranged an apparatus in connection with their chief clock, which sends out time signals every minute by means of a special signalling circuit to the main telephone exchange of Hamburg. Means are there provided for switching on to subscribers, who can thus regulate their clocks to standard Continental time. The different minutes of the hour are distinguished by different signals.

It is stated in the *Melbourne Age* that Mr. H. W. Ramsay Sharp, who has, at the request of the Government, been carrying out tests on the Melbourne telephone system, has issued a report which severely condemns the present arrangements. The cross talk on the lines is said to be very bad, and is attributed to carelessness on the part of the operators. He also complains of the laxity on the part of the operators in dealing with calls, and has found in some cases that, although both subscribers had rung off, their lines were still left connected.

According to the *Madras Standard*, the extension of wireless telegraphy in India is now to be carried out systematically. A route from Calcutta to Jutogh, Simla, by way of Allahabad and Delhi was chosen in the first instance, and the installations are nearing completion. The next station to the north will be at Lahore, and this will be put in touch with Karachi. Later on Peshawar will doubtless be included in the system. In the west an installation is to be given to Bombay and another to Nagpur. Necessary funds will be provided next year.

In the Chancery Division on Friday, Mr. Justice Swinfen-Eady granted an injunction, upon the application of the National Telephone Co., restraining the Hythe Corporation from revoking the license now held by the company for maintaining telephone poles along the bank of the Royal Military Canal, and also from removing or interfering with the company's poles or cables. The wayleaves to erect these poles, it was pointed out, were granted in 1889, and now the Corporation had ordered their removal by December 27th. The point was made on behalf of the company that, by this action of the Corporation, the company would be deprived of the value of the line, which, in the ordinary course, will have to be purchased by the Postmaster-General next year. Mr. Justice Swinfen-Eady, in giving judgment, said he could not understand what was behind this dispute between the company and the Corporation, and granted an injunction, as stated above, and at the same time made an order preventing the company from removing the poles, an order which disposes of an application by a subscriber for an injunction preventing the company from disconnecting his telephone instrument.

The Hanekin route is interrupted on Ottoman territory, and lines were also down between Alep and Bagdad and between Diarbekir and Mossoul on the 13th inst. There is no change in the state of affairs in China and Tripoli, and disturbances also continue in Mexico.

LOCAL NOTES

Acton: *Electric Pumping.*—The Metropolitan Electric Supply Co. have quoted a standing charge of £400 per annum and ¾d. per unit for the supply of electricity for pumping purposes at the sewage works. The quotation was made subject to the supply not being taken during the hours of maximum demand. The offer has been refused.

Barrow-in-Furness: *Ice Factory.*—There is every probability of an ice-manufacturing industry being established in Barrow. The plant will be electrically driven, and it is calculated that the quantity of electricity used will amount to about £400 per annum.

Belfast: *Street Boxes.*—The Board of Trade have recommended the ventilation of all the Electric Supply Department's street boxes. It appears that there are about 2,300, of which only 350 are ventilated. The carrying out of the recommendation of the Board of Trade will involve an expenditure of £1,350, and the Engineer has been instructed to make inquiries as to the practice in other towns.

Brighton: *Electrical Exhibition.*—On account of the great success of the Electrical Exhibition described in our issue for November 2nd, it has been decided to keep it open until Saturday next, a week longer than originally anticipated.

Canada: *Electric Water Heaters.*—It is stated that the Winnipeg Electric Water Heating Co. is in process of formation for the purpose of manufacturing the "Gray" instantaneous electric water heater. The capital of the company will be £10,000, but none of the capital is to be offered to the public.

Fareham: *Electricity Works.*—The Council's Consulting Electrical Engineers, Messrs. May & Hawes, report that the Electricity Works have been completed at a total expenditure of £9,320, which is £680 less than the original estimate. The thanks of the Council were accorded the Consulting Engineers on the result of their work.

Greenock: *Electricity Accounts.*—There was a gross profit of £17,471 upon the working of the municipal electricity undertaking last year, and after meeting capital charges the sum of £1,500 has been placed to reserve. The balance carried forward is £4,021.

London: *L.C.C.: Position of Electric Supply.*—The Finance Committee, in a report upon the financial relations between the Council and the London Borough Councils, deal specially with the sanctioning of loans for electricity supply purposes. After detailing the powers of the Council, the Committee go on to say that, having in view the purchase by the Council of all the London companies' undertakings twenty years hence, it is desirable that some policy should be laid down as to the basis of future loans to the Borough Councils. They point out that after the purchase of the companies the County Council will be the authority for supplying electricity in London side by side with Borough Councils, and that it is desirable that all extensions should be carried out with a view to the development of the whole supply to the Metropolis. The Committee suggest that the Highways Committee might formulate a comprehensive policy as to the action which the Council should take under these circumstances. The immediate point for consideration is the question of the development of the various electric supply undertakings in the most effective and economical manner in view of the powers of co-operation conferred by the London Electric Supply Act of 1908.



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Bermondsey: Loan Refused.—The Council recently applied to the London County Council for sanction to borrow £18,563 for extensions at the electricity works. The L.C.C. applied for information as to certain terms recently offered the Council by two companies for giving a supply in bulk, and from a report of the Finance Committee, the Engineer has merely replied that he is of an opinion that the offers do not in any way compare with the advantages and economy derived through the extensions of the Council's own plant. The Borough Council will not give more specific information, and disputes the right of the L.C.C. Committee to interfere with the policy which has been adopted. The Finance Committee apparently take a serious view of the matter, and holds the opinion that, as the loan-sanctioning authority, the County Council has the duty of self-guarding the interests of future ratepayers, and in this capacity must have regard to the financial aspects of applications for loans. As the Bermondsey Borough Council have refused to supply information which will make clear the financial aspects of their proposal, the Finance Committee feel that they have no alternative but to recommend the Council to decline to sanction the loan.

Marylebone: Electric Lighting Tariffs.—The Council have adopted a report by the Electric Supply Committee recommending that a 6d. flat rate shall be extended to any consumer who desires to adopt it.

A scheme has been prepared for the electric lighting of dwellings in John Street, without meters, at 6d. per week per 25 c.p. Osram lamp in living rooms, or 5d. per week per 16 c.p. lamp; 4d. per week per 25 c.p. Osram lamp in bedrooms, or 3d. per week per 16 c.p. Osram lamp, or 2d. per week per 8 c.p. carbon lamp. These dwellings have been lighted experimentally at a somewhat higher charge during the past twelve months, but the success of the experiment has induced the Electric Supply Committee to approach owners of smaller dwellings. A sum of £500 from the revenue balance has been set aside to cover the cost of any work of this description, all of which is to be given out to contractors.

Melbourne: *Charges for Power Supply.*—It is proposed that the charge now made by the Municipal Electricity Department for power and heating purposes shall be reduced from 2d. to 1¾d. per unit.

Wednesbury: *Municipal Electric Time Service.*—An electrically operated clock, supplied by the Synchronome Co., Ltd., was put into service last week. It forms part of a Coronation memorial tower which the Council have erected.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia.—The New South Wales Government Railway Department, Sydney, require tenders by December 4th for two return boosters. Particulars from the Electrical Engineer, Office 61, Hunter Street, Sydney. The time available renders the above information only of use to firms who have resident agents in Australia.

Blackpool.—Tenders are invited by November 29th for a 1,500-kw. turbo-alternator, a barometric jet condenser, and a 800-kw. steam turbo-generator (mixed pressure). Particulars from Borough Electrical Engineer.

Clayton.—The Council are in negotiations with several authorities with regard to electricity supply.

Dartford.—Extensions at an estimated cost of £8,500 are contemplated. The estimates are made up as follows:—engine, balancer, switchboard, superheaters, piping, feed pump, and buildings, £5,700; cables, £1,000; boiler, £1,600; contingencies, £200.

Dolgelly.—The Council have decided upon an electric supply scheme at an estimated cost of £3,000.

London: *Islington.*—The Finance Committee of the L.C.C. have sanctioned a loan of £6,316 for electrical extensions.

New Zealand.—The Napier Corporation invite tenders for an electric tramway, lighting, and power works. Copies of the plans and specifications may be seen at 73 Basinghall Street, London, E.C.

Portsmouth.—The Corporation have passed the Tramway Committee's recommendation to extend the tramway system.



Salford.—Two 1,000-kw. D.-C. turbo-generators are required. Particulars from Town Clerk and tenders by November 27th.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Bexhill — School. Architect, H. P. Burke-Downing, 12 Little College Street, Westminster, S.W.

Edinburgh.—Extensions to central telephone exchange. H.M. Office of Works, London.

Glasgow.—Catholic institute. Professor J. S. Phillimore is chairman of the Organising Committee.

Greenock.—New public school.

Nottingham.—Cinematograph theatre at Pinxton. Architect, J. Tomlinson.

West Ham.—Tenders are invited by December 4th for the electric wiring of the Gainsborough Road Schools. Architect, W. Jacques, 2 Fen Court, Fenchurch Street, E.C.

MISCELLANEOUS

London: *Islington.*—The Council contemplate an expenditure of £2,400 upon the construction of testing stations in order to comply with the L.C.C. regulations.

L.C.C.—The Highways Committee recommend the construction of tramways from Forest Hill to Rushey Green at an estimated cost of £52,580.

New Zealand.—The Government intend to bring the telephone system of the country fully up-to-date, and special attention is to be devoted to the installation of telephones in private houses. Mr. T. Buckley, Chief Electrician to the Government Post and Telegraph Department, is now making a tour in this connection, and British firms desirous of communicating with him can do so c/o the High Commissioner for New Zealand, 13 Victoria Street, London, W.

In the recent Annual Financial Statement of the Minister of Finance, it was pointed out that inquiries are being made by the Government with a view to establishing new electro-chemical industries in New Zealand which will take their power from the Government water-power electricity works. It was also stated that plans are being prepared for the conversion to electric traction of the railway through the Lyttleton Tunnel.

North-Eastern Railway Co.—Tenders are invited for general stores, including electric lamps, wires, cables, &c. Particulars from Stores Superintendent, Gateshead, and tenders by November 21st.

Russia.—It has been decided to erect seven wireless stations at various points on the Russian Far East coast.

TENDERS RECEIVED AND ACCEPTED

Atherton (Lancs.).—The Council have accepted the tender of the Brush Electrical Engineering Co. for two 30-k.v.a. single-phase, core type, oil-cooled transformers, 2,400/240 volts and 50 periods.

Nelson.—Two additional tramways have been ordered from the United Electric Car Co., Ltd.

West Hartlepool.—The Electrical Engineer has been authorised to purchase from Messrs. Crompton & Co., under their existing contract, meters and switchboard panels as required.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £58 15s. to £59 (last week, £57 15s. to £58).

Metal Filament Lamps.—Ship Carbons, Ltd. (67 Adersgate Street) have been appointed sole agents in the United Kingdom for the "Monowatt" lamp, made by the Watt Electric Lamp Works, of Vienna.

Dissolution of Partnerships.—H. T. Byford and H. Speight, carrying on business as Byrds Electrical Co., 2 Inner Temple and 24 Dale Street, Liverpool, have dissolved partnership.

C. E. Harrison and L. J. Aron, carrying on business as the British Electric Time Co., have dissolved partnership. L. J. Aron continues.

Liquidations.—The creditors of the Davis Electrical Co., Ltd., the liquidation of which was referred to in our issue for November 2nd, have been offered 2s. 6d. in the £1, but no definite statement having been prepared, the offer is not being considered. A resolution has been passed to the effect that the appointment of Mr. G. E. Corfield be not confirmed, the opinion being held that the case was one for compulsory liquidation.

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The creditors in the winding-up of the Winchester Electric Light and Power Co. should send particulars of their claims to F. E. Gripper or A. R. Dyer, Broad Sanctuary Chambers, Westminster, by November 30th.

W. H. Howard, Electrical Engineer, 17 Russell Road, Finsbury Park, lately carrying on business as the Holborn Electrical Co., 5 Featherstone Buildings, Holborn, has been adjudicated bankrupt.

Thames Ironworks & Shipbuilding Co.—On the application of a debenture holder in the Chancery division on Tuesday, Mr. Justice Joyce appointed a receiver and manager.

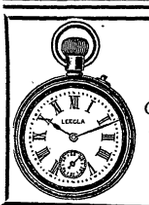
Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E., have just furnished us with some particulars of their advertising campaign for the present lighting season. Although the final arrangements have been delayed somewhat owing to the fact that they have been considerably increasing the manufacturing capacity of their works, we have no doubt that contractors will have realised that the usual enterprising technical paper advertising scheme has been kept going, whilst special arrangements have been provided for. Great interest has been stimulated in the pictorial designs selected as a result of the "Tantalum" Showcard Competition, and, as previously announced in these columns, four designs were selected. As usual, a very wide provincial poster campaign has been adopted, and posters are appearing in practically every town of importance throughout the country. Very humorous showcards of the "Little Bill" design have been reproduced in several colours, and many thousands of these have already been circulated among their trade customers, together with a wide selection of literature which can be over-printed with the name and address of contractors. Facsimile reproductions of the poster on postcards can now be obtained in quantities for contractors' use as correspondence cards, and Messrs. Siemens Bros. Dynamo Works, Ltd., will be glad to send a consignment. to any contractor who would care to circulate them. New and attractive pamphlets are in the press, and these will also be supplied in quantities to contractors. In addition to these arrangements, a large provincial newspaper campaign is already in operation, and hundreds of thousands of actual electricity users are being circularised in order to stimulate the demand for "Tantalum" lamps. It should be obvious to the trade generally that by displaying these showcards about their premises they will obtain their fair share of the large demand for "Tantalum" lamps which will be created by such a comprehensive circularisation. In addition to these schemes, the London ground is well provided for, as the usual underground and electrical railway systems are carrying their pictorial advertisements, whilst many of the carriers' vans covering Greater London are also displaying posters of the "Little Bill" design. This very exceptional campaign has been organised with a view to assisting the trade generally, and with a view to increasing contractors' sales in "Tantalum" lamps and accessories for use in conjunction with same without the imposing of any conditions or stipulations as to the value of the orders placed. Such arrangements are calculated to bring "Tantalum" lamps into even greater prominence with the public than previously, and it is interesting to note that the effect of these schemes is already resulting in greatly increasing the turnover of the lamps in question. The lamps themselves have maintained their long reputation for strength, durability, and efficiency, and consumers thoroughly realise their sterling worth.

APPOINTMENTS AND PERSONAL NOTES

We understand that Mr. C. C. F. Monckton is giving up his consulting practice at Parliament Mansions, Victoria Street, S.W., to take up the newly established post of superintendent of Telegraphs and Telephones, Fiji, and that he left England yesterday. His business will be carried on by Mr. Arnold G. Hansard, of the same address, in conjunction with whom he has worked for the last five years.

In consequence of the decision of the Newport (Mon.) Council to separate the management of the tramways from the Electricity Department, the salary of Mr. H. Collings Bishop, Borough Electrical Engineer, has been fixed at £400 per annum as from March 1st, 1912. Mr. Bishop's present salary is £500 per annum.

The South Shields Corporation invite applications by November 27th for the appointment of electrical engineer. The salary is £400 per annum.



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SAM FAY, General Manager.

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Electrical Engineering and Agency, Ltd , 109, New Oxford Street, W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Holophane Ltd , 12, Carteret St., S.W.
Landberg (A. P.) & Sons, Liverpool Rd., N.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames St., E.C.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Sun Electrical Co., Ltd., 118, Charing Cross Rd., W.C.
Veritys, Ltd., 31 & 32, King St., Covent Garden, W.C.

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Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.
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Electric Journal, 422, Mansion House Chambers, E.C.
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Indian Industries and Power, 204, Temple Chambers, E.C.
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WIRING CONTRACTORS. See page iv.

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ELECTRICAL ENGINEERING

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SUMMARY

The name "Licentiate" for the new class of member proposed by the Council of the Institution of Electrical Engineers has been abandoned. This was the only concession announced at the meeting held in London last Thursday. We review the Council's proposals with regard to the change in subscriptions, and put forward an alternative scheme under which a greater revenue could be made to accrue without raising the subscriptions of existing members. The local sections have made strong protests against the Council's proposed new Articles, and meetings have been held at Manchester, Leeds, Dublin, and Birmingham. (Page 637.)

The report of the last Council Meeting of the British Electrical and Allied Manufacturers' Association shows signs of considerable activity. Members of Parliament are being circularised with a view to preventing the use of electricity in mines being restricted by the Coal Mines Bill, which is about to be read a third time. (Page 639.)

The electric light and power supply for the new building of William Whiteley, Ltd., is taken entirely from the firm's own steam-driven station, which has been enlarged and rearranged. The lighting is principally by arc lamps, but in some departments metal filament lamps are used, and with Holophane shades. Electric power is used for machinery driving, lifts, vacuum cleaners, and pneumatic tubes, and a very complete fire alarm system is provided. (Page 640.)

After considerable experimenting, Messrs. Thomas Tilling, Ltd., have decided to use only petrol-electric omnibuses for the future. In conjunction with Messrs. W. A. Stevens, Ltd., they have produced a vehicle with which they hope to reduce expenses to 7½d. per car-mile. Arrangements are being made to manufacture these in quantities in the Midlands. A demonstration of one of these omnibuses was given on Tuesday. (Page 641.)

Some new arc lamps for photographic purposes are described and illustrated. (Page 642.)

The water-power electric supply plant at the British Aluminium Co.'s works at Kinlochleven was described in two papers by Mr. A. H. Roberts and Mr. F. B. Sonnenschein, read last week before the Institution of Civil Engineers. The capacity of the plant aggregates over 30,000 h.p. (Page 643.)

An improvement in a balanced feeder protective system, in which a compensating winding is provided to overcome capacity effects, has been patented by the British Thomson-Houston Co., and an electric resistance furnace, arranged so that the crucible wall is heated to a high incandescence, is also protected. Other patents published by the Patent Office include a new type of cable coupling, with a metal bush, and a cheap and simple form of lamp reflector. Three patents expire during the coming week, after a full life of fourteen years; one deals with a fusible cut-out, another with a train-lighting system with means for changing the polarity of the external circuit, when rotation is reversed, and a third relates to a surface contact system of traction, in which the magnet on the car has two windings. (Page 644.)

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AN important scheme for converting the North London Railway to electric traction, and linking it up with the L. and N. Western lines and all the London tube railways, is referred to in our "Electric Traction Notes."—The Central London Railway have also an important extension in view.—It is expected that the arbitration in connection with the Hammersmith lines of the London United Tramways will conclude next week.—At the Board of Trade inquiry into the accident upon the Rawtenstall tramway system it was stated that the shunt coil on one of the motors of the car had broken down.—We also refer to recommendations as to the railway and tramway systems of Melbourne, and the placing of an order in America by the Newcastle Corporation for tramway rails. (Page 645.)

UNDER "Telephony and Telegraphy (Including Wireless)" we give some points from a report of the Engineering Standards Committee dealing with experiments upon the mechanical properties of hard-drawn copper and bronze wires which have been carried out with the co-operation of the Post Office and National Telephone Co.—The Constantinople Telephone Co. is inviting subscriptions to its capital. (Page 646.)

MR. S. L. R. PRICE'S inaugural address to the Dublin Local Section of the Institution of Electrical Engineers dealt with electric heating and cooking. (Page 647.)

AT a joint meeting last week of the Manchester local section of the Institution of Electrical Engineers and the Liverpool Engineering Society, Prof. E. W. Marchant read a paper on the functions of engineering laboratories. (Page 647.)

THE Sheffield Corporation have included a clause in a Bill which is to be promoted next session, asking for powers to wire and fit consumers' premises for electric lighting. The National Electric Construction Co. is also promoting a Bill to legalise the free wiring agreements which have been entered into with a number of local authorities. (Page 647.)

THE London County Council have decided to appoint a committee to make a full inquiry and obtain expert advice in connection with electric supply.—The Board of Trade have sanctioned the system of supplying a group of houses from one service at Farnham.—The Finchley Electricity Committee are appealing against their present assessment of £4,300 gross and £1,800 rateable.—An improvement of £1,780 is shown in the accounts of the Leeds Electric Lighting Department for the half-year to September. (Page 649.)

CABLE is required at Warrington, Hackney, Hastings, and Hammersmith; transformers at Fulham; water-tube boilers at Norwich; a 500 D.C. reciprocating engine set at Darlington; a 3,000 kw. power-house is to be erected in Siam, and loans of £10,000 at Hammersmith and £3,500 at Mansfield are to be raised.—The tender for a Howden-Siemens 5,000-kw. exhaust steam set is recommended for acceptance by the Manchester Council. (Page 649.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, NOVEMBER 23RD.

Institution of Electrical Engineers.

8 p.m. "Automatic Reversible Battery Boosters," by R. Rankin.

FRIDAY, NOVEMBER 24TH.

Institution of Electrical Engineers: Newcastle Section.

7.30 p.m. Special meeting at Armstrong College to discuss proposed new Articles of Association.

Institution of Electrical Engineers: Scottish Section.

8 p.m. At 207 Bath Street. Special meeting to discuss proposed new Articles of Association.

SATURDAY, NOVEMBER 25TH.

Association of Mining Electrical Engineers.

5.30 p.m. Warwickshire and S. Staffs Branch. At Imperial Hotel, Birmingham. "Electricity in Connection with Explosives," by E. K. Scott.

MONDAY, NOVEMBER 27TH.

Institution of Electrical Engineers: Newcastle Section.

7.30 p.m. At Armstrong College. "The Principles of Radio-telegraphy," by A. S. M. Sörensen.

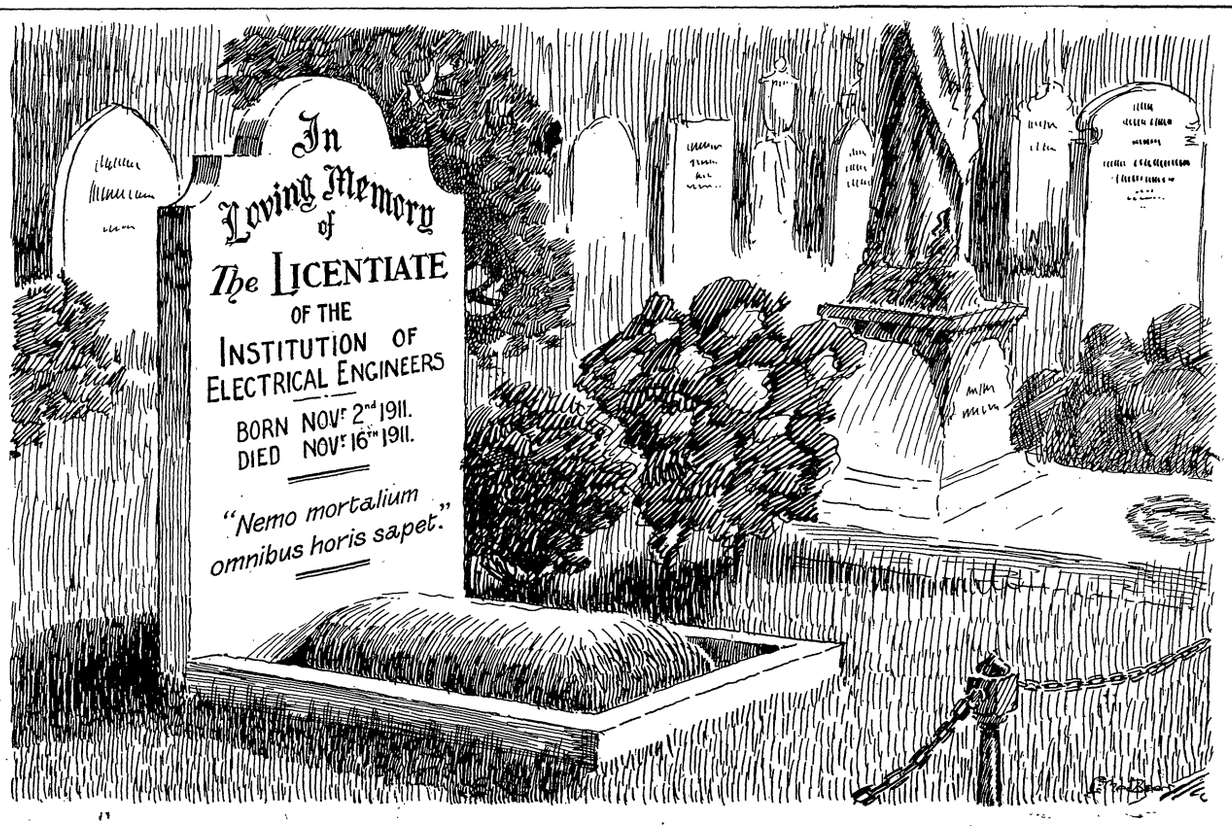
TUESDAY, NOVEMBER 28TH.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "Automatic Reversible Battery Boosters," by R. Rankin.

Institution of Civil Engineers.

8 p.m. "Electric Lighting of Railway Trains: the Brake Vehicle Method," by Roger T. Smith.



At the Institution of Electrical Engineers on Thursday, Mr. Ferranti referred to the "late" Licentiate. R.I.P.

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THE INSTITUTION OF ELECTRICAL ENGINEERS

The Name "Licentiate" Abandoned: Critical Review of Subscription Proposals and a Suggested Alternative: Strong Protests at the Local Sections

THE informal meeting, held at the Institution of Electrical Engineers last Thursday under the auspices of the Council at the suggestion of Mr. W. R. Cooper, was a dreary waste of time. The President was at the outset asked by Mr. Trotter to regulate the discussion so that the main points of the Council's proposals might be debated one at a time, but Mr. Ferranti did not accede to this request, and the result was a desultory and rambling discussion. There were, however, a few outstanding points to which we will refer.

The first of these was a reference by Mr. Ferranti to the "late Licentiate," which shows that the Council has acknowledged at any rate one of its mistakes. Another feature of the debate—which was a regrettable one—was the attitude adopted by Mr. Ferranti towards the main amendments received, which, as our readers know, had been sent in with a long list of signatures, including those of many influential members. Instead of announcing these and making clear the policy of the Council with regard to them, Mr. Ferranti read out a "summarised" list of all amendments received, in which the serious ones dealing with vital matters of principle were jumbled up with irresponsible and in some cases flippant suggestions sent in by a few individual members, in such a way that one was forced to doubt whether the Council had really been sincere in its announcement that proposals emanating from the membership would receive proper consideration.

In marked contrast to this was a dignified appeal by Mr. Trotter, pointing out how unfair it would be to raise the subscriptions of country members, and thus to make them contribute a larger share than the London members towards the lavish expenditure on the new building from which they themselves would derive little advantage. Mr. Trotter also supported the name "Subscriber" for the class which the Council had proposed to designate as "Licentiates," candidly putting forward as a reason that the title must be one that the man in question cannot write after his name.

Mr. Frank Bailey spoke as one of the extremists in opposition to the Council's proposals. In a violently aggressive speech he denounced and ridiculed the whole of the new Articles that had been drafted, and urged members to make no attempt to amend them, but to reject them as a whole.

Besides Mr. Ferranti, there were three speakers from the Council table: Mr. J. F. C. Snell, who is a Vice-President of the Institution and a member of the Revision of Articles Committee, confessed that they had recognised, before submitting the draft Articles to the members, that the name "Licentiate" was not a good one for the new class proposed. Mr. J. E. Kingsbury seemed rather to glory in the fact that £73,000 had been spent on the building and alterations, although the original estimates previously announced to the members had amounted only to £56,000, and yet he refused to adopt the view that country members should not have their subscriptions increased at the same time as London members. He admitted that the Council wanted increased subscriptions partly on account of the new building, and that the margin of annual expenditure over receipts was now too small for safety. Finally, Mr. Hugo Hirst appealed for general support of the proposals for broadening the basis of the Institution and increasing its utility to the industry.

Whether the scope of the Institution should be broadened in this manner or should be narrowed down to be a professional body was discussed to some extent, there being speakers both of one opinion and the other. If carefully done, with proper safeguards and without too much precipitancy, we believe that the Institution could be made to represent the whole industry, and not merely the technical and professional element, without any loss to its status—in fact, with ultimate increased prestige in this direction; and since this alteration will help to relieve the present financial difficulty as well, we think that those who favour the narrowing down policy would be well advised to waive their objections, and to concentrate their attack upon those features of the Council's proposals (summarised in our last two issues) against which there is practical unanimity.

Practically the only other question discussed at the meeting was the Rules for Professional Conduct: Mr. McGregor Duncan suggested that all consulting electrical engineers should be registered by the Institution. Mr. J. G. Lorrain wanted an addition of a rule preventing members from adding "Past President" or "Member of Council" after their signatures in signing reports to clients. Mr. A. H. Dykes was so insistent on making it clear that he adopted a conciliatory attitude to the Council's proposals that it was not quite evident whether he considered the Rules for Professional Conduct adequate or inadequate.

Besides Mr. Dykes, Mr. W. L. Madgen was the only member not at the Council table who expressed approval of the Council's revised Articles. Mr. Madgen was unstinting in his praise.

THE SUBSCRIPTION QUESTION

We have already pointed out that the financial question dominates the whole position, but we are now able to assert positively that a general increase in the subscriptions of existing members would not only be contrary to the wishes of the large majority of members, but would defeat its object by bringing about so many resignations that the income of the Institution would be decreased instead of increased. The Council proposes not only to increase subscriptions, but also to increase the entrance fees, including those payable on transfer from one class to another. Yet they intend to bring pressure to bear upon the older and more experienced of the existing Associate Members to transfer to the Member class. Let us examine how these transfer proposals will work out. At present an Associate Member who becomes a Member has to pay one guinea entrance fee and three guineas instead of two guineas subscription. The Council is not satisfied with this, but insists that any one transferred after the end of this year shall pay three guineas extra entrance fee, and a subscription raised from two to four guineas. The Associate Member would therefore be faced with this difficulty: he could remain Associate Member, and have his subscription raised by half a guinea, while his rank would yet be of less value to him than hitherto, owing to the new ("Licentiate") class created, and a large influx of non-engineers as Associates; or he could move up to Membership and pay a large extra entrance fee and double his old subscription. The majority of the Associate Members would adopt neither course. They would simply resign; a few might request to be transferred to the new ("Licentiate") class, continuing to pay the same subscription as now, and would then clamour for the return of half the entrance fee they had paid, for the entrance fee proposed for the

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"Licentiate" is one guinea, whereas the Associate Members have paid two guineas. A few of the more wealthy or more extravagant among the Associate Members, and those with growing consulting practices, would prefer to be transferred to Membership, and a few would remain Associate Members, but the loss from resignation would be enormous. That Members, too, would resign in large numbers is evident from the mass of letters we have received, typical ones of which we published last week. We repeat that the loss of revenue to the Institution resulting from an increase in subscriptions and transfer entrance fees would be enormous.

It is positively astounding that the twelve men who constitute the Revision of Articles Committee, and the other Members of Council who adopted their recommendations, should not have foreseen this effect before they published their present proposals and aroused discontent throughout the membership. In this connection, however, we hasten to add a word of approval for one of the Council's other proposals. From what we have said above, it would certainly appear to be desirable that business men eligible for admission on the Council should be admitted as soon as possible.

We trust that the Council will adopt a simple alternative which will overcome the subscription difficulty in a very practical manner, and should enable the Institution to obtain an immediate increase in revenue if its acceptance by the Council is announced before the discontent becomes even more widespread than at present. Our suggestion is as follows: That there be no changes in the subscriptions of Members of each class until January 1st, 1913, and that only the subscriptions of Associate Members elected after January 1st, 1913, and Members elected, or transferred from Associate-Membership after that date, be in accordance with the higher scale. Also that the increase in entrance fees be postponed until the same date.

The result of this would be that all Associate Members eligible for transfer would immediately take steps to obtain it so as to benefit by the existing transfer entrance fee and the existing subscription. At the same time there would be a large number of new candidates for election both as Members and Associate Members during the next twelve months, so that they might come in under the lower entrance fees and subscriptions. Further, in the scale for subscriptions of new members, a difference between town and country members could be made, so that the rates would be as follows:

SUBSCRIPTIONS.

Members elected before Jan. 1, 1913	3 guineas.
Associate Members elected before Jan. 1, 1913 ...	2 guineas.
Members elected after Jan. 1, 1913 (London) ...	4 guineas.
Members elected after Jan. 1, 1913 (country) ...	3½ guineas.
Associate Members elected after Jan. 1, 1913 (London)	3 guineas.
Associate Members elected after Jan. 1, 1913 (country)	2½ guineas.

ENTRANCE FEES.

Members elected before Jan. 1, 1913	3 guineas.
Associate Members elected before Jan. 1, 1913 ...	2 guineas.
Fee payable on transfer from Associate Member to Member before Jan. 1, 1913	1 guinea.
Members elected after Jan. 1, 1913	5 guineas.
Associate Members elected after Jan. 1, 1913 ...	3 guineas.
Fee payable on transfer from Associate Member to Member after Jan. 1, 1913	2 guineas.

LOCAL SECTIONS

MANCHESTER.

A Special Meeting was held on Tuesday evening. Mr. Ferranti, Mr. Hammond, Mr. Hirst, and Mr. Pearce (together with the Secretary), were present on behalf of the Council, and Mr. W. Cramp occupied the chair.

Various suggestions were put forward on behalf of the Committee of the Manchester Local Section by Mr. Cramp, and the whole were very favourably received. The following were the chief recommendations made:—

"Licentiates" (Clause 15).—It was decided to recommend that this name should be dropped, but that a new class be formed to cover the type of man included under this clause.

Eligibility of men of business, finance, and law as Members (Clause 12 d).—It was agreed to recommend the Council to delete this sub-clause.

Subscriptions.—Recommended as follows:—(1) That London members pay a higher rate of subscription than Provincial members. (2) That members who can attend meetings of Local Sections should pay a higher rate of subscription than members who cannot attend.

Vice-Presidents.—That Chairmen and past Chairmen of Local Sections be eligible as Vice-Presidents, even if they have not been Ordinary Members of Council.

Representation on Council.—This to be modified in accordance with a recommendation outlined by Mr. S. L. Pearce, and to be submitted later.

The Manchester Students' Committee held a meeting on Monday, November 13th, at which the Council's proposals were discussed, particularly in so far as they affect the Student class. A number of "proposed amendments" were formulated, which it was resolved should be placed before a general meeting of Students to be held on Tuesday, November 21st.

YORKSHIRE.

Mr. Robert Hammond and Mr. J. E. Kingsbury represented the Council at a meeting of the Yorkshire Section held at Leeds on Monday. They heard some very plain speaking by the Yorkshire members.

The hurried manner in which it had originally been proposed to pass the amended Articles was commented on. The finances of the Institution also came in for severe criticism, and the relative benefits obtained by London and country Members. The proposed raising of subscriptions was condemned, as also was the new arrangement of the classes of membership. It was urged that there should be an alteration in the proportion of country Members to town Members on the Council, and the wide powers proposed to be given to the Council as to dealing with the property of the Institution, and disagreement with the proposed method of election of Members of the Council, and other matters in the new Articles was expressed. There was a strong feeling that the membership could easily be increased without lowering the prestige of the Institution, one leading Member offering to be responsible for a dozen "good men and true."

Mr. Hammond and Mr. Kingsbury replied to much of the criticism with their usual eloquence, but it was clear that the Meeting was not to be converted by the explanations given, and after a sitting lasting 2½ hours, it was unanimously decided that the representatives from London, who were heartily thanked for their attendance, be requested to "ask the Council to defer the question of amending the Articles of Association for a period of 12 months from this date."

BIRMINGHAM, GLASGOW, AND NEWCASTLE.

Yesterday evening Mr. Ferranti was at a general meeting in Birmingham, and on Friday he will attend one at Glasgow. Mr. Kingsbury and Mr. Hammond will, it is expected, address a meeting at Newcastle to-morrow (Friday). At all these centres there is strong disagreement with the Council's draft Articles of Association.

DUBLIN.

A general meeting of the members of the Dublin Local Section was held at the Royal College of Science at 8 p.m. on Tuesday last week to consider the proposed new Articles.

The Secretary announced that when the Council heard that the meeting was to be held, they sent a wire to the effect that such a meeting was contrary to the rules for the government of Local Sections. It was then pointed out that a similar meeting was being held in London on the 16th inst., and finally the Council gave permission to the Section to hold the meeting, but it was announced that the President had specially desired that no resolutions should be passed at the meeting. In deference to this wish, no resolutions were put.

The members of Committee, however, raised point by point the opinions which they had proposed as resolutions at the Committee meeting held on the previous day, and each point so raised was discussed. After the ideas of the Committee as to revision were exhausted, suggestions were asked for, and one such (No. 10) received sufficient support to be included with the others as opinion widely held. At the close of the meeting the members present were invited to sign such opinions as they agreed with—each opinion being on a separate sheet.

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There are 15 Members and 33 Associate Members attached to the Dublin Local Section. Of these 48, no less than 33 have signed the Memorandum below, either during the meeting or during the next few days, representing 70 per cent. of the membership of the Section.

The wording of the Memorandum, which has been sent to the Council with the signatures, is as follows :—

We are of opinion :—

(1) That the proposed changes in the Articles of Association which lower the professional standard for admission to existing grades, the proposed change which creates a new class (Licentiate) with low professional qualifications, and proposed changes which tend to increase the number of non-professional members beyond the provision for this purpose under the heading of Associates, are against the spirit of Section 3 of the Memorandum of Association, are not in the interests of the Institution as a professional Institution, and tend to lower the status of the professional members, and that the new Articles should be referred back to the Council for amendment in these particulars.

(2) That subscriptions be not raised to members of any class, and that entrance fees and subscriptions of new members of any class joining after July 1st, 1912, or transferring after February 1st, 1913, be according to the new schedule as far as London members are concerned, and at the old rate for members living more than 20 miles from the Institution Buildings.

(3) That the last paragraph of Article 13 should read :—The Council shall require candidates for Associate membership to pass an examination unless in possession of diplomas or degrees of teaching bodies approved by the Council.

(4) That Article 15 [relating to the Licentiate class] be deleted.

(5) That a time limit for remaining a student should be enforced.

(6) That if it shall be found through loss, or feared loss of revenue from any cause that the retention of the building on the Embankment necessitates the lowering of the professional status of the Institution in order to provide increased revenue, then that the building should be sold and the professional standing of the Institution not sacrificed to it.

(7) That in the proposed new Articles 66 and 69 [respectively empowering the Council to effect loans and to incorporate other societies] the clause subject to the sanction of two extraordinary general meetings be inserted.

(8) That the final decision of the Institution should be taken by postal vote of Corporate Members in the British Isles on the leading points in the proposed new Articles to which exception has been taken after sufficient interval for discussion by the Local Sections.

(9) That Article 80 be amended to read :—"14 clear days notice" instead of "7 days notice" [of all Annual and Special General Meetings].

(10) That the ordinary members of Council should be :—Twelve members, four Associate members, and two Associates.

CORRESPONDENCE RECEIVED

We have received a number of further signatures to the amendments which we have sent in to the Council. The amendments and first list of signatures were published in our last issue. Forms will be sent to any other Members or Associate Members desiring to place on record their concurrence with our objections to the Council's proposals.

Dr. C. C. GARRARD has sent us a long letter objecting to examination for Associate Membership.

Mr. A. H. DYKES sends us a still longer letter on the Rules for Professional Conduct in the new draft Articles. He regards these only as "a few guiding rules," and insists on the necessity of an Association of Consulting Engineers. [We may mention that Mr. Dykes, in conjunction with some others, has been endeavouring for some time past to form such an Association, but it is not receiving entirely cordial support from electrical engineers, as it is proposed that only Members of the Institution of Civil Engineers shall be eligible for membership.]

Mr. E. W. COWAN writes us with regard to the election of Council, proposing the issue of two nomination lists, one containing the names of the Council's nominees, and the other alternative nominations which have been put forward by the membership.

A POWER STATION MANAGER, in returning us our amendments with his signature, adds that he considers that the bulk of the town members would have the same ground for complaint as the country members if the subscriptions are raised, as the average town member only makes use of the building on meeting nights.

Mr. THOMAS ROLES, City Electrical Engineer and Manager, Bradford, has sent us a letter giving interesting statistics showing the relative contributions of London, country, and foreign Members to the funds of the Institution. We shall deal with this in our next issue.

B.E.A.M.A. ACTIVITIES

A MEETING of the Council of the British Electrical and Allied Manufacturers' Association (Incorporated) was held at the Association's offices, 36 Kingsway, W.C., on the 9th inst.

The following firms were elected members : British Thomson-Houston Co., Ltd., British Electric Transformer Co., Ltd., Browett, Lindley & Co., Ltd., Dick, Kerr & Co., Ltd.

Messrs. Feld Bros. & Co., Ltd., were elected associates.

We are informed that since that date the Secretary has received applications for membership by several other important firms.

The Secretary reported that the following gentlemen had assented to their election as Vice-Presidents of the Association : S. Z. de Ferranti, J. McDonald Henderson, M.P., Hugo Hirst (Managing Director, General Electric Co., Ltd.), John Kerr (Chairman of Directors, Dick, Kerr & Co., Ltd.), N. Kilvert (Chairman, Lancashire Dynamo & Motor Co., Ltd.), C. A. Park (Managing Director, British Westinghouse Co., Ltd.), O. H. Smith (Director, British Thomson-Houston Co., Ltd.), W. T. Stubbs (Director, Electromotors, Ltd., and President, Manchester Chamber of Commerce), G. A. Touce, M.P., Lord Vaux of Harrowden, and Douglas Vickers (Director, Vickers, Ltd.).

The following gentlemen were elected Vice-Presidents of the Association : Sir Wm. Mather, Sir Andrew Noble, Sir C. A. Parsons, Mr. Alex. Siemens, Colonel Crompton, and Lord Furness.

Reports from various sub-committees were considered and adopted, including that of the sub-committee on the Coal Mines Bill, under the recommendation of which a letter was despatched to every Member of Parliament. This letter called attention to a clause in the Bill which would seriously restrict the use of electricity in mines, and would, in fact, even prohibit its employment in certain cases in which even naked lights are permitted. Reference to this matter was made by Mr. Patchell at the recent Birmingham dinner (see ELECTRICAL ENGINEERING of November 16th, page 627), and an article on the subject was published in our supplement, "Electrical Engineering in Mines," on September 7th. We propose to return to the matter in our next mining supplement. The sub-committee on the "Model General Conditions," proposed by the Institution of Electrical Engineers, recommending the transmission to the Institution of amendments provisionally agreed by the Association, was also adopted.

In order to provide for the more prompt despatch of ordinary and pressing business than customary under the monthly meetings of the Council, an Executive and Finance Committee of five members was elected. One of the immediate duties of this Committee will be to prepare for the Annual General Meeting (January), at which a new Council will be elected.

Applications for support from certain bodies desirous of projecting electrical exhibitions were considered, and the Secretary was instructed to inform the applicants that the Council were unable to depart from the standing rule.

It will be of interest to those not yet working in the Sectional Groups to know that most of the important business of the Association (excepting matters of policy and questions affecting it as a whole) is conducted by these groups, which are at present as follows : (*a*) arc lamps and carbons, (*b*) accessories (light, power, and other electrical), (*c*) accumulators, (*d*) conduits and conduit fittings, (*e*) dynamos and motors, (*f*) fittings (including heating and cooking apparatus), (*g*) instruments, (*h*) meters, (*j*) incandescent lamps, (*k*) switchgear and controllers, (*l*) transformers, (*m*) telephone, telegraphic, and signalling apparatus and primary batteries, (*n*) wires and cables, (*o*) engines (reciprocating, turbines, gas and oil engines). Arrangements are in progress for the early meeting of each of the groups.

The new offices of the Association at 36 Kingsway, W.C., afford good facilities, particularly for country members and their friends, for meeting and conducting correspondence. ELECTRICAL ENGINEERING and practically all the other weekly technical papers are to be found on the table of the Reading Room.

Each member of the Association is requested to send to the Secretary at an early date a bound set of his complete catalogues for reference by visitors from abroad.

In view of the fact that Mr. Hawes resigned the position of Secretary as from the 9th inst., and that Mr. Dunlop assumed full responsibility as from that date, members should bear in mind that all correspondence should be addressed to him at 36 Kingsway, W.C.

Electric Supply Advertising.—A further issue of new pamphlets, &c., has been made by the Electric Supply Publicity Committee, laying special stress on cooking and vacuum cleaning, both dealt with by the aid of attractive illustrations. These publications are intended as a follow-up to the Exhibition at Olympia. A new poster has also been designed, showing a statue of Liberty dressed as a housemaid, with an electric lamp in one hand and a radiator in the other, symbolising the fact that electric lighting and heating give freedom from smoke, dirt, and work.

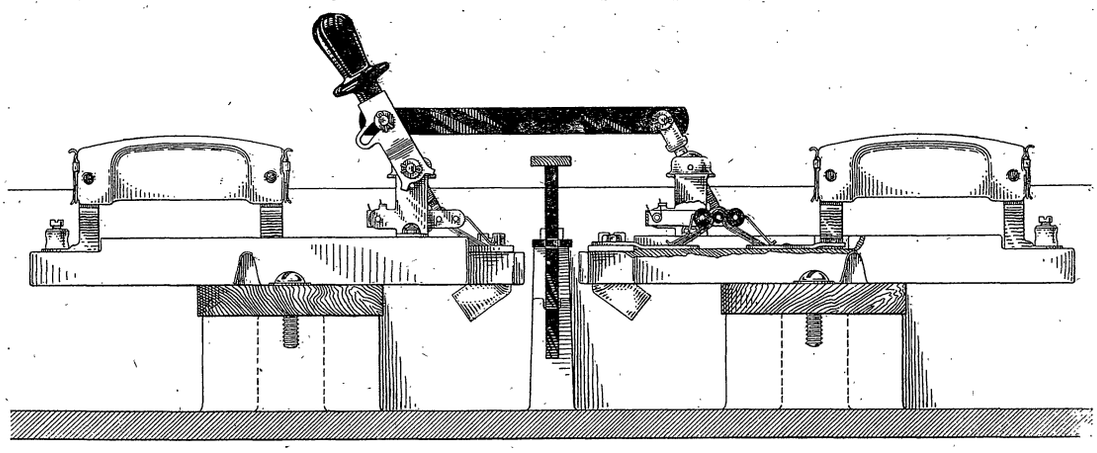
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ELECTRICAL EQUIPMENT OF THE NEW PREMISES OF WILLIAM WHITELEY, LTD.

THE latest and one of the most sumptuous of the commercial palaces which form so prominent a feature of the centralised business undertakings of the capitals of the world is the new building in Queen's Road, Bayswater, which William Whiteley, Ltd., have completed on the site of the old Paddington Baths for the accommodation of the departments of the business hitherto housed in the original premises in Westbourne Grove, as well as for new developments and extensions of their activities. The building itself, for which the architects are Messrs. Belcher & Joass (9 Clifford Street, W.), and the contractors Messrs. Holloway Brothers, Belvedere Road, S.E., contains many features of interest as regards its construction, arrangement, and appearance, but it is only the purpose of this article to call attention to the ways in which electricity is used in the new part of the establishment. The arrangement provides for a ground, first, and second floors, with a fourth floor over a part of the area and a handsome dome. The premises were opened by the Lord Mayor on Tuesday.

The electric supply is provided entirely from the firm's own steam generating station in the basement behind the older Queen's Road premises, and considerable alterations and additions have been made owing to the extensions. No stand-by connection or auxiliary supply of any kind is obtained from the supply company serving the district. The decision to trust entirely to their own steam-driven station was due largely to the fact that steam was already, and is now still more extensively, required for such purposes as heating the buildings, cooking in the provision department, &c., so that in any case extensive boiler plant would be necessary. Considerable economy is secured by using exhaust steam for these purposes, and throughout the new building the heating is carried out on the low pressure or "atmospheric" system of Messrs. H. J. Cash & Co. It was found, on going into the matter and bearing in mind the depreciation of the old plant, that some extension and remodelling of the existing station would lead to a more economical result than providing independent live steam heating boilers and taking power from outside at the price available. The changes made in the old plant, most of which has been running for a great many years, embrace raising the steam pressure from 80 to 120 lbs. per square inch, providing a certain amount of new boiler plant, rearranging the flues and constructing a new chimney shaft, compounding the existing engines, putting down a new generating set, and remodelling the switchboard and metering arrangements. The boiler plant now comprises four new Galloway 30 ft. by 8 ft. boilers (replacing smaller units of the same make), and two of the same size by Daniel Adamson & Co., formerly worked temporarily at the lower steam pressure. All these are provided with superheaters, and are fitted with Meldrum electrically-driven, automatic stokers, and are connected up through new flues to the new chimney shaft, which is arranged for either natural or forced draught. In the engine-room, which has been somewhat enlarged, are now four 100-kw. sets driven by Willans central valve engines, which have been recently compounded, two similar 60-kw. sets, and a new Bellis-Siemens 200-kw. set, with two-crank compound engine. All the generators are wound for 200 volts, and a simple two-wire distribution at this pressure is employed. A new generator switchboard has been provided in the engine-room, and a lighting feeder board is provided in an adjoining switch-room, to which leads are taken forming virtually part of the bus-bars. The power distribution board is in the engine-room itself.

The whole of the wiring of the new building was carried out by Messrs. H. J. Cash & Co., Caxton House, Westminster. From the generating station feeder board, mains are taken to all parts of the premises. Those to the new building consist of two, each of 0·75 sq. in. section, leading to two four-way main distribution boards at the north end of the block, with D.P. switches and fuses on slate bases for 400 amperes per way. The supply to the seven shops into which the premises may be divided is taken alternately from these two boards, and in the basement of each is its own sub-main board, from which wires are taken to the various floors. All wiring from the main boards is in screwed iron conduit, with each main and sub-main cable in a separate tube. The whole system of steel conduits was erected complete before flooring was laid and ceilings plastered. All wires were drawn after the buildings were completed in these details, and unusually large capacity is provided in all tubes, so that the wires may be withdrawn or added to at any time without disturbance of the buildings or of the decorations. Messrs. Cash make a great speciality of this method of installation. The shop



SECTIONAL ELEVATION OF D.P. DISTRIBUTION BOARD.

distribution boards are of a special pattern, supplied by P. W. Rands (Caxton House, Westminster). An illustration is given showing details of one of the double pole boards used for the arc lighting. This contract is one of the first on which the tandem arrangement of switches has been employed, but the same form of switch, known as the "Kartret" switch, resembling in some respects a miniature circuit-breaker, has been used in single pole units by the War Office at Sandhurst College and elsewhere. About 32 of these boards, from 19 way downwards and averaging about 15 ways, all fitted with 10-ampere switches, are in use. They are in substantial cast-iron cases fitted in most instances with special catches where they are too near the wall for a lock to be got at. The narrowness of the switch allows plenty of room in the box for wiring, and the arrangement is such that they can easily be wired up in place. A special form of enclosed fuse is used, in which no screws or rivets are employed to hold either the fuse wire or the clips to the porcelain tube. The fuse wire is held by the spring shutters at the ends, and the metal parts are of phosphor-bronze, all except the soft copper contact piece against which the fuse wire bears. There is $1\frac{1}{4}$ in. clearance between the end of the porcelain and the cast-iron case, allowing, as we have said, plenty of room for wiring.

The general scheme of lighting is the provision of arc lamps down the centres of the various shops, with a certain amount of local incandescent lighting, but, as mentioned below, some departments are lighted entirely by metal filament lamps. About 450 arc lamps are employed, and these are all of the well-known Brokie-Pell pattern supplied by

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the Foster Engineering Co. (Wimbledon). The auxiliary incandescent lighting will be added gradually as required. In the jewellery, ladies' costume, and some other departments, as well as in the extensive refreshment rooms, the lighting is almost entirely by "Onewatt" lamps, supplied by Messrs. Siemens Brothers Dynamo Works, Ltd., of the 200-watt size, effectively arranged in Holophane reflectors and shades. The material for the special window lighting was also supplied by the Siemens firm, and consist entirely of Tantalum lamps in box reflectors, suspended behind the top of the window to throw light down on the goods displayed. No outside lamps of any kind are employed.

The generating station supplies more than 100 kw. for power purposes, not all, however, in connection with the new building, and among the purposes for which it is used may be mentioned the driving of machinery for printing, cabinet-making and general joinery, general purposes in the workshops of the building department, &c. In fact, all machinery on the premises is electrically driven. Electric lifts are also employed throughout. In the new premises there are twenty lifts altogether, supplied by R. Waygood & Co., Ltd. (Falmouth Road, S.E.), of which ten are for passenger service. These lifts are each capable of raising 20 cwt. at 250 ft. per minute, and are provided with control of the car switch type with self-centring detachable handle, somewhat similar to that in use on the tube railways. The cages are iron and glass in construction, and are made to the special designs of the architects. There are six lifts for goods service capable of taking loads from 10 to 20 cwt. at speeds varying from 125 to 250 ft. per minute, and three service lifts for a load of 1½ cwt. at a speed of 120 ft. per minute, and controlled by push-buttons on each floor. In addition to the above there is an inclined travelling goods hoist, driven electrically, for the purpose of taking up trolleys of parcels. The parcels sorting arrangements also include ingenious arrangements of glissoirs in connection with an electrically-driven revolving table. The main ventilation is by electrically-driven Blackman fans in the basement.

Among other special features is the special vacuum cleaning outfit supplied by the Vacuum Engineering Co., in which large electrically-driven turbine vacuum pumps are employed, and a very complete installation of pneumatic tubes has been installed by the Lampson Pneumatic Tube Co., also employing electrically-driven pumps. A further purpose to which electric power will probably be put is to drive the refrigerating machinery for a cold-store, but the details of this are not as yet decided upon.

The telephone arrangements involve a private branch exchange with connections to about 250 instruments, and a scheme for a wireless telegraph equipment is under consideration. In addition to the automatic gongs of the sprinkler installation, there is also fitted an installation of fire alarms by the Aero Automatic Fire Alarm Co. The great feature of this system is an automatic device for detecting any sudden rise of temperature or any slow rise that is too long continued. It consists of a small copper tube no larger than a number 14 wire, which is placed on the ceilings of the rooms and wherever the heat of a fire would affect it. The tube contains air at atmospheric pressure, which. when acted on by the heat, expands and generates pressure. This pressure acts on a sensitive instrument containing electrical relays at the central entrance of the extension, where all the tubes are collected, and rings fire gongs and transmits a telegraphic message to the Fire Brigade. In order that the outbreak may be located, the tubing is split up into forty different sections, each independent, and each dropping a different indicator. There are about eight miles of this sensitive tubing in the building.

In conclusion, we wish to acknowledge the help of Mr. W. Stewart (engineer to William Whiteley, Ltd.), and of several of the contractors for the equipment, in supplying us with information, particularly to Mr. H. J. Cash, of the firm who were responsible for the whole of the wiring.

THE TILLING-STEVENS PETROL-ELECTRIC OMNIBUS

WE have on several occasions referred to the progress of the petrol-electric system which Messrs. W. H. Stevens, Ltd., of Maidstone, have been developing, and in ELECTRICAL ENGINEERING, Vol. III., page 83, January 16th, 1908, we gave a complete illustrated description of the first omnibus which was equipped by them for Messrs. Thomas Tilling, Ltd., and has been running continuously in service since that year. The excellent results of this vehicle, especially as regards reliability and low cost of upkeep, have led to the decision of the company to adopt electric transmission gear exclusively for their omnibuses in the future, and an improved model was designed for the purpose on the same general lines as that described in ELECTRICAL ENGINEERING, Vol. VI., page 678, October 27th, 1910. Several of these are now in service, and preparations are already in hand for their manufacture in large quantities. On Monday last a demonstration was given of the steadiness of running, ease of control, and smoothness of starting of one of these vehicles (see Fig. 1) in the presence of a number of well-known men in electrical and automobile circles, who were afterwards entertained to lunch at the Holborn Restaurant by the directors of W. H. Stevens, Ltd.

The Tilling-Stevens petrol electric omnibus in the final form, which is the outcome of experience with the earlier vehicles referred to above, presents an example of an "all-electric" transmission, with no mechanical connection at any time between the engine and the road wheels, thus differing from several other systems which have been proposed or experimented with. The engine simply drives a semi-enclosed shunt-wound generator, while the rear axle is driven through a differential, worm and cardan shaft by a single series-wound electric motor. As is seen in Fig. 2, the motor is immediately behind the dynamo under the driver's floor-boards, but there is no mechanical connection between the two. Mounted between them is a fan carried on the dynamo shaft, which serves to ventilate both machines. The engine, specially designed for the work, has four cylinders, 105 mm. by 125 mm., and is coupled to the dynamo by a spring universal coupling. The dynamo is rated at 25 kw., at speeds from 350 to 1,400 r.p.m., and has been designed with a falling characteristic, so that any increase in the demand for current when the engine is fully loaded is accompanied by a reduction of voltage automatically, so that in combination with the series motor an automatic adjustment of the current and voltage takes place, according to the torque demanded by the conditions, thus giving the equivalent of a continuously variable



FIG. 1.—THE TILLING-STEVENS PETROL-ELECTRIC OMNIBUS.

gear. The control is of the simplest nature imaginable. When the car is ready to start the engine is running at a speed too slow to allow the generator to excite, but the circuit between the dynamo and motor is closed. To start, the "accelerator" or throttle pedal is depressed, the engine speeds up, the dynamo begins to excite, and the vehicle moves smoothly away as the field builds up; further speed regulation is effected almost entirely on the throttle pedal, but on stiff gradients a shunt resistance switch on the steering column is moved to weaken the dynamo field and permit of a higher engine speed. The shunt rheostat can also be so manipulated as to allow the engine to be considerably slowed down when

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the car is running fast, but not requiring much power, as down slight inclines, with a substantial gain in economy of petrol consumption. The main circuit is never broken except for permanently stopping or reversing, and the pedal controlling the main circuit breaker is interlocked with the reversing lever, so that the latter can only be moved when the circuit is broken, thus preventing current being broken on the reversing controller contacts. This controller, together with the very simply constructed shunt regulator, is placed in a very accessible cast-iron box under the side of the frame. We are principally concerned here with the electrical equipment, but the mechanical design of the chassis, for which Mr. P. Frost-Smith, Chief Engineer to Messrs. T. Tilling, is chiefly responsible, shows as much care in design as does the electrical transmission.

Mr. Richard Tilling (Chairman, Thomas Tilling, Ltd.) was in the chair at the lunch which followed the inspection of the

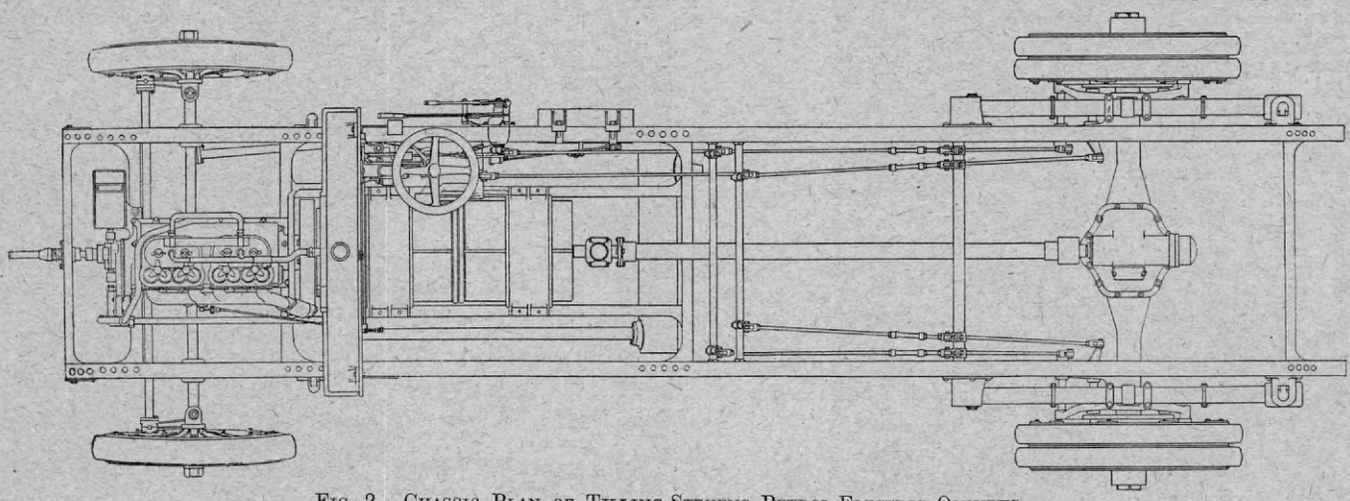


Fig. 2.—Chassis Plan of Tilling-Stevens Petrol-Electric Omnibus.

vehicle, and, in proposing the motor-omnibus industry, referred to some of their early troubles with geared vehicles, and to their friendly relations for the last fifty years with the London General Omnibus Co. They had now, in conjunction with Mr. Stevens, evolved a vehicle which was not only lighter, more silent, and more smooth running than its predecessors, but was considerably more economical, and they had made arrangements to build them in quantities at a works covering some 34 acres in the Midlands, to which Messrs. Stevens were removing from Maidstone. They were prepared to supply them to anyone, and to start with Messrs. Tilling had ordered 100 for their own use.

Mr. Duff (Joint Manager of the London General Omnibus Co.) replied, and emphasised particularly the advantage of having as few different types of vehicle as possible to look after.

Mr. W. A. Stevens then rose to propose the visitors, and outlined the general features of the omnibus which we have described above. He also paid high tribute to the work of Mr. Frost-Smith, without whose collaboration they could not have produced a vehicle to satisfy both traffic and police requirements.

Prof. W. C. Unwin (President of the Institution of Civil Engineers) and Mr. Louis Brennan replied to the toast.

Col. R. E. Crompton, in proposing the operating engineers, praised the work of Messrs. Tillings' engineering staff, and expressed his admiration for the shockless acceleration and the great overtaking power of the vehicle they had just seen, which would go far to relieve the congestion of street traffic.

Mr. P. Frost-Smith replied, and in the course of his speech remarked that in 1910 their expenses totalled 10·5d. per car mile, whereas the vehicles of the new type were now costing about 8d. per mile, and when running in quantity should lower the figure to 7½d. The great advantage was the reduction of maintenance expenses, a more important matter than the cost of fuel. Again, the depreciation would be much less for the electrical machines than for gearing. They had now been enabled to dispense entirely with their night repairing staff, and ran each 'bus for nine or ten days, after which it was overlooked in the day time, when much better work could be done.

Mr. P. Ellison (Chief Engineer, Eastbourne Corporation Omnibus Department) also replied.

Mr. W. M. Mordey, in proposing the Press, expressed his admiration for the smoothness of starting obtainable by electric transmission, which was better than they could ever get with the most perfect clutch, and prophesied that electrical methods would displace all forms of mechanical transmission for this class of work.

After this toast had been responded to, Dr. H. S. Hele Shaw proposed the Chairman, who fittingly replied.

ARC LAMPS FOR PHOTOGRAPHIC PURPOSES

SEVERAL new developments in photo-printing arc lamps have been made recently by the General Electric Co. (67 Queen Victoria Street). We understand that these lamps have now been sold in considerable numbers to process and photo engravers, cinematograph film-makers, printers, and photographers, whilst a recent further use for these has been found by lace-makers, who employ them to take blue prints of lace for travellers' use, the patterns, of course, being reproduced to the exact scale, besides which they are largely used for taking the photos of articles for catalogues, independent of daylight, giving much more artistic prints, when sepia ink is used, than can be produced by the blue print process.

Two types are supplied, viz., the enclosed type (see Fig. 1), emitting rays of high actinic value, and the open type (see Fig. 2), with spectrum especially suitable for colour work. For printing from negatives and tracings, the enclosed type is recommended, either medium or high power, according to the rapidity of exposure required. A 1,200-watt 200-volt lamp

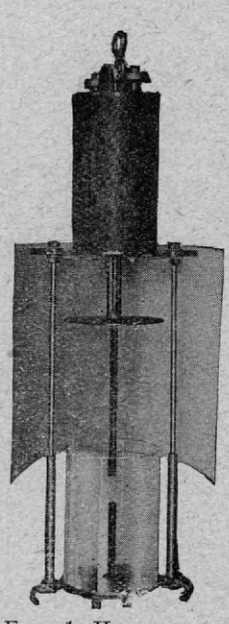


Fig. 1. High power enclosed lamp, showing globe dropped for trimming.

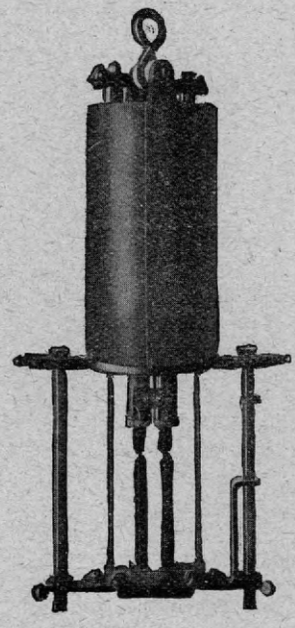


Fig. 2. Double carbon open type lamp.

will print four sheets of ordinary blue paper in flat frames, each 40 in. by 25 in., in ten minutes, at a cost (reckoning 3d. per unit) of a fraction over a halfpenny. Using a printing cylinder, 2,520 sq. in. can be printed in 3½ minutes, at a cost, on the above basis, of slightly under one farthing. For portraiture, enclosed lamps are advised. The best results are obtained by using two lamps—one a fixture and the other

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used in conjunction with a suspension gear, movable so as to alter the direction of the light thrown upon the object. The company has recently designed a double arc open type lamp to meet the ever-increasing requirements of process work. This lamp, which is shown in Fig. 2, will give equally good results with all three colours, and by means of a special arrangement, the light from the crater is thrown directly on to the object, thereby increasing the efficiency. These lamps are designed for easy trimming, an arrangement for dropping the globes being provided, whereby this can be undertaken even when the lamps are hot, and the risk of broken globes enormously reduced. The bottom carbon-holder is so arranged that perfect alignment of the carbons can be instantly obtained. The lamps are manufactured throughout by the company at "Witton" Works, near Birmingham, all parts being standardised and allowing of easy replacement.

WATERPOWER PLANT AT THE BRITISH ALUMINIUM CO.'S WORKS AT KINLOCHLEVEN

TWO Papers, one entitled "The Loch Leven Water-Power Works," by Mr. A. H. Roberts, and the other, "The Hydroelectric Plant in the British Aluminium Company's Factory at Kinlochleven," by Mr. F. B. Sonnenschein, were read last week before the Institution of Civil Engineers. The first Paper was devoted to the hydraulic arrangements, and described the construction of the Blackwater dam, 3,112 ft. in length, and with a maximum height of 36 ft. This is provided with a valve-tower containing the six valves of the three draw-off pipes, the spindles being carried up to the valve-house above top water-level. The draw-off pipes lead to the upper penstock-chamber, whence the water is delivered over a measuring-weir into the conduit. Water is conveyed to the pipe-track by this conduit, which is 3½ miles in length; it is of square section, 8 ft. by 8 ft., and is laid to a general gradient of 1 in 1,000. The conduit discharges its water into the lower penstock-chamber of about 300,000 gallons capacity, where it is measured and delivered to the pipes as required. From the penstock-chamber water is conveyed to the power-house in six welded steel pipes of 39 in. diameter. The track is 1¼ miles in length, and the fall of 935 ft. yields a normal static pressure of 406 lb. per sq. in. Water is distributed from the six main pipes to the various turbines by a system of pipes comprising two omnibus pipes and six feeders, all of 39 in. diameter. The main valves which control the supply of water to the distributing pipes are of the sluice-valve type, hydraulically worked, and fitted with a mechanical device for controlling the speed of closing. At the top of the pipe-track, immediately below the penstock-chamber, automatic cut-off valves have been installed to stop the flow of water in the event of a burst occurring on the main pipe-lines. At the summit of a slight elevation in the main line, air-valves have been fixed to allow large quantities of air to pass in or out, as required, when filling or emptying pipes.

The plant in the power-house was dealt with in the second Paper. The aggregate power installed is 30,660 h.p. at the generator couplings, the generators being capable of a maximum output of 21,088 kw. Nine main units and two exciter units are erected, each unit consisting of a turbine and two generators. The main turbines are of the Pelton-wheel type, supplied by Messrs. Escher, Wyss & Co., with two water jets, and are designed to develop 3,200 B.H.P. each at any head between 870 ft. and 925 ft. when running at any speed between 300 and 330 revolutions per minute; the guaranteed efficiency at 2,900 B.H.P. is 80 per cent. Each drives two generators coupled in parallel; these are shunt machines without commutating poles, and have slot-wound drum armatures. The maximum output of each pair of generators is 2,200 kw. when running at 275 volts, and the guaranteed efficiency is 93 per cent. at 2,000 kw. self-exciting. They were supplied by Messrs. Dick, Kerr & Co. The two small exciter units are also of the Pelton-wheel type, each driving a pair of generators on one shaft. These consist of an exciter and lighting machine, capable of giving an output up to 550 kw., and a traction machine up to 94 kw. capacity. Each pair of main generators driven by one turbine are connected in parallel, with their leads coupled together through links to its own series of furnaces. A pair of bus-bars run down the power-house, which can be connected through links to any main unit, and to any series of furnaces. This allows of any set being taken off load without shutting down its series of furnaces, as they can be supplied with power through the bus-bars from any other pair of generators available.

The feeders and distributors for transmitting electrical power to the village and to the auxiliary plant consist of bare stranded aluminium cables erected on poles and varying in section from 169/0·085 cable (0·96 sq. in.) to 1/0·144 (No. 9 S.W.G.) wire. The poles are spaced to give spans not exceeding 40 yards, and at this length of span the cables have a sag of 16 in. at 60° F. The straight-through and tee-joints in the feeders and distributors are of the autogenous-weld or cast-type, but the house-service and public-lighting leads are connected to the distributors by mechanical clamps made of aluminium with aluminium-bronze bolts. The total length of feeders and distributors is nine miles.

The latter part of the Paper describes the tests which were taken after the plant was erected to ascertain whether the plant fulfilled the conditions of the specification as regards output, consumption, efficiency, and governing. It was found during the tests that the generators were liable to flash over if the voltage increased excessively, and that they were also liable to flash over if a circulating current flowed round the two armatures of the dynamos on the same shaft running in parallel, when load was thrown off. An electrical protective device was therefore designed and fitted to each pair of generators, which automatically breaks the field-circuit when either of these two conditions arises.

The consulting electrical engineers were Messrs. Kennedy & Jenkin.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

CREOSOTED WOOD.—A leaflet from R. Wade & Co. illustrates sections of poles, sleepers, &c., creosoted by the Rüping process, showing the great penetration obtained. A blotter accompanies the leaflet.

ACCUMULATORS.—Full details and prices of the large variety of batteries, cells, and accessories made by the Hart Accumulator Co., Ltd. (Stratford, London), are clearly set out in a neatly bound volume, which they have just issued. These include 25, 50, 60, and 100-volt types for lighting, as well as a smaller type for motor-car lighting and ignition work. A range of portable batteries from 2 to 12 volts is listed, and instructions for working and erecting the batteries are also given.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ELECTRIC HEATING.—A booklet is being circulated by the City of London Electric Lighting Co., Ltd., pointing out the advantages of electric heating, and describing various patterns of radiators, water heaters, cooking appliances, irons and pans which the company are prepared to hire out.

LANTERNS.—A card from Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.), gives some particulars of a new pattern lantern for outside and shop window lighting. These are supplied in all sizes suitable for lamps of 50 c.p. to 1,000 c.p. or for eight 50-c.p. lamps, and can be had in aluminium, and polished or oxidised copper.

KALKOS CONDUITS.—The Sun Electrical Co., Ltd. (118 and 120 Charing Cross Road, W.C.), have issued a catalogue relating to the Kalkos system of wiring without condensation, which has often been mentioned in this column. The demand for this material is so great that substantial reductions have been made in a number of the standard fittings. This catalogue will be sent to any of our readers on application to the firm.

Finsbury Technical College Old Students' Association.—At the annual general meeting, Mr. E. W. Moss was appointed to the new office of Honorary Assistant Treasurer, and all subscriptions should be forwarded to him at 20 Huddlestone Road, Tufnell Park, N. The annual dinner will be held at the Trocadero on December 9th, with Mr. R. J. Wallis-Jones in the chair. The annual dance will be held at Caxton Hall on February 3rd, 1912, and a smoking concert is to take place during March. A dining club has been formed among members of the Association, with the object of dining together once a month. Particulars can be obtained from Mr. H. W. Gregory, 1 Atherton Road, Forest Gate, E.

Manchester Municipal School of Technology.—The fourth volume of the journal of the school contains, among other papers on technical subjects, a reprint of a paper, by Mr. C. F. Smith, on single-phase motors, and Prof. Schwartz's paper on testing of rubber, read recently before the Institution of Electrical Engineers. A paper by Prof. W. W. H. Gee and Mr. F. Brotherton, on the resistance of the human body, is also reprinted, and a Faraday Society paper, by Prof. Gee and Mr. W. Harrison, on the electrical theory of dyeing, is also included. Other papers read before the Institution of Electrical Engineers reprinted in the volume are :—The high-tension spark discharge in air, by P. Kemp and W. A. Stephens, and the irregularities in the rotating field of the polyphase induction motor by Mr. C. F. Smith.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Nov. 16, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

26,124/10. **Coupling for Cables.** H. R. Doel and A. E. Clarke. A cylinder with a threaded exterior and a tapered interior receives one side of a tapered metal bush of circular bore for taking the cable, the other side being reversely tapered to take a nut with a tapered bore, and threaded on the exterior for screwing on to the cylinder. The bush is slit down its entire length, and a corresponding opposite groove is also made to weaken it, so that when the nut is screwed on it gives to the pressure, and grips the cable firmly. Three figures.

8,998/11. **Electric Furnace.** W. E. Lake (*Florence*). The crucible portion is made of a more highly resisting material than the body portion of the furnace, and the former is broader and higher than the latter. The advantage of this, is that when the current is forced through the furnace it first passes through the crucible wall and heats it to incandescence while the body is comparatively cool. The crucible is lined with a material which is only a conductor when it is highly heated, the idea being that it absorbs the current and tends to maintain the voltage constant. Low resistance terminals are provided, which make and break the circuit on tilting the furnace.

9,806/11. **Lamp Reflector.** E. and N. R. Booth. This takes the form of a curved piece of sheet metal, the edges of which are bent over to form grooves for taking a thin sheet of flexible material with a high reflecting power, such as blotting paper. This is held in position on the lampholder by a metal lug riveted or soldered to the metal sheet. One figure.

21,662/11. **Protective Systems.** British Thomson-Houston Co. and J. Whitcher. The object of this patent is to provide means of overcoming the effect of the capacity current due to the long pilot wires, &c., of a balanced feeder protective system. For this purpose a compensating winding is applied to each trip coil. This can be a separate winding, or the main winding of the coil may be tapped at a point which is connected to one end of each series transformer, so that the current flows through one part of the winding in the opposite direction to that in the other part. The trip coils can be connected either in series or in shunt with the transformers at the ends of the feeder. Three figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Electrodes] 17,723/11.

Distributing Systems, Cables, and Wires: Becker [Reducing energy lost in lines with electro-magnetic equalising] 65/11; Shuttleworth [Joint for cable troughs] 2,765/11; Cheese [Flexible conductors] 17,387/11.

Dynamos, Motors, and Transformers: Fawcus [Cooling dynamos] 25,036/10; Vandervell and Midgley [Variable-speed self-regulating dynamos] 25,588/10; Macdonald [Motors] 4,286/11; Haefely [Transformers] 20,523/11.

Electrochemistry: Elektrochemische Werke Ges. and Rothe [Disc-like flaming arcs for gas reactions] 13,335/11; Elektrochemische Werke Ges. [Electrolytic production of ammonium nitrate] 16,426/11

Incandescent Lamps: Phillips and Phillips [Means for supporting] 3,526/11

Switchgear and Fittings: Parkes [Ceiling roses, &c.] 25,478/10; Price [Rotary switch construction] 28,501/10; Smithson and Sharpe [Lamp suspension apparatus] 29,314/10; Clapham [Electric plug couplings] 16,935/11.

Telephony, Telegraphy, and Signalling: Wanisch [Automatic telephone systems] 25,243/10; Cassel [Signalling system] 25,318/10; De Freystadtler [Block-signalling system] 342/11.

Traction: Monard [Railway point and signal control] 10,740/11.

Miscellaneous: Maddick [Electric lighting of pictures] 25,371/10; Tate [Electric horns] 25,858/10; Thomas [Intermittently illuminating signs] 25,877/10; Justice (*Soc. Anon. Electricité et Electromecanique*) [Electrically-driven drilling apparatus] 27,701/10; Electric Construction Co. and Jay [Rotary fan construction] 5,924/11; Menns [Magnetic speed indicators] 9,575/11; Rushmore [Systems of electric lighting] 14,478/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Incandescent Lamps: Carangelo, 23,725/11.

Switchgear: Murray [Cut-out for meter testing] 18,763/11.

Telephony: McBerty [Semi-automatic exchange systems] 23,508/11.

Traction: Peffer [Trolley-pole attachments] 22,295/11.

Miscellaneous: Trautmann and Mayer [Charging accumulator plates] 23,439/11; Soc. Electro-Industrielle et Anciens Etablissements Mathieu Réunis [Sterilising apparatus, &c.] 23,828/11.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

27,598, of November 24th, 1897. **Fusible Cut-outs.** G. Byng. In order to minimise danger from arcing, the fuse wire is led through a chamber lined with a refractory material, such as plaster of Paris, which will not volatilise at the high temperature of the arc. In a modification the fuse wire is led through a suitably lined tube or handle.

28,225, of November 30th, 1897. **Tramway System.** W. M. Brown. A surface contact system in which the magnet carried by the vehicle has two windings, one of high resistance connected to both sides of the circuit, and the other of low resistance in series with the motors. A battery, which can be thrown in by a foot switch, is also provided, so that the magnet may be excited in the event of the line current being cut off temporarily. The battery can be charged while current is being delivered to the motors.

28,159, of November 30th, 1897. **Train Lighting System.** S. Watkins. In this system, the generator is carried on the car axle, and means are provided for automatically regulating the current under all conditions, and for maintaining the direction of the current constant when the rotation is reversed. The latter is done by gearing to the dynamo a shifting helix with two circumferential grooves, engaged by a spiral groove forming reflecting shoulders at the point of intersection. This actuates a sliding lever, having a fixed stud with a spring-actuated sleeve, which operates suitable mechanism for changing the polarity of the external circuit. A bearing sleeve to facilitate the mounting of the parts on the car axle is also described.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: T. L. Carbone [A.-C. type] 15,591/05.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Insulation] 15,770/05, and [Distribution] 17,561/06; Land-und Seekabelwerke Akt.-Ges. [Cables for mines] 9,176/07.

Dynamos and Motors: B. G. Lamme [A.-C. commutator series motor control] 5,507/07; F. M. Meyer [Coupling for driving shafts in either direction] 17,783/07; J. Arenas y Garcia [Armatures and field magnets of D.-C. homopolar machine] 25,350/07.

Electric Ignition: J. C. & G. Fuller and B. J. Moore, 17,601/06.

Incandescent Lamps: E. Bohm [Bulbs, &c.] 15,996/05; A. and G. J. Bonnella, 17,309/07.

Switchgear and Fittings: R. T. Preston and H. E. Theobald [Lamp holders] 17,346/07; G. Harding [Switches for electric bells] 17,584/07; H. J. Dowsing [Switch] 17,661/07; C. E. Hunter and W. H. Warren [Switch] 17,707/07; G. C. Fricker [Switches for advertising devices] 17,796/07.

Telephony, Telegraphy, and Signalling: P. M. Justice (*Rowland Telegraphic Co., U.S.A.*) [Electric telegraphs] 15,475/01; V. H. and H. E. A. C. Donnithorne [Locating sound signals] 17,264/07; J. & W. Mladek and K. Samal [Telegraph relays] 17,332/07; W. E. Lake (*H. B. Newhall*) [Wire supports] 17,683/07.

Traction: Siemens Bros. & Co. and L. M. G. Ferreira [Electric signal indicators] 16,894/04.

Miscellaneous: R. H. Wappler and C. F. Fayer [X-Ray interrupter] 17,308/07; A. S. Hickley [Electrolytic current rectifier] 17,457/07, and 17,458/07; W. Fennell and W. P. Perry [Thermo-electric couples] 17,490/07; P. E. Trainor [Electrically-propelled vehicle or boat] 17,526/07; McVittie [Safety-suspending apparatus for lifts] 17,660/07.

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ELECTRIC TRACTION NOTES

The important announcement is made that the London and North Western Railway Co. propose, in connection with their Watford-Euston electric railway, to connect up with the North London Railway to Broad Street, and run a through service of electric trains upon these lines. This scheme is in order to accommodate the large number of London & North Western passengers now using Euston and who want to get further into the City. Another development in electric traction in London is the proposal of the London Electric Railways Co. to link up the whole of their tube railway system with the London & North Western Railway Company's system, and also to extend the Baker Street & Waterloo Railway to Queen's Park. In this way, by the use of a special type of carriage, it is anticipated that through connection will be given from Watford to Paddington, Marylebone, Baker Street, Oxford Circus, Piccadilly, Charing Cross, Waterloo, and other stations on the Baker Street and Waterloo lines. A lengthy official statement has been issued with regard to the scheme, but it gives no information as to the system of traction which has been adopted. On the Watford line, however, the continuous current third rail system is being adopted, and it is reasonable to conclude that this will be employed throughout if the extended scheme is sanctioned. An application is to be made to Parliament by the London Electric Railways Co. and the London & North Western Railway Co., authorising them to enter into agreement for the carrying out of the above scheme, which involves some forty miles of railway. Another important proposal is by the Central London Railway Co. for the construction of a line from Shepherd's Bush to Kew, Isleworth, and Hounslow, Hanwell and Ealing, joining up with the extension of the company's lines to that point which is now under consideration.

Among the other important electric traction schemes which will be promoted in the next session of Parliament may be mentioned proposals by the Stockport and Sheffield Corporations for powers to use trolley omnibuses, and another for the incorporation of the North Ormesby, South Bank, Normanby, and Grangetown Railless Traction Co.

The Board of Trade inquiry into the accident at Accrington upon the Rawtenstall tramway system referred to in our last issue, was held on Thursday. The driver's evidence was to the effect that the car had been running satisfactorily all day, and he could give no reason for the accident. The conductor and an inspector both stated that just before the car ran away, there was a smell of burning rubber. The Manager of the tramways stated that he found the shunt coil of No. 1 motor had gone, with the result that the motor could neither drive nor generate. It would be, however, difficult for a driver to realise what was the matter in so short a time, and with the rails in their greasy condition, the best brakes in the world would have failed to hold the car in check on such a gradient.

The Royal Commission appointed to inquire into the railway and tramway systems of Melbourne and its suburbs have issued a report. Among the more important recommendations are the conversion to electric traction of the Flinders Street-Richmond cable tramway, the Hawthorne and Kew horse tramways, and Camberwell and Caulfield railways. It is also recommended that the suburban railways be electrified, and that a State power station be established, capable of providing the necessary electric power, in addition to giving a supply of electrical energy for other public and private purposes. It is recommended that the overhead trolley system be adopted on the tramways. The full report may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, E.C.

According to the *Board of Trade Journal*, the Anglo-Argentine Tramway Co. have placed an order with a German firm for the construction of subway tramways in Buenos Aires. Three additional lines will be built later.

It is stated that a syndicate has been formed at Middlesbrough for running trolley omnibuses from Middlesbrough, through Grangetown, to Eston.

A company have approached the local authorities concerned, with regard to a trolley omnibus scheme between Leeds and Ilkley.

It is stated that the Cheshunt Council are considering the adoption of a trackless trolley system between Waltham Cross and Turnford. If this scheme is approved, it will, of course, be carried out by the Metropolitan Electric Tramways, Ltd.

The Newcastle Corporation recently placed an order for

ELECTRICAL INSTALLATIONS

Being a Compendium of information on Electric Light, Power Traction and Industrial Electrical Machinery.

By RANKIN KENNEDY, C.E.

The necessity for electrical engineers being well acquainted with all designs for installations that have given good results will be readily acknowledged by those whom the matter concerns.

While there are numerous text-books dealing with one branch or another of electrical engineering, they are all prepared for the student, and their contents deal rather with theory than with practice.

The aim of "ELECTRICAL INSTALLATIONS" is to assist the practical man who is concerned with electrical installations in any form, and this because it is recognised that there exists a very large class engaged in constructive and installation work, and a still larger class whose duty it is to take care of the machinery employed in working by electricity. Most of these men have picked up a working knowledge of their employment. What they need is to study the elements of the science of the subject. These elements are fully treated of in the first volume; and on the sound foundation thus laid, the author, who is a civil and electrical engineer by profession, and recognised as being in the front rank of electricians and engineers, proceeds to deal with every possible form of electrical installation, their principles and practical application.

This work describes and illustrates the best practice in all branches of the electric light and power installation business; the last volume treats of all the lighter branches of electrical manufactures—telephones, wireless telegraphy, and kindred subjects.

This second and revised edition of the work justly claims to have brought all subjects up to date with descriptions and information regarding recent machinery and apparatus. The matter has also been re-arranged so that all information relating to one subject follows consecutively.

The illustrations number 1,000, and there are eight fine plates in each volume. In addition, each plate contains a coloured cardboard sectional model of an electrical machine in four sections superposed.

TWO OPINIONS:

Mr. PONTECORVO, Engineer, The British Westinghouse Electric Co., Ltd., Manchester:—"The work is very clear in its explanations, and gives, by means of well illustrated experiments, a complete idea of the electrical phenomenon. The chapter with hints as to how to build experimental apparatus seems particularly useful. Printing and illustrations are clear and accurate."

Mr. A. H. SHAW, M.I.E.E., A.M.I.Mech.E., Manager Ilford Electricity Supply and Tramways, Ilford:—"I consider this work is all you claim for it. The matter is clear and up-to-date, and the diagrams and plates are particularly good. The article on supply meters should prove very useful. This is a work that everyone engaged in the practical applications of electricity should have access to."

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600 tons of tram rails with an American firm, and some questions have been asked locally as to why the order was not placed in England. According to the Chairman of the Tramways Committee, these rails are for some very heavy gradients, and were made to an exceptional specification, which, we gather from the reported statements of the Chairman, English firms would not adhere to.

In consequence of the objections of the Borough Councils, the Highways Committee of the London County Council have abandoned for the present year the proposed tramway from Marble Arch to Cricklewood.

The arbitration concerning the purchase of the Hammersmith lines of the London United Tramways, Ltd., has been continued daily since our last issue. Mr. H. F. Parshall gave evidence for the company, in which he agreed with everything put forward by Mr. Sellon. Evidence was also given on behalf of the company by Mr. H. E. Blain, General Manager of the West Ham Corporation Tramways, and Mr. Leslie Vigers, the latter dealing with the valuation of the land and buildings. On Friday the case for the L.C.C. was opened by Mr. C. C. Hutchinson, who drew special attention to the fact that out of a total claim of £386,443 nearly £210,000 was in respect of the Chiswick Power House, which he said it was obvious the company was very anxious to get rid of. His construction of the clause of the Tramways Act of 1870, under which the purchase is taking place, is that anything that is not necessary could not be included in the property which was to be purchased. The Chiswick Power Station was used at present for a mileage several times greater than that of the Hammersmith lines, and could not, therefore, be said to belong wholly to the Hammersmith undertaking. The first witness for the County Council was Mr. J. H. Green, who valued the land upon which the Chiswick depôt and Power Station is situated at £1,800, as compared with £3,500 claimed by the company. Mr. J. K. Bruce, Deputy Chief Officer, L.C.C. Tramways, estimated the number of cars required for the Hammersmith service at thirty on the average, and, allowing for the maximum load, he put the required number at thirty-six. From a number of checks made on various days by counting the cars going into the Hammersmith area, he said that there were usually about thirty-three cars, the maximum number being forty on Whit Monday. Mr. W. E. Ireland, Superintendent of Rolling Stock, L.C.C. Tramways, said that while the company's cars were well painted, they were in a bad condition generally. It is possible that the arbitration will conclude next week.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

An exhibition of a working model of the automatic telephone system of the British Insulated and Helsby Cables, Ltd., was given at Donington House yesterday. We hope to deal with this more fully in our next issue.

An application to prolong the life of Patent No. 809/98, relating to automatic telephone systems was to have come before the Court of Chancery on Tuesday, but at the last moment it was decided not to proceed with it. The patent, which will expire on March 19th, 1912, describes the finger-plate calling device used on the Strowger automatic telephone system.

Some extremely interesting experiments on the magnetic properties of iron at high frequencies, made with an alternator generating at a frequency of 200,000 cycles per second, are described by E. F. W. Alexanderson, in the *Elektrotechnische Zeitschrift* of Oct. 26th last. This machine was designed especially for use in connection with wireless telephony, and the experiments are of more than theoretical interest. The iron armature has 800 slots, and generates at 90 volts. The rotor runs at 20,000 r.p.m. Experiments on a wound ring of iron strips of 0·076 mm. thickness showed that the true permeability of the iron remained practically constant, even up to the maximum frequency of 200,000 cycles per second. The magnetising current decreased with increased frequency, in spite of the very strong "skin effect" which caused a very rapid apparent saturation of the iron at the high frequencies. The apparent permeability at 200,000 cycles was only one-tenth of that at normal frequencies. At this frequency the highest flux density that could be produced was 1,200 lines per sq. cm. (with an effective magnetisation of 2·9 ampere-turns per cm.). The article concludes with a series of designs for high-frequency transformers with iron cores. A 5 kw. transformer at 200,000 cycles is stated to weigh less than one-twelth of a 5 kw. 60 cycle transformer, and to have an efficiency of 98·3 per cent., as compared with an efficiency of 90 per cent for the 60 cycle transformer.

The Engineering Standards Committee have just issued a report (No. 55) on a research into the mechanical properties of hard-drawn copper and bronze wires, which has been carried out at the National Physical Laboratory, with the assistance of the General Post Office and the National Telephone Co., with a view of obtaining some independent data in regard to the breaking stress of hard-drawn wire of small diameter, used for telegraph and telephone purposes. The experiments include investigation into the variation of mechanical properties of these wires due to difference of make, variation in diameter, length, and temperature, as also variation of strength due to the kinking of the wire, which latter defect apparently has a more considerable influence on the strength of the wire than has hitherto been appreciated. The figures for the moduli of elasticity clearly evidence the influence of kinks in the wire. A comparison between the modulus of elasticity as calculated on 50-ft. lengths and as calculated on a short, straight length brings this point out very distinctly. In conclusion, it is suggested that in view of the effect of kinks, an increase in the diameter of the coils above that in common use is desirable. We shall be pleased to forward copies of the report to any of our readers on receipt of the published price, 10s. 6d.

Reuter's correspondent at Cairo states that the wireless telegraph station at Port Said has now been completed, and is now available for private and commercial messages.

Subscriptions are invited for 60,000 ordinary £5 shares of the Constantipole Telephone Co.

A West Indian cable interruption epidemic has manifested itself during the past week, the cause of which is at present difficult to ascertain. The first failure occurred on 13th inst., the Jamaica-Colon cable of the West India and Panama Telegraph Company having given out, and the repairing steamer *Henry Holmes* is now engaged in restoring it.—The cable between Trinidad and British Guiana, belonging to the same company, was down on 16th inst., and was speedily repaired. —The French Company has been the most unfortunate, for not only was their main cable from New York to Hayti interrupted on the 16th inst., but also the connecting link between Guantanamo, Cuba, and Mole St. Nicolas, Hayti, this necessitating the transmission of all telegrams for Hayti, San Domingo, Venezuela, Curaçao, and Martinique *viâ* Key West and Guadeloupe at largely increased rates. But further trouble has also followed by the failure of the main cable from Martinique to Paramaribo, Dutch Guiana, and also the connecting link between the latter place and Cayenne, French Guiana, so that Dutch Guiana is entirely cut off from telegraphic service, and French Guiana can only be reached *viâ* the lines of the Western Telegraph Company.—The *Pouyer-Quertier* of the Compagnie Française des Cables Télégraphiques is likely to have a busy time for a while.—On the 18th inst. the cable between Saigon and Haiphong (China), belonging to the Eastern Extension Telegraph Company, broke down.—The Pontianak-Saigon cable has also followed suit by taking a rest on 20th inst. The telephone will be used between these two places.

The "Cole" Code.—We regret that in our review of the Cole Code on page xxxvi of last week's ELECTRICAL ENGINEERING Literary Supplement, the name of the publisher given was incorrect. The Code is published by The Advertiser, Limited, Rugby; and the wholesale agents are Sir Isaac Pitman and Sons, Ltd.

Drawn Filament Lamps.—The Deutsche Gasglühlicht Akt.Ges. (Auergesellschaft), the original manufacturers of the Osram lamp, have placed on the German market a complete series of lamps with drawn tungsten filaments, including a 10 (Hefner) c.p. lamp for 100–140 volts, and a 16 (Hefner) c.p. lamp for 160–260 volts. The former takes 1·2 to 1·3 watts per candle, the latter 1·25 watts per candle. The Allgemeine Elektricitäts-Gesellschaft also supply drawn filament lamps in all sizes except the 10 c.p., and both concerns have just reduced the prices about 25 per cent. Thus the 16 to 50 c.p. 100/130 volt lamps now cost 1.5 mark (1s. 6d.) instead of 2 marks, and the 25, 32, and 50 c.p. 200/250 volt lamps 2.5 marks (2s. 6d.) instead of 3.5 marks. According to the *Elektrotechnische Zeitschrift*, it is expected that Siemens & Halske will shortly also reduce their prices. This firm, according to the above journal, have stated that the American licencees of the tantalum and "Wotan" drawn tungsten lamps, have succeeded in developing a new and cheaper method of manufacturing drawn tungsten filaments, and that, by virtue of certain agreements, Siemens & Halske, the Allgemeine Elektricitäts-Ges., and the Auergesellschaft are all now entitled to manufacture under the patents covering this new process.

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ELECTRIC HEATING AND COOKING

MR. S. L. R. PRICE, in his inaugural address as chairman of the Dublin Local Section of the Institution of Electrical Engineers, on Friday, November 17th, chose as his subject a general survey of electric heating and cooking. After referring to the conservatism that often bars the way to a realisation of the advantages opened up by new methods, and speaking of the value of showrooms run by the supply authority in educating the consumer, he passed on to the heating of rooms, distinguishing between the radiation and convection methods. He pointed out the disadvantage of the ordinary open fire method of heating, with its attendant draughts caused by cold intake air in the lower part of the room, and the lack of circulation of the air near the ceiling. For satisfactory heating, the aim should be for a maximum of air to be brought into contact with the heaters, with a minimum tendency to flue action, thus promoting gentle lateral currents of warm air. It was important not to concentrate the heating apparatus at one point in a room; four 250-watt radiators at different parts of a room had much more effect than one 1,000-watt radiator. The electric heater had a steadiness of heating unapproached by the coal fire, and a great advantage in not requiring attendance. Results of a comparative test were given, showing that the temperature of a certain room was raised from 45·2° F. to 52·8° F. in one hour and forty minutes by coal, with a fuel cost of 1·25d., while in a similar case the temperature was raised by electric heating from 52·6° F. to 57·6° F. in two hours, at a cost of 2d. for current.

Passing on to electric cooking, he said that the great stumbling-block was the provision of an adequate supply of hot water for domestic purposes. He outlined the work done in the Therol system of Messrs. Spagnoletti in this direction (see ELECTRICAL ENGINEERING, October 19th, Exhibition Supplement, p. 91), but finally recommended that water heating should be kept distinct from cooking, and effected by coke-fired boilers. The cooking problem itself was dealt with in the cheapest and most effective manner electrically. Instead of having a kitchen fire burning from about 6.30 a.m. to 9.30 p.m. to deal with three meals, at a cost of about 9d. a day for fuel, the various operations could be performed electrically, each unit being switched on and off as required, at a cost for current (at 1d. per unit) of 6d. per day, to which 2d. for the supply of hot water should be added to make the comparison complete.

Electric ovens as at present constructed were usually too flimsy to be of real use, and the lagging required to be improved. Relying on a polished surface to keep the heat might be more or less sound in theory, but was not so satisfactory in practice. Self-contained vessels were not such as would withstand the conditions to which they would be subjected for any length of time. The hot-plate must be the solution, but it must be capable of taking ordinary utensils without specially planed bottoms. Comparative curves were shown to show the relative speed of heating up of various patterns of apparatus, and several commercial forms of cooker were described. Finally, some comparisons with gas-heating were given showing that, under everyday conditions, the difference in cost between gas and electric cooking was very slight, and when to electric cooking had been added the advantages of convenience, cleanliness, and general adaptability from an economic standpoint, there could be no doubt as to its advantages over gas.

ELECTRICAL ENGINEERING LABORATORIES

A PAPER entitled "The Function of the Laboratory in the Training of an Engineer, with a short account of some New Laboratory Equipment," was read by Prof. E. W. Marchant at a joint meeting of the Manchester Local Section of the Institution of Electrical Engineers last week. Knowledge gained by experience, he said, was real knowledge, and was not soon forgotten or lost, and it was with the object of instilling some of this real knowledge about materials and machines that the laboratory had been created. The chief functions of the laboratory were: to teach the art of deduction from experiment and to give a practical knowledge of the operation of the machines with which the laboratory is intended to deal. It was not necessary that the machinery should be of great size; with small machines the student could be given a freer hand in the connection and arrangement of the apparatus. It was, however, sometimes possible for students to participate in tests on outside plant of large power. In the larger laboratories, such as those in Germany, too little was left to the student to do.

In some cases the student appears to be set a definite routine in his laboratory course, the organisation of the laboratory work appears to be almost military in its precision, and the inevitable result, as far as the English student is concerned, is to deaden his intelligence and make him a far less useful member of the engineering profession than he would have been had he been given greater freedom and allowed to act on his own initiative.

In many modern laboratories the teaching of the art of deduction from experiment seemed to have been lost sight of, and their function perverted into a training in the art of reading instruments correctly and drawing curves. The training which the laboratory gives was mainly in methods of analysis, and it was a matter for discussion as to how much of a student's time should be spent in work of this kind and how much in the constructive design which it will be his main business to achieve in his subsequent career. Although one of the most valuable purposes to which the laboratory could be put was for research, it was in most cases the carrying out of the work that was of the greatest value and not the result. Research work should not, in the author's opinion, be required from more than a small proportion of engineers in training.

The latter part of the Paper gave some descriptive notes on plant recently added to the equipment of the electrical engineering laboratories of the Liverpool University, dwelling particularly on a set designed for testing induction motors, consisting of two four-pole three-phase induction motors, one with a squirrel-cage rotor, and the other with slip-rings coupled up to two D.C. machines. A three-phase Westinghouse rotary converter had also been presented recently to the laboratory by Mr. Edward Whitley, and a specially designed 30-kw. high-speed motor generator was another new addition. Suitable switchgear has been provided for all these machines, and the laboratory has recently been equipped, through the generosity of Sir William Hartley, with a complete installation for wireless telegraphy.

MUNICIPAL WIRING POWERS

Among the clauses in the Sheffield Corporation's Bill, which is to be promoted next session, we notice one seeking powers to enable the Corporation to sell, let for hire, and fix any electric fitting for lighting, motive, or other purposes. This would rather indicate that the Sheffield Corporation, in spite of its defence of the action against it by the Electrical Contractors Association, is itself in doubt as to the legality of its position in at present maintaining the municipal wiring department. The action by the Electrical Contractors Association is expected to start very shortly, and in the event of the decision being against the Corporation, it may be anticipated that the Contractors Association will strongly oppose the Bill in Parliament.

Another Bill of interest in this connection is being promoted by the National Electric Construction Co., Ltd., in which it is sought to give Parliamentary authority to the agreements between the company and their predecessors the National Electric Wiring Co., Ltd., and some twenty-five local authorities throughout the country, by which the latter make an extra charge for current to cover the cost of the wiring. At Canterbury last year it was decided that a local authority, without specific Parliamentary authority, could not make such a charge.

Electrical Driving of Textile Factories.—An address on this subject was given recently before the Belfast Association of Engineers by Prof. Stanley. Last year, he said, not more than about 300 motors were in use for textile mill driving, whereas they were now being installed by hundreds, and one firm alone had delivered 2,000 since January, and had in hand inquiries for a further 5,000. In Germany there were over 50,000 loom motors at work. He pointed out the differences between group and individual drive, favouring the latter for most purposes. Three-phase induction motors were, in his opinion, the best for most spinning or weaving machinery, but for printing machinery he preferred D.C. and for spinning frames single-phase repulsion motors. Three-phase motors were now made dust-proof, and with ball bearings were most easy to control and gave a steadier drive than any other method. He emphasised the importance of selecting a size of motor suitable to the work. The general advantages of electrical driving in simplicity, flexibility, reliability, compactness, &c., were dwelt on, as well as the increase in production available, which in one Lancashire mill had been from 12 to 18 per cent. The improved quality of the work was also referred to. In conclusion, he dealt with power supply, and said that the time was ripe for starting a large power supply scheme in the north of Ireland. Several speakers joined in the discussion, in the course of which Mr. Pegg gave some particulars of a power scheme with peat fuel, where the generating costs were 0·6023d. per unit.

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LEEDS—11, Upper Mill Hill, Boar Lane (Messrs. Casperson Bros.); **MIDDLESBROUGH**—303, Linthorpe Rd. (Messrs. J.T Bell & Co);
NEWCASTLE-ON-TYNE—1, Higham Place (Mr. F. T. Hanks); **SHEFFIELD**—74, High St. (Mr. Wm. Molesworth).

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LOCAL NOTES

Abingdon: *Electric Supply.*—A committee has been appointed to inquire into the desirability of having an electric supply undertaking.

Cheltenham: *Electric Supply.*—The Cheltenham Rural District Council have given consent to the Cheltenham Corporation to extend their electric supply mains into a number of districts in their rural area.

Derby: *Electric Lighting Extensions.*—The Electric Lighting Committee's proposal to apply to the Board of Trade for sanction to supply electricity to Quarndon has been passed by the Council. The supply will be given by means of overhead wires, and the capital outlay is estimated at £1,300.

Farnham: *Wiring Small Property.*—The Farnham Gas and Electricity Co., Ltd., have received the consent of the Board of Trade and the Council to the system of having one service to supply a group of houses, the supply being carried from one to the other by means of a special cable fixed to the fronts of the houses.

Finchley: *Electric Light Works Assessment.*—The Urban District Council have given notice of appeal with regard to the assessment of the electric light works. The present assessment is £4,300 gross and £1,800 rateable. The appeal will be heard at the next meeting of the Assessment Committee.

Johnstone (N.B.): *Electric Supply.*—The Clyde Valley Electric Power Co., through their affiliated company, the Strathclyde Co., are taking up the question of electric supply in the district.

Leeds: *Electric Lighting Accounts.*—The accounts of the Electricity Department for the half-year to September 30th show that the accession of new consumers is now beginning to counteract the effect of metal filament lamps. The sales to private consumers during the half-year show an increase of £403. The sale of energy for power and heating purposes increased by 847,904 units, and in spite of a reduction on July 1st in the tariff, the income from this source increased by £2,377. The total revenue for the half-year is £2,699 more than that of the previous corresponding period, whilst the working expenses only increased by £65. The financial result of the half-year's working is £1,780 better than that for the previous corresponding period. The net result for the half-year is a deficit of £7,199, but this is purely a misleading figure, as the department depends to a large extent on the demand for light, and the year to which these figures apply represents the summer months.

London: *L.C.C.: Electric Supply.*—In a discussion upon the report by the Finance Committee of the London County Council concerning the future of electric supply in London (ELECTRICAL ENGINEERING, November 16th, page 631), Mr. H. H. Gordon suggested that in order to secure uniformity during the remaining period of the companies' lives, it would be a good policy to loan the companies the necessary money for their extensions, upon the same terms and under the same conditions as it was at present loaned to municipal authorities. He suggested, further, as an inducement to the companies to help in the formation of a comprehensive scheme, that distribution might be left in their hands for a certain period beyond the time when the County Council had statutory authority to purchase the undertakings. Mr. Hayes Fisher said he did not think there would be any unwillingness on the part of the companies to co-operate with the Council, and steps were being taken to set up a committee of members of both political views in the Council, with instructions to make a full inquiry and to obtain expert advice.

Bermondsey: Loan Refused.—The recommendation of the Finance Committee of the L.C.C., set out on page 632 of our last issue, refusing a loan to the Borough Council, for the reasons then given, has been adopted by the County Council.

Lowestoft: *Electrical Exhibition.*—As the result of two visits of the Borough Engineer and Chairman of the Electricity Committee to the Olympia Electrical Exhibition, the Committee have decided to arrange for an exhibition in Lowestoft early next year, for the display of applications of electricity to cooking, heating, and power purposes.

Shipley: *Street Lighting.*—Terms have been arranged between the Highways Committee and the Electricity Committee for street lighting.

Skegness: *Supply of Electricity.*—A resolution by the Chairman of the Council that a special day be set apart for the consideration of the question of electricity supply in the district has been passed.

Sweden: *Electricity Supply.*—The *Board of Trade Journal* states that plans have been submitted to the Stockholm Gas and Electric Lighting Department for a large electric power station at Dalelfven. The cost of the entire undertaking is put at £746,000. It appears that certain legal questions are preventing the work from being commenced immediately.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Atherton.—The Council have decided to erect a sub-station for the purpose of supplying electricity in the Four Lane Ends district.

Chili.—Plans for the erection of a generating station in the town of Puerto Monte have been approved. The work must commence within six months and be completed by September, 1912. The concessionaire is Don Santiago Schweizer.

Darlington.—The Corporation invite tenders by December 4th for a 500-kw. D.C. dynamo and reciprocating engine. Particulars from Borough Electrical Engineer.

Hastings.—A Local Government Board inquiry was held at the Town Hall last week concerning an application for a loan to extend the Council's electric lighting mains to West Hill.

London: *Battersea.*—Mains extensions at an estimated cost of about £136 are to be carried out.

Hackney.—Mains extensions at an estimated value of about £130 are to be carried out.

Hammersmith.—The Borough Council propose a further expenditure of £10,000 upon the electricity undertaking. The sum has already been sanctioned by the Council in a previous loan of £23,775.

The Electricity Department require 2,500 yards of 0·025 square inch and 500 yards of 0·08 square inch service cables.

Mansfield.—An application is to be made to the Local Government Board for sanction to a loan of £3,500 in connection with supply to the Mansfield and Woodhouse district.

Menai Bridge.—The Council have approved of a scheme of electric lighting by Mr. W. E. Parry.

Norwich.—Tenders are invited by November 27th for two water tube boilers. Particulars from City Electrical Engineer.

Romford.—The Rural District Council have given the Electrical & Engineering Supplies Co., Ltd., permission to lay mains for the supply of electricity in the Harold Wood district.

Siam.—Tenders are invited for the erection of a 3,000-kw. generating station at Bangkok. Tenders will be received at the Ministry of Local Government at Bangkok by March 15th, 1912. Correspondence and inquiries should be addressed to Mr. F. B. Shaw, Engineer-in-Charge, Municipal Electric Power Station, Bangkok. Copy of the specifications, &c., may be seen at 73 Basinghall Street, E.C.

Warrington.—The Council invite tenders by November 28th for low-tension cable. Particulars from Borough Electrical Engineer.

Wrexham.—Tenders are invited by December 5th for a main switchboard. (See an advertisement on another page.)

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Aberdare.—Cinematograph Theatre. Architects, Messrs. Johnson & Richards, Merthyr Tydfil.

Bournemouth.—New Law Courts. Borough Engineer.

Dumfries.—Theatre in High Street.

Leek.—New baths.

Northampton.—Electric lighting and power installation in temporary building at technical school.

Southend.—New concert hall at Westcliff.

Warrington.—Tenders are invited by December 1st for an electric bell installation at the Evelyn Street school.



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TENDERS RECEIVED AND ACCEPTED

Atherton.—The Council have accepted the tenders of Callender's Cable & Construction Co., Ltd., for 880 yards of high-tension concentric paper-insulated, lead-covered cable, and that of Messrs. Hanchett, Barrett & Co. for two transformers.

Belfast.—The tender of Messrs. Willans & Robinson, Ltd., has been accepted for a second turbo-alternator and condensing plant. Orders have also been placed for the overhead work for the Ligoniel and Belmont tramway extensions as follows:—Poles, Messrs. John Spencer & Co., Ltd.; cast-iron work, Messrs. G. Webber & Sons (Belfast); wrought-iron work, Messrs. W. Boydell & Sons, Ltd.

London: *Hammersmith.*—The following tenders were received for an illuminated sign at the Council's electricity works:—Imperial Lighting Co., £13 15s.; Darling & Roch, £16; Brilliant Sign Co., Ltd., £18 10s.; Sun Electrical Co., £26 10s. The tender of the Brilliant Sign Co. has been accepted.

The Council have agreed to purchase from the British Electric Transformer Co. the two 250-kw. and two 75-kw. transformers used at Olympia during the recent electrical exhibition, at a total cost of £330; as part of the sale the Council is returning to the company the eight old transformers now rendered useless in consequence of the change over from arc to incandescent lighting in the main streets.

L.C.C.—The following tenders have been received for the supply of static transformers and switchgear for the new Vauxhall sub-station:—Static transformers: British Westinghouse Co., £2,772 10s.; British Electric Transformer Co., £2,803 5s.; General Electric Co., £2,875; British Thomson-Houston Co., £3,065; Dick, Kerr & Co., £3,129 10s.; W. E. Burnand & Co., £3,388 10s. High and low-tension switchgear: Switchgear & Cowans, £5,029 18s.; Johnson & Phillips, £6,193 15s.; A. Reyrolle & Co., £6,399 10s.; The General Electric Co. £6,498; Spagnoletti, £6,821; Electric and Ordnance Accessories Co., £6,950 12s.; Electric Construction Co., £7,408 2s.; Siemens Bros. Dynamo Works, £7,449 15s.; Ferranti, £8,079 10s. The tender of the British Westinghouse Co. has been accepted in the first instance, and that of Switchgear & Cowans, Ltd., in the second.

Battersea.—The Council have accepted the offer of Messrs. Whipp & Bourne for four circuit-breakers at £33 17s.

Hackney.—The tender of the Synchronome Co. for a master clock and thirteen electric movement dials for the Town Hall at £68, has been accepted.

Manchester.—The Electricity Committee has recommended for acceptance a tender for a Howden-Siemens 5,000-kw. exhaust steam turbine generating set, with Mirrlees-Watson condensing plant. The exhaust steam turbine will be used in conjuction with the Yates & Thom engines at the Stuart Street generating station.

Oldham.—The tender of the Brush Electrical Engineering Co., for a 1,200-kw. turbo-alternator, has been accepted.

South America.—Marconi's Wireless Telegraph Co., Ltd., have received a contract for the erection of a number of wireless telegraph stations along the South American coast. The total contract price is £64,066.

Amongst the orders for surface condensing plants which the Mirrlees Watson Co., Ltd., have recently received for steam-condensing plant are:—Bolckow Vaughan's Steel Works, Southbank; De Beers Consolidated Mines, Ltd., Kimberley; Carron Iron Works; Elliott's Metal Co., Birmingham; Bradford Colliery; Wigan Coal & Iron Co. Jet condensing plants are being supplied to Nobel's Explosives Co.; Empress Mills, Nagpur; London Electric Supply Corporation.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars c.i.f. port of arrival, quoted on Tuesday night, was £59 10s. to £59 15s. (last week, £58 15s. to £59).

Siemens Bros. & Co., Ltd.—As the greater part of the office staff at Caxton House was removed last Monday to new offices at the Woolwich works, all future communications relating to the following branches of the business should be addressed to the company at Woolwich, viz.:—Insulated wires and cables, telegraph and telephone apparatus, line materials, measuring and testing apparatus, batteries, railway signalling, publications, accounts. The postal address is Siemens Brothers & Co., Ltd., Woolwich, Kent. Telegrams: "Siemens, Woolwich." Telephone: City 6400.

Plant for Sale.—The Bury Corporation has for disposal two 250-kw. Belliss-Siemens generating sets (see an advertisement on another page).

Plant for Sale.—The business of the Beck Flame Lamp, Ltd., is for sale. (See an advertisement on another page.)

Coal Testing.—Messrs. D. E. Greenwood and J. K. Wells have opened a coal-testing laboratory at 25 York Place, Baker Street, W., where they will be pleased to receive inquiries from central station engineers and others respecting the calorific value and other properties of the fuel they use.

Bankruptcies.—W. R. Gard, Orchard Electrical Works, Orchard Street, Canterbury, now residing at 65 Kingsley Avenue, West Ealing, has been adjudicated a bankrupt.

APPOINTMENTS AND PERSONAL NOTES

Mr. Fred. E. Hinton, who for the last three and a half years has held the post of Superintendent of the Electric & Ordnance Accessories Co., Ltd., at Cheston Road, Aston Manor, Birmingham, is leaving to take up a position at the London office of Vickers, Ltd. A presentation was made to Mr. Hinton at a Smoking Concert on Monday of last week.

Mr. W. Mackenzie, late Mechanical Superintendent of the West Ham Corporation Generating Station, who is leaving to take up the appointment of Station Superintendent of the Stratford Station of the Charing Cross, West End, and City Electricity Supply Co., was presented with a silver cigarette case, match box, and sovereign purse by the staff of the West Ham Electricity Department at a dinner on Saturday, November 11th.

Mr. W. Hughes, late manager of the Plant Department of the British Westinghouse Co., and formerly their South Wales representative, has terminated his connection with the company, and, in conjunction with his associates, will henceforth devote his whole time to consulting practice, specialising in electrical mining equipment, at 5 Dowgate Hill, Cannon Street, E.C.

Mr. William C. Jeary, formerly Manager of the Vacuum Cleaner Department to the General Electric Co., Ltd., has been appointed General Manager of Magic Appliances, Limited (Magic Suction Cleaner), 6 Farringdon Avenue, E.C. (Telephone, Holborn 6525.)

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Johnson-Billington Electricity Meters, Ltd.—Mr. A. M. Billington has ceased to be a director of this company.

Mexican Light and Power Co.—Applications have been invited for the purchase of £1,000,000 5 per cent. second mortgage 50 year bonds at 87.

Companies Struck Off Register.—The names of the Amalgamated Dry Batteries, Ltd., and the South-Western Electrical Co., Ltd., have been struck off the Register of Joint Stock Companies.

Rio de Janeiro Tramways, Light & Power Co.—It is proposed to increase the share capital of this company by $10,000,000, of which $5,000,000 are to be offered for subscription at once.

NEW COMPANIES

WINSCOMBE ELECTRIC LIGHT & POWER CO., Longfield, Winscombe, Somerset. Capital, £2,000.

GENERAL ENGINEERING CO., Hipperholme. Capital £1,000. Electrical and general engineers.

THE LEOMINSTER ELECTRIC SUPPLY CO., registered by S. Williams & Co., of 38 Parliament Street, S.W. Capital £4,000.

The Illuminating Engineering Society.—At the opening meeting of the session on Friday last, Mr. L. Gaster gave a short summary of the progress in the Society's work made during the vacation. He mentioned that with the co-operation of the Library Association, the Association of Medical Officers in Schools, the Association of Teachers in Technical Institutions, and the London Teachers' Association, committees had been formed to investigate school and library lighting. The Joint Committee on Street Lighting Specifications had continued its meetings, and the Society had been represented at the Congress of the Royal Sanitary Institute at Belfast and at the International Hygienic Congress at Dresden. The hon. secretary also attended the meeting of the International Electrotechnical Commission at Turin, with which a certain amount of co-operation is favoured, and the International Electrical Congress at Turin, where approval was expressed of the Society's efforts to form an International Commission for the Study of Illumination. Announcements were also made as to courses of lectures on illumination which had been arranged at the Regent Street and Battersea Polytechnics and the Northampton Institute.

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ELECTRICAL ENGINEERING

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SUMMARY

We report the meetings held in Birmingham, Newcastle, and Glasgow, to discuss the proposed new Articles of Association of the Institution of Electrical Engineers. The Glasgow Section is the only one which has passed a vote in favour of an increase in the subscriptions. Mr. Ferranti has announced another decision of the Council on the question of a name for the "late-Licentiate" class. We publish an interesting analysis of the number of members in London, the provinces and abroad, the revenue derived from their subscriptions and their representation on the Council. (Page 653.)

We give the provisions of the Bill which is being promoted by the Incorporated Municipal Electrical Association to confer wiring and other powers upon municipalities. (Page 654.)

In the House of Commons on Tuesday, Clause 59 of the Coal Mines Bill was amended to read that the use of electricity is to be discontinued in any mine where the proportion of inflammable gas exceeds $1\frac{1}{4}$ per cent. In the Bill as it left the Standing Committee, the proportion was $\frac{1}{2}$ per cent. (Page 654.)

A paper on automatic reversible boosters by Mr. R. Rankin was discussed at last Thursday's meeting of the Institution of Electrical Engineers. The author described all the more usual types of battery boosters, pointing out some of the advantages and disadvantages of each; on the whole he preferred those controlled by external regulators to those of the diverter type. The sluggishness of the latter was referred to in the discussion, which also dealt with the alleged instability of certain systems. (Page 655.)

Mr. F. A. Newington, in his inaugural address to the Scottish Local Section of the Institution of Electrical Engineers, dealt with a number of aspects of electric supply matters, and urged the importance of modifying the Conspiracy and Protection of Property Act (1875) to include electric supply undertakings. (Page 656.)

A cable box explosion occurred in the Strand (London) on Thursday last, due to a short circuit on a bitumen-insulated cable. (Page 657.)

Mr. H. Harding Churton's inaugural address to the Yorkshire Local Section of the Institution of Electrical Engineers, was devoted to a consideration of the relations between capital and labour. (Page 657.)

Mr. W. T. Taylor's paper on "High Voltage Transformers" has been discussed by the Birmingham Local Section of the Institution of Electrical Engineers. The paper was not so severely criticised as it had been in London, but some points of detail were taken up. (Page 657.)

A convenient form of ceiling rose, with removable terminal blocks, and a cord grip on the base, was one of the patents published last week. For cable troughs, a joint which keeps perfect alignment, and can be used without jointing material, was also protected. The British Thomson-Houston Co. have introduced a process for steadying the arcs of arc lamps in which light-giving and steadying materials are used. An improved insulating sleeve for oil transformers, which increases the cooling effect, and gives good oil circulation was also patented, as well as one in connection with submersible motors, with a new form of bearing, and means for protecting the coils from the rush of water. A patent for an insulating material has been granted to A. R. Müller in spite of opposition. (Page 658.)

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At Clerkenwell Police Court on Wednesday, Mr. Bros appointed Mr. C. A. Baker, of the London County Council, as Electrical Inspector under the St. Pancras Electric Lighting Provisional Order, for twelve months. (Page 659.)

In our "Electric Traction Notes" we mention a decision of the L. & S.W. Railway with regard to electric traction; the proposed conversion to electric traction of the East London Railway; and the reference back to the arbitrator of his award in the Cavehill and Whitewell tramways arbitration. (Page 659.)

Under "Telephony and Telegraphy (including Wireless)" we give an account of the demonstration last week of the Strowger automatic telephone system. A special company has been formed to take over the system. We also refer to the large wireless telegraph station which the Marconi Co. has erected at Coltano in Italy. (Page 659.)

The Brighton Corporation have refused to support the Municipal Wiring Bill of the I.M.E.A. financially; but the Dundee Electricity Committee recommend that financial support be given to this Bill.—The Islington Council propose to spend £250 on a hiring-out scheme for shop-front lighting.—Additional street arc lighting is being carried out at Blackpool.—There has been a good deal of opposition to the electric supply scheme in Aldeburgh.—The St. Annes-on-Sea electricity accounts show a surplus of £971. (Page 661.)

The Sydney Council propose to borrow £250,000 for electric supply extensions, and the following electric supply loans are also contemplated:—Worcester, £1,400; Dartford, £8,500; Greenock, £3,700; Redditch, £5,850; Swinton, £3,323. Extensions are also contemplated at Bolton. A switchboard is required at Wrexham, the Worsley Council are contemplating an electric supply scheme, and the Singapore Municipal Authorities are taking up a loan for electric supply extensions. (Page 661.)

Subscriptions are being invited this week to the Automatic Telephone Manufacturing Co., and the Hadley Engineering Co. The latter is in connection with the Tilling-Stevens petrol-electric omnibus system. (Page 662.)

ARRANGEMENTS FOR THE WEEK

FRIDAY, DECEMBER 1st.

Northampton Institute Engineering Society.

5 p.m. At the Institute. Debate on "The Prospects of the Technical and Practical Man."

TUESDAY, DECEMBER 5th.

Institution of Electrical Engineers: Manchester Students' Section.

7.30 p.m. At the Municipal School of Technology. "Practical Points in the Design and Construction of Drum Type Controllers," by A. N. Howarth.

Institution of Civil Engineers.

8 p.m. Paper to be further discussed. "Electric Lighting of Railway Trains: the Brake Vehicle Method," by R. T. Smith.

THURSDAY, DECEMBER 7th.

Institution of Electrical Engineers.

8 p.m. "Notes on National and International Standards for Electrical Machinery," by Dr. R. Pohl.

FRIDAY, DECEMBER 8th.

Electrical Engineers' Dance.

9 p.m. At Midland Hotel, Manchester.



INHUMANITY!

OLD LADY (watching Jointer at his "dangerous work")—Why does it hurt you to touch those two wires and not that one?

JOINTER—'Cause they *earth* that one, mum.

OLD LADY—Then it's a great shame that they don't earth the others as well!

PUBLISHERS' NOTICE:—Books containing 48 Reprints of the Cartoons from Oct., 1910, to Sept., 1911, may be obtained, Price* 8d. *net (post free 9½d.).

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THE INSTITUTION OF ELECTRICAL ENGINEERS

LAST week we published special reports of the meetings held in London, Manchester, Leeds, and Dublin to consider the new Articles of Association proposed by the Council, and this week we give accounts of similar meetings at Birmingham, Newcastle, and Glasgow. Members in every centre except Glasgow have raised their voices against the proposal to increase subscriptions, but a meeting of the Glasgow Local Section has distinguished itself by giving a unanimous vote in favour of the increase. The feeling that there is no necessity to increase the subscriptions of existing members is, however, so widespread elsewhere that there is little doubt that the proposal, if persisted in, would not receive a sufficient number of votes to pass it. In the unlikely event, however, of subscriptions being increased, we predict that, notwithstanding the vote at Glasgow, there would be proportionately more resignations of Scotch members than English ones. The Englishman growls at the price of a thing being raised, but as often as not he pays in the end. The Scotsman says little, but if he thinks a thing is too dear he simply does without it.

The only other development in the situation is that the Council is gradually deciding on a name for the new "late-Licentiate" class by a process of elimination. "Licentiate" has been abandoned, and the announcement has now been made that no name which includes the word "Member" will be considered suitable. This disposes of the title "Junior Associate Member," suggested and abandoned in the Council chamber, and re-suggested by one of our contemporaries, who has apparently not noticed that a Junior Associate Member I.E.E. would obviously have to put up with the unofficial abbreviation "Jamie." Another contemporary has chosen the name "Junior Member," which is also put out of court. Practically the only two useful suggestions left of the many names proposed are "Graduate," and our own suggestion, "Subscriber"; and "Graduate" is obviously unsuited for a class composed of young men who have not graduated and older men who never will. The only objection to "Subscriber" is that a man will not be tempted to join the Institution in order to write this title after his name; in the opinion of the Associate Member, at any rate, that is its greatest recommendation.

BIRMINGHAM

A special meeting was held on Wednesday last week. Mr. M. Railing (Chairman of the Section), presided, and Mr. R. Hammond, Mr. Hirst, and Mr. Kingsbury were present to hear the views expressed. Associates were present at the meeting as well as Corporate Members.

Mr. M. Solomon first explained the attitude of the Committee of the Local Section, after which the new articles were discussed block by block, and a vote of the members was taken on each of the principal points.

The opinion of the meeting was almost unanimously in favour of retaining the old sub-clause 12 (d), which allowed the Council full power to elect as members any persons who were "prominently associated with the objects of the Institution," but were not technically qualified. Opposition to the new "Licentiate" class was almost unanimous. On the subscription question, a considerable proportion of members supported the view of the Birmingham Committee that it would be unfair to ask country members to pay an increased subscription in order to pay for the up-keep of what was virtually a club-house, from which they would receive no personal benefit, and that the subscriptions of existing members should continue on the old basis, while new members residing within 20 miles of London should pay on the new schedule. There was, however, a feeling on the part of a good many members that if the increase of subscription resulted in raising the status and extending the utility of the Institution, it would be justified even in the case of country members. It was pointed out by more than one speaker that the German and American societies did much more for their members than the English Institution. The German society, for instance, had issued a set of rules for the testing of plant and material which were used all over the world. The suggestion that a postal vote of the whole body of members should be taken on each of the principal innovations proposed was adopted unanimously.

Amongst the members taking part in the discussion were Messrs. R. A. Chattock, W. Fennell, C. C. Garrard, W. C. Goodchild, S. H. Holden, Dr. G. Kapp, E. J. Kipps, F. J. Moffett, R. O. Orsettich, N. B. Rosher, and S. P. Smith.

At the end of the meeting Messrs. Kingsbury, Hirst, and Hammond dealt shortly with the points raised in the discussion. Mr. Hammond stated, as treasurer, that the Institution was in a perfectly sound state financially.

NEWCASTLE

A special meeting was held on Friday. Mr. J. E. Kingsbury and Mr. Rowell (the Secretary) were present on behalf of the Council. Mr. Kingsbury, in reply to a number of questions which had been submitted to the Council by the Committee of the Newcastle local section, said that there was no urgent anxiety regarding the finances of the Institution, but that at the present rates the yearly surplus would be a decreasing one. The expenditure on the London members, he said, was slightly less than that applicable to the local sections, after making allowance for the expenses at headquarters, which were of benefit to the whole Institution. The amount of the examination fees had been left open, as this might have to be altered from time to time. He hoped that the question of closing down a local section would never require to be discussed, but it was obvious that some provision had to be made for dealing with a section which had become ineffective, owing to lack of support.

Mr. H. L. Riseley pointed out that the Institution as a whole had to bear the cost of such items as the deficit on the London dinner, the cost of the conversazione, and the upkeep of the library, whereas the local section had to pay for their dinners out of their own pockets, and any deficit had to be made up by the members. He suggested that the Journal should follow more on the lines of the *Proceedings* of the American Institute of Electrical Engineers, and that it should be published in parts, so as to reach members promptly.

Mr. Sloan thought that the increased subscriptions would result in a serious decrease of membership, and he suggested that the local section should have clearly explained to them what they were likely to gain by these increases, and on the other hand, what they would lose in the event of the increases not going through.

Mr. Carter advocated a system of confidential reports from employers, as a guide to a man's fitness for admission or transfer, as opposed to mere written examination.

Mr. Blackman (Sunderland Corporation) gave some figures to show that the Institution made a clear profit of £126 per annum out of the Newcastle section at the present rates, and he could not see any reason for increasing this to £250 by raising the subscriptions.

Mr. C. Vernier asked for a more prompt distribution of the Papers, and suggested that the delays in the past had been the result of the rule that all Papers had to be submitted to a committee in London.

Mr. G. Stoney prophesied that although an increase in the subscription might result in a temporary decrease in the membership, the effect would not be felt at the end of three or four years.

Several other members also spoke.

Mr. Kingsbury, in reply, pleaded for a broader view of the Council's proposal by the provincial members. The new powers sought by the Council were necessary for the efficient running of the Institution, and it was certain that they were not likely to be abused. Additional expense would be incurred by issuing the *Proceedings* in parts, as had been suggested, as a double printing would be required. The Institution, he said, was run on exceedingly economical lines, and the expenses could not be reduced without at the same time impairing the efficiency.

A resolution asking for further consideration of the new rules to be deferred for a year was put forward by Mr. Riseley, but was lost by the casting vote of the Chairman.

GLASGOW

A special general meeting of the Scottish Local Section was held at Glasgow on Friday. Mr. Sam Mavor presided, and was supported by Mr. Ferranti, President of the Institution, and Messrs. E. G. Tidd and W. W. Lackie, past-chairmen of the Section. The discussion lasted 2½ hours.

Mr. Ferranti said that, although the Council had attempted to do what was best for the Institution and its members, they were by no means infallible, and in the present instance a mistake had been made. The revision of the Articles of Association had been a matter of consideration for a considerable time, and the committee entrusted with this work had latterly began to lose interest in it, so that it was felt that the proposals should be formulated as soon as possible. He pointed out that there had grown up multifarious interests, some of them purely technical, some of them commercial, and many a combination of the two, which were not being properly looked after and superintended as he thought ought to be done by the Institution. The admission of the various classes of people represented by these interests meant broadening the basis of membership. He next insisted that subscriptions should be regarded as a payment made to a central body who were organised to look after their interests, and see that they were conserved.

At the suggestion of Mr. James Caldwell, it was then agreed that the discussion should be regulated to deal with specific points one at a time, and the proposed broadening of the basis of membership was first considered.

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Mr. McWhirter favoured the proposal. Mr. T. Crichton Fulton (Associate) said that they might end by weakening their Institution if they admitted too many non-technical men. He asked if any voting power would be given to provincial members in connection with the adoption or otherwise of the amended constitution, and Mr. Harold Watson thought that proxy voting might be possible. Mr. Ferranti agreed that this was worth looking into. Mr. Scott Maxwell said that broadening the basis on the lines indicated would tend to lower the status of the commercial electrical engineer, who was the man they should seek to encourage. Mr. W. W. Lackie supported the Council's proposal. Mr. E. G. Tidd said that the technical business man was eligible for Associate Membership. Mr. W. L. Spence said in his experience as an engineer he had never found that broadening the basis of a structure detrimentally affected the possibilities of the height to which it might attain. Professor F. G. Baily agreed to the desirability of getting both the purely commercial man and the technical commercial man into the Institution. Mr. J. A. Robertson asked for some guarantee that the new class would be properly distinguished, so as to keep a distinct class for qualified technical men whose qualifications gave them a certain position in the technical world.

Mr. Ferranti said only Corporate Members would still be Members and Associate Members. The new class would not have the word member as part of their title.

Mr. Onslow, in supporting the proposals, thought the new class should be included in the Associate class. Mr. Simon suggested that due discrimination should be exercised in the admission of non-technical men. Finally, Mr. Lee Murray complained that many men remained in the Associate class who should be Associate Members. He thought corporate membership should be confined to engineers. Great good would be done to the Institution, and its scope of usefulness would be increased by moving in the direction proposed by the Council.

On a show of hands being taken, the principle of broadening the basis of membership was declared unanimously agreed to.

The subject of subscriptions was then discussed.

Mr. McWhirter stated that local provincial members did not enjoy the privileges of London members. Mr. Mavor, although at first opposed to the increased subscription, now thought the increase was absolutely necessary. Mr. W. L. Spence objected to the extent of the proposed increase. Mr. J. S. Nicholson was against a graduated subscription for town and country members. Mr. Burbidge thought an increased subscription would have the effect of decreasing the funds. He suggested a small increase now and a further increase later. Mr. Scott Maxwell, Mr. J. A. Robertson, and Professor Baily favoured a uniform subscription. Mr. Simon compared the subscriptions with those levied by the Institution of Engineers and Shipbuilders, which were lower, whilst better value was received by local members. Mr. Lackie said the financial year should synchronise with the beginning of the winter session, so that new members might not have to pay two subscriptions within fourteen months.

Mr. Ferranti referred to the Civils having no local sections, whilst the Engineers' and Shipbuilders' Institution had not erected their buildings out of members' subscriptions. He calculated to lose 10 per cent. of the members by the increased subscription, and no allowance had been made for any revenue from the proposed new grade of member.

On a vote being taken,

It was unanimously agreed that the present subscriptions should be increased, whilst the majority present at the meeting were in favour of a uniform subscription.

ANALYSIS OF THE RECEIPTS FROM SUBSCRIPTIONS

Mr. Thomas Roles, City Electrical Engineer and Manager, Bradford, has sent us an interesting analysis, comparing the numbers of the London and country members and those living abroad together with an estimate of the aggregate subscriptions in each of the three cases, and a comparison of their representation on the Council. He includes in the metropolitan district all places within 50 miles of London, *e.g.*, Bedford, Brighton, Cambridge, Colchester, and Reading. We have corrected an inaccuracy in his estimate of the subscriptions which the members residing in the colonies and abroad should be paying, but in other respects the figures are given as he has sent them to us.

	London.	Country.	Colonies and Abroad.	Total.
Members	568	391	369	1,328
Associate Members	977	1,209	603	2,789
Associates	371	318	200	889
Students	486	636	148	1,270
Total	2,402	2,554	1,320	6,276
Proportion of Members to Associate Members	58%	32%	61%	47%
Total revenue from proposed Subscriptions	£6,689	£6,652	£3,503	£16,844
Estimated Revenue from Present Subscriptions ...	£5,131	£5,106	£2,273	£12,510
Increased Revenue from present membership	£1,558	£1,546	£1,230	£4,334

	Number.	Percentage.
London members	2,402	38·3
Members in Country, Colonies, and Abroad	3,874	61·7
Representation on Council (excluding Past Presidents).		
London Members	19	63·3
Country Members (including Chairmen of Local Centres)	11	36·7

Mr. Roles also traverses Mr. Hammond's statement that more than one-third of the subscriptions from Local Sections is expended by way of money grants to them and printing for them, and points out that last year the grants, including travelling expenses, amounted only to £729 15s. 11d. He remarks that the cost of including the Local Section Papers in the Journal ought not to be debited to the Local Sections only, and that, as a matter of fact, the whole cost of printing and issuing the Journal amounted in 1910 only to 4s. 7d. per member.

Mr. A. H. Dykes writes us with regard to the proposed Association of Consulting Engineers (originally intended to be confined to Members of the Institution of Civil Engineers). It is now proposed "to include all Engineers of standing who are full members of the Institution representing the particular branch of the Profession in which they practise."

A delegation of the Manchester Students' Committee, which had drawn up a number of proposed amendments to the Council's draft Articles of Association, was received by Mr. Robert Hammond and Mr. Rowell at the Queen's Hotel, Manchester, on Wednesday last week.

THE I.M.E.A. BILL

Full Wiring Powers Sought.

IN the House of Commons on Tuesday, Sir William Howell Davies, the Member for Bristol (South), who is on the Government side of the House, introduced a Bill to amend the Acts relating to electric lighting. This has been prepared by the Incorporated Municipal Electrical Association, and considerable support has been promised by local authorities.

Clause 1 gives Local Authorities power to wire houses and to sell, or to let for hire, wiring, fittings, lamps, motors, &c., but they may not do this under cost price.

Clause 2 authorises them to have showrooms, to promote exhibitions, and to advertise.

Clause 3 permits them to sell by-products.

Clause 4 relieves them of the obligation to provide a standby supply to premises "having a separate supply of energy, Electric or otherwise," unless a reasonable agreement as to price is arrived at.

Clause 5 legalises payment of the expenses of delegates to meetings, conferences, &c.

Clause 6 enables net profits (not exceeding half the nett. annual revenue) to be applied "to any of the purposes of their undertaking, including the formation of a fund for Working Capital," instead of to relief of rates.

Clause 7 authorises the raising of loans for periods of ten years for working capital, payments to the sinking fund to commence only two years after the date of the loan.

Clause 8 extends Section 4 of the Conspiracy and Protection of Property Act, 1875, (relating to breach of contract by persons employed in supply of gas and water) to electricity supply, so as to make "wilful and malicious" strikes of electricity works employees illegal.

Clause 9 permits Local Authorities to work in combination in exercising the powers conferred under Clauses 1 and 2.

Clause 10 will give the Bill, if passed, the title "Electric Lighting Act, 1911."

Further reference to the Bill will be found under the headings Brighton and Dundee on page 661.

THE COAL MINES BILL

ON Thursday and Friday last week, the House of Commons considered the Coal Mines Bill, as amended by the Standing Committee. In "Electrical Engineering in Mines" for September 7th, 1911, we dealt with the Bill as it left the Committee, particularly in regard to Sub-section 2 of Clause 59 (Clause 60 in the original Bill), which, as amended by the Committee, provided that if the amount of inflammable gas in the air currents exceeds ½ per cent., the use of electricity shall at once be discontinued. On Friday Mr. Newman moved the omission of the sub-section, but after considerable discussion an amendment by Sir A. Markham that 1¼ per cent. be substituted for ½ per cent. was adopted. As naked lights are permitted in places in which the amount of gas does not exceed this percentage, electricity is evidently to be considered as dangerous as exposed lights. We shall deal more fully with this matter next week.

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AUTOMATIC REVERSIBLE BATTERY BOOSTERS

A PAPER by Mr. R. Rankin on automatic reversible battery boosters was discussed at last Thursday's meeting of the Institution of Electrical Engineers in London and at the Manchester Local Section last Tuesday. With a view to comparing the various types in use, the author classified these boosters as follows:—Those in which the booster can be self-contained and operated by its own field windings independently of any outside controller; those in which a so-called exciter is an absolute necessity, not merely for exciting purposes, being an essential in the theory of the system, and those in which an external automatic regulator is used on the booster field, either indirectly or through an exciter, the latter not being an essential in the theory of the scheme. He proceeded, after a few introductory remarks on the economy incidental to the load equalisation and good voltage regulation produced by booster controlled batteries, to describe a number of arrangements in use.

The simplest in the first class is the plain differential booster with one field winding excited by the bus-bar voltage, giving a booster voltage in the charge direction, and another in opposition to it, carrying a portion of the load current. This system provides no compensation for variations in the battery voltage or resistance. This difficulty is got over in the Pirani booster by placing the principal shunt across the battery. This, however, has a tendency to make the action unstable, but this is sometimes avoided by including iron-aluminium cells in the shunt coil circuit. The Highfield semi-automatic booster is similar to the plain Pirani booster, but both, if used without exciters, require an excessive amount of copper in the field circuits. The Crompton booster seeks to compensate for the variation in the state of the battery by the addition of a shunt coil across the booster terminals, but retains some unsatisfactory feature of the Pirani arrangement. A similar third coil forms a part of the Lancashire booster, and this, being excited by the difference between the bus-bar and battery voltage, tends to produce a voltage equal to that at its own terminals, and leaves the other coils free to exercise their functions independent of the state of the battery, and enables the current diverter to be placed in the generator circuit instead of the load circuit.

In the second class we have first the Highfield booster, in which the state of the battery is taken care of by a small exciter connected in opposition to the battery through the booster shunt coil, so that the latter is excited by the difference between the exciter and battery voltages. Owing to the presence of the exciter, the battery and booster can be run alone on the load, and a compounding effect may be obtained by a suitable setting of the diverter. The E.C.C., or Strang booster, is similar in principle, except that the exciter voltage is controlled by the bus-bar voltage instead of being constant. All diverter controlled boosters are, however, unsatisfactory with over-compounded generators, as it is difficult to adjust the compounding of the booster and generator to be exactly the same, and various other difficulties are also met with in the adjustment of the diverters.

In the Entz booster, which is of the third class, a pair of variable carbon resistances, controlled by a solenoid in the generator circuit, takes care of the field of the booster or its exciter, the field coil being in the centre arm of a bridge arm, so that the current can flow in either direction, according to the relation of the two variable resistances. The regulator is easily set to balance at any generator current, and the working is quite independent of the generator compounding. The regulator can be set to give at first a change of exciting current greater than the steady value required, resulting in much quicker building up of the field changes. The well-known Tirill regulator of the British Thomson-Houston Co. can be employed in almost exactly the same way, but owing to its "overshooting" action, it is necessary to employ additional floating contacts as an auxiliary checking control. Another similar device is the Taylor-Scotson regulator (*see* ELECTRICAL ENGINEERING, February 16th, page 83), but instead of a resistance in series, with a field winding being open and short-circuited alternately, as by the Tirill regulator, the operation is performed directly on a field winding itself. The Tilney booster employs a potentiometer-type booster, field regulating, and reversing switch, controlled by a small motor, of which the armature is connected through a resistance across the line voltage, while its field is wound differentially, one coil being excited from the bus-bars, and the other carrying a portion of the generator current. The action is not so quick as in the foregoing, and no provision is made for over-regulation. The Thury voltage regulator is employed in the Thury booster in a similar way, and is open to some of the same objections. Other systems on a similar principle to that of the Entz booster are those of Lincoln and Bijur. In the former system, which is designed particularly for alternating current work, the torque of a small A.-C. motor, which is responsive to variations in the main generator current, is balanced by a spring, and controls ordinary switches. In Bijur's system the pull of a solenoid is balanced by a spring, and mercury contacts are used. The Brown-Boveri voltage regulator (*see* ELECTRICAL ENGINEERING, July 13th, page 400) is employed in that firm's booster system. The two resistances, each provided with a number of contacts, are connected in Wheatstone bridge fashion, the booster field taking the place of the galvanometer. Over-regulation is prevented by the construction of the apparatus. As in other differential systems, compounding of the main generator affects the working.

The author then passed on to consider some methods of using boosters, pointing out some of the difficulties in the adjustment of three-wire booster sets. He referred also to the use of booster-controlled batteries for load equalisation in connection with colliery winding plants, describing a method proposed by Crompton & Co., and a way in which an Entz or similarly regulated booster can be adapted to this work.

For regulating alternating current systems in which a battery is linked to the system by a rotary converter, the Entz regulator can be worked by an alternating-current solenoid wound so as to be responsive to variations in the energy component of the alternating current. If, however, the split pole type of converter be used, auxiliary booster plant can be dispensed with entirely. This system was fully described in a Paper by Mr. J. L. Woodbridge, read in America (*see* ELECTRICAL ENGINEERING, Vol. IV., page 731), where an automatic exciter method of controlling equalising plants was also described. Some notes were then given on the plant at Gary Steel Works, where this system is in use, and the booster plant at the Hucknall Torkard Colliery, Nottingham (*see* ELECTRICAL ENGINEERING IN MINES, July 7th, 1910, page lxxxi.).

A few tables of figures of results of working of booster installations are given, and finally the author summarised his conclusions, drawing attention to the improvement in the life of batteries when worked under the conditions of automatic booster control. There was little difference in working results between the second class of booster and the Lancashire type of the first class, but the first and second classes were all more sluggish in their action than the third, in which a diverter is not used, but external regulation was relied on; and of these, on the whole, he preferred the Entz type.

DISCUSSION.

Mr. J. S. HIGHFIELD (Chief Engineer, Metropolitan Supply Co.), who opened the discussion, wished that makers would devise some method of charging for maintenance that was not on the principle of the present Insurance Bill, viz., that the healthy people did not pay for the sick ones. The difficulty of designing automatic boosters was that the battery curve of charge and discharge was not a straight line, and that it turned up very quickly when the battery came to its final state of complete charge. It was therefore necessary to employ various constant pressure devices and external regulators, &c. In designing a booster for ordinary work, however, it was advisable not to take account of the extreme end of the charge curve. In working on loads with violent variations it was best to work the battery at a light state of charge and complete the charge only at the end of the day. He did not think it was necessary to design a booster to keep constant load on the generator when the battery was fully charged. The Thury regulator was satisfactory so long as the variations in the load were slow, but when they became rapid then it was not adequate, and other forms of regulators worked very much in the same way. He agreed with the author that the non-inductive diverter was not altogether satisfactory, as the current increased in it at a greater rate than in the field circuit. In his opinion the diverter should be made inductive, as by that means the growing current in the external circuit is deflected round the fields of the booster. He had used these successfully in connection with a series-wound generator. With rapidly varying loads it was essential to put a heavy fly-wheel on the booster. Laminated fields made the booster respond more rapidly to the variations. He was not altogether in agreement with the author that it was

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a fairly common practice to use compound generators for traction and power loads. If the original design of the station contemplated the use of a battery and booster, the generators should be shunt wound.

Mr. A. M. Taylor (Birmingham Corporation Electricity Department), said that at Birmingham they found that the variation in the traction load in view of the large number of tramcars, was so small that it was unnecessary to have their generators compound wound. On the question of whether a standby battery should be tied up to the bus bars for good or bad, or whether it should be off automatically at the critical moment, he mentioned that there was a circuit-breaker at Manchester, where there was a 15,000 ampere battery, which cuts the battery off from the bus bars, not so much to save the battery as to save the boosters. In Birmingham they proposed to do the opposite, viz., to tie the battery up to the bus bars. If a sudden and unexpected load of, say, 17,000 or 20,000 amperes came, they wanted the battery to stand up to the bus bars absolutely, and they were proposing to introduce an automatic short switch to clap the battery on to the bus bars and cut out the booster. On the question of cost, there was strong competition between boosters and automatic end cell regulating switches. He did not believe that there was much scope for automatic boosters on A.C. systems. In Birmingham they started with heavy loads on their A.C. supply up to 1,000 kw. for each individual installation, without any Tirrill regulator, and he did not think that the economy from the use of this regulator could have paid for a battery. He thought that it was only with winding installations where it was absolutely indispensable to have a battery.

Mr. H. Burge (Crompton & Co., Ltd.), said that the instability of the Pirani booster mentioned by the author could be cured by providing the machine with interpoles, and by setting the brushes forward so that the armature reaction was split up, so as to demagnetise the field and reduce the booster bolts by a fixed amount for every 100 amperes in the armature. He disagreed with Mr. Highfield that a shunt generator should be adopted with a battery and booster for traction work; over-compounding was nearly always necessary. He also criticised the author's description of the working of the Crompton winding scheme.

Mr. B. M. Jenkin described a case where considerable overloads were caused on a traction system owing to the sluggishness of the diverter type of booster, but the difficulty had been got over by allowing the generator to take the momentary overload. It seemed to him that the diverter type was more expensive than a booster with Tirrill regulator. With regard to compounding traction generators, when there was a battery booster that was supposed to keep the load on the generator constant, if the battery booster did its work properly there was no fluctuation in current on the main generator by which it could be made to over-compound. One arrangement which worked satisfactorily was to put the generator field series winding in the main return circuit. Then the fluctuation in the main return circuit over-compounded the booster, but the current through the generator armature remained constant.

Mr. G. C. Allingham (Tudor Accumulator Co.) pointed out that the distinction made in the paper between boosters with and without exciter was one of arrangement and not of principle. The Pirani booster, which was simply a differential booster with a separately excited coil connected across the battery, was not really unstable. It was true that when the battery discharged, the battery volts dropped, and the separately excited field dropped slightly, but there was not a cumulative effect, as the rise of voltage in the booster due to the drop of voltage in the shunt coil was insufficient to compensate even for the drop in the machine itself. What did make the machine unstable was when a third coil was put across the armature, as in the Crompton arrangement as described by the author, but he believed Crompton's had given up this. If the third exciting coil was made very strong, compared with the other coils, the machine would be very unstable, and there would be a very strong building up effect, but if the third coil was made weak then it had no effect at all. The Highfield booster could be unstable in exactly the same way as the three-coil booster. The Lancashire booster, being controlled by the generator current, was quite stable.

Mr. E. K. Scott said the simple differential type of booster had done good service, and had been working in London for ten years, and suggested the use of homopolar machines for booster work, as they were exceptionally suitable for heavy overloads.

Mr. Rankin, in reply, said an inductive diverter would not be so simple as Mr. Highfield thought. If compounding were necessary they must carry the feeder current or return current round the generator magnets, and let the armature current remain steady, as Mr. Jenkin had said. If a brush-shifting arrangement could make the Pirani booster stable, he was surprised that such people as Siemens-Schuckert use aluminium-iron cells. In his opinion it was cheaper to have a battery and booster than follow the plan suggested by Mr. Jenkin. If they designed their machines for 200 per cent. overload, they would not need a battery at all. He had shown in the Paper exactly what Mr. Allingham had pointed out, and the net result was the same.

ELECTRICITY SUPPLY PROBLEMS

MR. F. A. NEWINGTON (City Electrical Engineer, Edinburgh) delivered his inaugural address as chairman of the Scottish Local Section of the Institution of Electrical Engineers on Tuesday, November 14th, and gave a survey of several subjects connected with public electric supply. Speaking first of generating plant, he said that, although for limited areas the continuous-current system had advantages, all development on a large scale would be carried out in the immediate future, at any rate, with alternating-current plant, as the largest practicable unit for high-speed continuous-current generators appeared to be 1,500 kw. He then gave a few descriptive notes on the exhaust steam turbine plant at Edinburgh, by which for the same quantity of steam used, the output had been increased by 77 per cent.

He then dealt with the metal filament lamp situation, saying that from the supply point of view the corner had now been turned, as the better efficiency had led to considerable increase in consumers. Without taking into account other advantages, he reckoned that the metal filament lamp was now able to compete with the gas mantle with electricity at 2⅜d. per unit, and gas at 3s. per 1,000 cu. ft. He thought the efforts of lamp-makers would be better spent in improving and cheapening lamps of about 30 c.p. than in bringing out more small sizes.

The majority of towns were not large manufacturing centres, and he thought that it would probably be more advantageous to the supply authorities to reduce the rates for lighting rather than to supply for power at very low rates. At Edinburgh all consumers who used motors for more than 3½ hours per day were entitled to reduced rates ranging from 1⅛d. to 0·8d. per unit. In such large manufacturing towns as Glasgow and Manchester, the conditions were different. Reference was made to various systems of charging. Electric heating and cooking were prevented from making as much progress as they should by the high cost of the apparatus and by the price charged for current. Electric cooking could only be expected to come into use on a large scale when the apparatus was hired out. The wiring contractors objected to the supply authorities having powers to do this, but did not appear to have sufficient capital to hire out cookers themselves. Mr. Newington then made reference to the impending depletion of our coal supplies, and emphasised the desirability for economy and restriction of export.

Passing on to the manufacturing industry, he said that most of the manufacturers of electrical plant appeared to be busy, but that the work was not remunerative. This he attributed to the extremely low prices quoted, and the real cause of this did not seem to be either the acceptance of the lowest tender by municipalities or foreign competition, but that the capacity of the existing works for turning out plant was far greater than the demand, and the only remedy seemed a large increase in the trade abroad.

In conclusion, he spoke a few words on the labour question, attributing some of the unrest to the present system of elementary education, which was unfitting men for the work they had to do without fitting them for anything higher. A serious phase of strikes was the possibility of stoppage of the electric supply. In 1875 the "Conspiracy and Protection of Property Act" made it a penal offence for any person employed in gas or water undertakings to break the contract of service, should such breach of contract interfere with the supply of gas or water. The date of this Act explained why electricity supply was not included, but it was the duty of the Institution to get this Act amended to meet the requirements of the present time with the least possible delay.

Public Time Service.—"Electric Clocks" was the title of a Paper read before the students of the Scottish Local Section of the Institution of Electrical Engineers on Friday, November 17th, by Prof. Magnus Maclean. The author mentioned that electric clocks were first produced about the middle of last century, since when hundreds of patents had been obtained, the most of which employed faulty mechanical gear, operated electrically, and consequently resulted in failure. Detailed descriptions were given of the three chief systems in successful use, consisting of: independent clocks wound up electrically; a number of independent clocks synchronised electrically by a master clock every hour; a number of clock dials controlled and impelled by a master clock at regular intervals. Prof. Maclean suggested a further method whereby a single master clock would synchronise every hour a certain number of independent clocks at different parts of the city, each of which would control and impel 200 or more dials in blocks of buildings in the neighbourhood.

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CABLE BOX EXPLOSION IN THE STRAND (LONDON)

ON Thursday last shortly after 1.30 p.m., some commotion was caused on the south side of the Strand, where a cable conduit explosion had lifted the cover of a street box and disturbed a portion of the footway, there being at the same time an alarm of fire in the adjoining premises. The mains in question are those of the Charing Cross, West End and City Electricity Supply Co., and consist of Callender's bitumen insulated cable laid in Callender-Webber ducts. The box is a plain brick chamber containing a pair of Peard enclosed fuses, it is not filled with compound or other substance and there are no branch or service connections from it. In fact the premises in question are not lighted by the Charing Cross Company.

It appears that a short-circuit developed a few yards away from the box and smoke was seen rising from the pavement, bring both the Company's staff and the Fire Brigade to the scene. Unfortunately, as the firemen were ripping up the pavement matters became worse, and the explosion of the inflammable gases caused the cable box-lid to be blown off and the pavement to be forced up, and about seven passers-by were slightly injured. The burning gases also appear to have spread into the cellars under the pavement through disused coal shoots, causing the alarm of fire inside the premises.

The exact cause of the original short-circuit will probably never be known; it may have been due to previous mechanical damage, percolation of damp after the heavy rains, or both. The records of the leakage indicator in the station show no previous lowering of the insulation, and it is curious to note that the fuses in the box itself did not blow. The Charing Cross Company's staff acted with great promptitude, and within five minutes of the alarm had disconnected the cable. There was no interruption of supply, as the arrangement of the net permitted of the supply being maintained through a different feeder.

CAPITAL AND LABOUR

MR. T. HARDING CHURTON chose the relations between capital and labour as the subject of his inaugural address to the Yorkshire Local Section of the Institution of Electrical Engineers, delivered at Leeds on Wednesday of last week. He pointed out that capital and labour were both necessary antecedents to the production of any commodity, and proceeded to show that it was the relation of supply to demand which controlled the market value of capital, labour, and the products of both. He then discussed the results tending to follow the artificial raising of the value of either capital or labour by combinations, finally arguing that "supply" is dependent upon the facility with which the commodity may be imported—and upon the degree of this facility depends the extent to which the value of either capital or labour may be locally forced up by combination of capitalists or of labour respectively. If the supply of either capital or labour falls below the amount which the other can profitably utilise, the supply of the product must be diminished. And, conversely, if both the factors of production are proportionately increased, the product will also be increased.

Plania Carbons.—As announced in our issue of October 26th, The Electrical Co., Ltd. (122-124 Charing Cross Road, W.C.), have now the sole agency for Plania carbons in the United Kingdom, and Mr. W. G. Mayer, previously with H. G. Mayer & Co., the former agents, has joined the Electrical Co. to take over the management of this department. The senior partner of H. G. Mayer & Co. (Mr. H. Mayer), has, however, joined the Globe Electric Co., Ltd. (11 Farringdon Avenue, E.C.), to manage their carbon department, and assigned H. G. Mayer & Co.'s contracts to the latter company. We publish this explanation to avoid confusion, but we understand from both firms that all orders for Plania carbons, whether given to The Electrical Co., or the Globe Co., pass through the Electrical Co.'s hands.

HIGH-VOLTAGE TRANSFORMERS

Institution of Electrical Engineers, Birmingham Local Section

AT the meeting of the Birmingham Local Section on November 15th, Mr. W. T. Taylor's Paper on "High Voltage Power" was discussed. An abstract of the Paper was given in ELECTRICAL ENGINEERING, November 16th, page 621. In the absence of the author, the Paper was to have been read by Mr. J. F. C. Snell, but he was unable to be present, and Mr. A. M. Taylor kindly filled his place.

Dr. G. KAPP (Birmingham University), in opening the discussion, commented on the statement made by the author that the shell type was mechanically stronger than the core type. In his opinion the reverse was the case. Transformers for supply of current to furnaces which made enormous sudden demands owing to short-circuits, were usually of the core type. He did not understand how three-phase current could be supplied when one of the three line conductors was broken down, and desired an explanation of this, together with the meaning of the term "open-delta."

Dr. D. K. MORRIS (Morris & Lister) pointed out that the author had not been quite fair to the core type of transformer, as when enumerating the comparative advantages and disadvantages of the two types, he had omitted some of the advantages of the core type, which he had mentioned in another part of the paper.

Dr. G. C. GARRARD (The General Electric Co.) said the advantage of the "T" three-unit system was that if one transformer broke down, the other two can be arranged to supply on open-delta. With respect to Dr. Kapp's query regarding the possibility of three-phase supply with one line conductor interrupted, this could be done if the earth was used. The method suggested of holding the core plates together by tape was unsatisfactory, and could only be used in very small sizes: steel bolts should be used in large transformers. The question of unequal heating depended more on the design than on the type, core or shell; the latter type was usually considered the best from this point of view. In the core type the yoke was usually made of the same section as the core, but for economy of material it was better to have the core of smaller section than the yoke. The best shape for the cross section of the core was an ellipse. To prevent breakdown in the end turns of the winding, it was preferable to reinforce the insulation of these turns rather than use an external choke coil. It was a good practice for successful parallel operation of transformers to adopt the same scheme of connections throughout the system. The delta-delta system was inferior from the point of view of regulation with out of balance loads, to the delta-star system.

Mr. FORREST (Birmingham Corporation) said the author did not make any definite recommendation with regard to the best type of transformer as regards the cooling system. With a self-cooled oil transformer there was trouble owing to the deposit of sludge which filled up the ducts and prevented proper circulation of the oil. The forced oil-cooled system tended to keep the ducts clear and allowed the oil to be cooled outside the building. The use of water-cooling worms on the top of a high-voltage transformer appeared to be risky. The table given by the author for the floor-space did not indicate whether in the case of the air-blast type the space occupied by the blower was included.

Mr. R. ORSETTICH (General Electric Co.) stated that transformers were liable to trouble from three causes, viz.:—At the terminals, from moving of the coils, and from failure of the insulation of the end coils. With transformers intended for voltages of the order described by the author, the condenser type of terminal was the best. To prevent movement of the coils owing to sudden current rushes, it was now the best practice to clamp the coils carefully. The insulation of the end coils should be such as to be capable of standing at least double the working voltage between turns. The author had not mentioned the question of the ageing of iron or the use of stalloy. The method of avoiding punctures of the insulation between turns was not given: it was, of course, as already pointed out, provided against by the extra insulation of the end turns. The development of the "T" three-unit system of connection was due to a patent quarrel in the United States. With regard to the specification, this should not lay down the details of construction, but specify simply the performance.

Mr. A. M. TAYLOR (Birmingham Corporation) said that the table for floor-space occupied by various types of transformer was useless for practical purposes, as it was not stated whether the transformers were single-phase or three-phase. In Birmingham floor-space was a very important consideration. His experience with 5,000-volt transformers was that there had been no trouble due to movement of the coils, although there had been short-circuits.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Nov. 23, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

25,478/10. **Ceiling Rose.** E. J. PARKES. To facilitate the erection of this type of fitting, the terminal blocks are formed of plugs and sockets arranged to slide into recesses in a rib on each side of a second insulating rib, which are at right angles to one another, and form the porcelain base. One end of the square terminal blocks has a longitudinal hole to receive a split pin, which has a transverse hole to form a socket in which the flexible is clamped by a screw. At the other end there is a similar transverse hole for the circuit wire, also clamped by a screw. The ends of the ribs are notched on the surface, and at the side, for the conductor to pass over and around, so that the rib supports the weight of the fitting. The passages at the back of the base for the line wires are preferably coned. Two figures.

2,765/11. **Joint for Cable Troughing.** R. SHUTTLEWORTH. This invention relates to a lock-fast joint for earthenware, &c., troughing. The spigot end of each section is provided with a snug, next to which there is a corresponding inwardly projecting snug. At the bottom of the socket end a raised section with a curved approach is arranged, on which the spigot end rests when the snugs have engaged each other. The curved part of the socket end can be filled in with jointing material if desired. This method prevents the troughs working loose or getting out of position and damaging the cables. Two figures.

4,286/11. **Submersible Motors.** W. R. MACDONALD. To prevent the ends of the windings from getting damaged due to the rush of water through the air gap, baffle plates are fixed to the sides of the casing to deflect the water away from the coils. An improved bearing is also covered by this patent. Cylindrical flanges extending inwards carry the bearings, which are perforated. On the outside of the bearing, above the perforation, a cup is fixed to give the water ready access to the shaft. The cup, however, is only necessary when the casing is not filled with water, so that the bearing can be fed with the water which is splashed about. One figure.

17,387/11. **Flexible Conductors.** E. V. CHEESE. A device for keeping flexible conductors, connected to apparatus, from twisting and becoming entangled, and causing, in the case of telephones, interference with the sounds, consists of a casing made in two parts. One of these has a longitudinal groove with undercut sides, and a semicircular bottom to take the flexible. The other, forming the cover, is of corresponding construction, and slides on to the lower part. Two figures.

17,723/11. **Arc Lamp Electrodes.** BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*). In the practice of mixing a steadying material with the lighting material for steadying the arc, it is found that the arc takes up the former before vaporising the latter, with the result that the proportion between the amounts of these vapours in the arc does not remain constant, thus producing a wide variation between either or both the intensity or colour of the light, from the materials. According to this invention, which is particularly applicable to A.-C. working, the light-giving material is introduced into the arc from one electrode during the first half period of the current, whilst the steadying material is introduced during the second half period from the other electrode, thereby fattening and giving conductivity to the arc. In one form titanium carbide is enclosed in a thin iron shell, while the other electrode is made of carbon impregnated with potassium viborate and then dried.

20,523/11. **Transformers.** E. HAEFELY. For effective cooling of oil transformers the insulating sleeve between the windings is of polygonal shape, so arranged that the inner winding is in contact with the sides of the sleeve, leaving the angular spaces open for the circulation of the oil and the cooling of the sleeve, whilst the outer winding bears on the corners of the sleeve, so that a space is left between it and the sides of the sleeve. Three figures.

Opposition to Grant of Patents

11,908/10. **Insulating Material.** A. R. MÜLLER and R. M. D. SYNDICATE, LTD. This patent has been granted in spite of opposition. It relates to an improved insulating material, comprising a mixture of two parts of asbestos to one of tar, compressed to the required shape, and heated to a temperature of 400° to 500° C.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: GES. FÜR MASCHINEN- UND METALLINDUSTRIE, 22,841/10.

Distributing Systems, Cables, and Wires: COSTAR, BATES, and BRITISH INSULATED & HELSBY CABLES, LTD. [Enamelling wire] 26,142/10; LAKE (*United States Light & Heating Co.*) [Automatic electric regulators for lighting circuits] 5,499/11.

Dynamos and Motors: BRESLAUER [Current generators] 26,187/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Speed control devices] 26,439/10; MACDONALD [Motors] 4,287/11.

Electric Ignition: FORSTER, 27,256/10; ROBERT BOSCH [Interrupter] 18,083/11.

Electrometallurgy: SIMPSON and OVIATT [Furnaces for producing iron or steel] 18,679/10.

Incandescent Lamps: GROTE, 26,667/10; BARROLLIER [Machine for joining filament supports to lamp bulbs] 7,868/11.

Storage Batteries: ELEKTRIZITÄTS AKT.-GES HYDRAWERK [Primary batteries] 6,664/11.

Switchgear: MCCAFFERY and KLYNE [Electrically-operated time switches] 25,906/10; DICKSON [Switches] 26,248/10; SCHRODER [Time switches for lighting] 7,416/11.

Telephony, Telegraphy and Signalling: TELEPHON APPARAT FABRIK. E. ZWIETUSCH & CO. GES. [Circuit device for operating selectors] 26,079/10; AITKIN, and BRITISH INSULATED and HELSBY CABLES, LTD. [Switchboards] 1,110/11; BOULT (*Oksnevad*) [System of railway signalling] 2,890/11; STEINBERGER [Telephone mouthpieces] 14,590/11.

Traction: CLARK [Batteries for train lighting] 26,542/10; CRAVEN [Electric radiators for railway carriages, &c.] 29,291/10; BLACKSTONE [Trolley heads] 30,240/10; SOC. LES FILS DE A. DEROME [Bogies for overhead trolleys] 8,201/11.

Miscellaneous: MUIRHEAD and WILKINS [Electrical connection devices] 26,077/10; REINIGER, GEBBERT, and SCHALL AKT.-GES. [Mercury-contact breakers] 26,341/10; KNOWLES [Purification of electrolytic gases] 27,264/10; BRÜCK [Magnetic separation of materials] 11,898/11; SOC. ANON "LE DÉTECTIVE" [Fire alarms] 12,450/11; MARKS (*Spinnerei and Weberei Steinen Akt.-Ges.*) [Current distributors for power looms with electric stopping and signalling devices] 15,798/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: CARL ZEISS [Reflector searchlights] 23,060/11.

Distribution: HEWLETT [Circuit controlling devices] 23,734/11.

Electrochemistry: CARL [Electrolysis of aqueous solutions of metallic salts] 24,238/11.

Switchgear: HEILBRUN [Switch] 24,003/11.

Traction: SIEMENS & HALSKE AKT.-GES. [Electric-signals] 21,873/11.

Miscellaneous: GES. FÜR ELEKTRO-TECHNISCHE [Electric welding seams of tubes] 23,943/11; COLEMAN [Electro-magnetic relay] 24,154/11.

The following amended Specification can now be obtained.

CLATWORTHY and HOLMES [Electrical driving of printing presses] 9,802/98; HUNTE [Dry cell] 14,615/08; SHARMAN [Musical signalling by radio telegraphy] 12,790/09.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: W. C. JOHNSON and M. P. THOMSEN, 16,301/05.

Distributing Systems: BRITISH THOMSON-HOUSTON Co. (*General Electric Co., U.S.A.*) [Electric circuit control] 18,022/07.

Dynamos and Motors: UNION ELEKTRICITÄTS-GES. [Single-phase commutator motor control] 17,220/04.

Electric Ignition: ELECTRIC IGNITION Co. and F. H. HALL [Contact maker] 17,812/06; A. HORCH [Switches] 18,083/06.

Electrochemistry: J. WETTER (*Elektricitäts Akt.-Ges. vorm Schuckert & Co.*) [Obtaining chlorine, hydrogen, &c., by electrolysis] 17,981/06; A. CLASSEN [Producing metallic deposits on articles] 17,969/07.

Incandescent Lamps: A. G. BLOXAM (*Siemens & Halske Akt.-Ges.*) [Metallic filaments] 17,973/07; N. KESSLER and G. JELICH, 18,013A/07; R. JAHODA, S. and I. VON LOTI and R. LATZKO [Metallic filaments] 18,053/07.

Fittings: W. J. BODELL [Lamp holders] 18,033/07.

Telephony and Telegraphy: SIEMENS BROS. & Co. (*Siemens & Halske Akt.-Ges.*) [Order telegraphs] 17,827/06.

Traction: H. B. SAWYER [Trolley pulley] 17,832/07; N. FALLEK [Tramcar bells] 17,947/07.

Miscellaneous: A. W. STEVEN [Centrifugal fans] 18,046/06; H. W. CHINNERY [Advertising apparatus] 18,151/07.

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DISPUTE re MUNICIPAL WIRING RULES AT ST. PANCRAS

AT the Clerkenwell Police Court on Wednesday last week, Mr. Bros finally disposed of the application for the appointment of an electrical inspector, made by Mr. A. E. Evans, of 38 Fitzroy Street, Fitzroy Square, and Messrs. McDonald, Syer & Co., Ltd., of 295 Gray's Inn Road. W.C. The previous proceedings were reported in our issues of October 12th, p. 559, and November 9th, p. 609.

Mr. Barrington Ward, on behalf of the St. Pancras Borough Council, said that since Mr. Tweedy Smith had taken the case in hand it had assumed a very different aspect. He now felt that he could not resist the appointment of an inspector, and he had intimated to the other side the willingness of the Borough Council to agree to the appointment of Mr. C. A. Baker, Principal Electrical Assistant, and senior inspector under the Electric Lighting Acts, in the Engineers' Department of the L.C.C. At the same time he asked the magistrate to appoint the inspector merely in respect of the two applications, and not generally or for any specific period.

Mr. TWEEDY SMITH first objected to the inspector being appointed for these two cases only, because he had a whole bundle of complaints in the area. He wanted a permanent inspector appointed under Section 28 of the St. Pancras Electric Lighting Order, and Regulation 31 of the Board of Trade Regulations, in order that St. Pancras should be dealt with in exactly the same way as all the other London boroughs. Otherwise he would be continually coming to the magistrate for the appointment of an inspector for each individual case.

Mr. BROS said he was inclined to appoint the inspector under the terms of the St. Pancras Order for 12 months to act generally.

Mr. TWEEDY SMITH pointed out that this would only enable the inspector to test works and lines, and not consumers' installations.

After a good deal of discussion it was decided that the inspector should be appointed as from January 1st, 1912, for 12 months, and if the parties cannot agree upon the form of the order making the appointment, or any other matters, the magistrate will decide.

ELECTRIC TRACTION NOTES

The arbitration to determine the price of the London United Tramways Co.'s Hammersmith lines is still proceeding. Mr. W. E. Ireland, Superintendent of Rolling Stock to the London County Council, has valued the cars at £338, compared with the company's estimate of £514 each. He also contends that the repair shop machinery only had, originally, a life of ten years, so that the value in 1909, after 8½ years' use, was very small. Mr. J. Shepherd, Electrical Engineer to the London County Council Tramways, expressed the opinion that the two 500-kw. D.-C. sets at the Chiswick Power House will be quite sufficient to run the Hammersmith lines, as the demand on a Bank Holiday would be from 460 to 560 kw. only. In cross-examination, Mr. Shepherd admitted that the Greenwich power station of the L.C.C. has an installed capacity of 31 kw. per car in use, whereas the average power used per car was only about half this, the excess being necessary to deal with peak loads and for spare and repairs. Mr. John Welling, Permanent Way Engineer to the L.C.C., said that, in his opinion, the rails on four out of the five sections on the Hammersmith lines were practically "dead," and he reduced the valuation of the permanent way and overhead equipment to considerably less than that of Mr. Sellon. Evidence was also given to the effect that the car shed at Chiswick, which the Company says the L.C.C. should take over, is three times too large for the number of cars required for the Hammersmith lines.

The Manchester Corporation is to be asked to appoint a sub-committee to consider the best means for relieving the congestion of traffic in the central portion of the city. Suggestions have been made that the construction of subway tramways was in contemplation, but we understand that the Tramways Committee have no intentions in this direction at present.

A proposal to instal trolley omnibuses in Bloemfontein is under consideration by the Council.

The Tynemouth Corporation have a proposal before them by the Tynemouth and District Electric Traction Co. for the running of trolley omnibuses upon certain routes where tramway extensions are thought necessary. As a condition for the construction of these lines, the company have asked for the consolidation of the dates of purchase of the existing tramways and light railways, so that they should be the same as that for the proposed trolley omnibus system, viz., twenty-one years from the granting of the trolley omnibus powers. There is, however, a difference of opinion between the company and the Corporation as to the cost of street widenings.

The Irish Court of Appeal has dealt with an appeal in connection with the purchase by the Belfast Corporation of the Cavehill and Whitewell Tramway Company's undertaking. Mr. Lynden Macassey, the arbitrator, fixed the price at £56,155, upon the basis of a going concern, and also taking into account other elements of value, which, he considered, had a bearing upon the sale. The Corporation argued that this was a misconstruction of the reference to the arbitrator and of an agreement between the parties, and the King's Bench Division ordered the award to be sent back to the arbitrator for further consideration. This latter decision was appealed against. After considerable argument, the order of the King's Bench Court referring the award back to the arbitrator was confirmed, with certain alterations, making it quite clear upon what basis the arbitrator is to proceed.

The report of the British Columbia Railway Co. for the past financial year shows very remarkable progress, the total receipts having risen by some 44 per cent. The gross revenue was £958,500, and a dividend of 8 per cent. for the year is declared upon the ordinary shares.

According to the *Pall Mall Gazette*, the London and South-Western Railway have definitely decided not to take any steps to convert their suburban lines to electric traction. This decision has been reached, it is said, after very careful consideration. In any event, no work of this description will be undertaken until Waterloo Station has been reconstructed, which it is expected will be finished in about three years.

At an extraordinary general meeting of the British Electric Traction Co. on Wednesday the modified scheme of capital reorganisation was passed. The poll taken resulted in 3,210 voting in favour of the scheme and 507 against. In addition the directors held proxies to the extent of 38,000 in favour.

Another electric traction scheme of some importance, which will come before Parliament next year, is one by the lessees of the East London Railway Co. for converting that line to electrical working.

The promoters of the proposed scheme for running trolley omnibuses between Guiseley and Otley, recently referred to in our columns, have decided to postpone their application to Parliament until next year.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

As was briefly mentioned in our last issue, an exhibition of a model automatic telephone exchange was given by the British Insulated and Helsby Cables, Ltd., in London, on Wednesday last week. The various parts of the model shown were similar to those to be employed in the Epsom exchange, which the company is now erecting for the Post Office. The system employed and the details of the apparatus were fully explained in a Paper read before the Institution of Electrical Engineers by Mr. W. Aitken on May 18th, and the object of the present demonstration was to make the apparatus familiar to the lay Press and the general public.

In our issue of May 25th, in which we referred to Mr. Aitken's Paper and reported the discussion upon it, we described and illustrated the subscriber's instrument, and also the connector employed in C.B. automatic exchanges. Such a connector is not, however, required for every line. Each subscriber's line is connected at the exchange to a simpler apparatus termed a line switch, which automatically extends the line to a free "selector" as soon as he removes his receiver from the switchboard. Each "connector" has 100 lines connected to it, and there would be 100 connectors in a 1,000-line exchange, so that each group of 100 lines would be available at 10 connectors. The connectors, which correspond more or less to the "multiple" on a manual board, are joined up to the "selectors" which, in connection with the line switches, may be taken to correspond to the operator's keyboard. Say, for instance, the number required by a subscriber is 865. The series of impulses sent by the subscriber's finger-plate switch, corresponding to the hundreds, will cause the selector to step up to the eighth level of contacts, and it will then rotate until the first free line to a "connector" is found. The connector will in its turn receive the first of the six impulses, causing it to step up to the sixth level of its contacts, and will then

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rotate until the fifth group of springs corresponding to the units of the number required is reached.

For details of construction, the actual connections, and the manner in which in the case of engaged lines connection cannot be made, and the "busy" signal is transmitted to the subscriber, we must refer our readers to Mr. Aitken's Paper published in full in the Institution *Journal*.

At the demonstration Mr. James Taylor, Vice-Chairman of the company, introduced Mr. Dane Sinclair, General Manager of the British Insulated & Helsby Cables, Ltd., and formerly Engineer-in-Chief of the National Telephone Co., who delivered a short lecture on the advantages of the system. Mr. Keith, the inventor, was also present, and explained the technical details to the visitors.

The Automatic Telephone Manufacturing Co., with a capital of £1,000,000 in £1 shares (500,000 preferred), has been registered. The company is to acquire from the Automatic Telephone Co., of Chicago, certain patents relating to the Strowger automatic telephone system, and will also acquire from the British Insulated & Helsby Cables, Ltd., certain lands, works and plant at Edge Lane, Liverpool, where the manufacture of automatic telephone apparatus upon the Strowger system will be carried on. The subscribers are J. Taylor, D. Sinclair, A. Brooker, J. S. Harmood Banner, F. E. V. Russell Roberts, V. D. Heyne, and J. Bruce. The directors are J. Taylor, D. Sinclair, J. S. Harmood Banner, E. A. Mellinger, of Chicago, J. B. Russell, of New York, and M. Muspratt. Reference to the prospectus will be found on page 662.

It was stated at the annual meeting of the German Society of Naval Architects last week that on the top of the existing 100-metre iron wireless telegraph tower at Nauen, the Telefunkengesellschaft have erected another tower of the same height. The range of the original tower was 5,000 kilometres, but much better results are now expected. According to the *Times* correspondent, the Telefunkengesellschaft have received orders this year for 390 wireless stations.

The *Daily Telegraph* correspondent at Stockholm states that several well-known business men have petitioned the Government for a concession to build a wireless station on the Marconi system near Stockholm with a radius of 1,200 miles. The idea is to undertake from this station regular telegraph communication between Sweden and several European countries, as well as with Canada, United States, South America, Africa, Asia, and Australasia. Communication with Great Britain would be direct, and with most other countries the communication would be *viâ* Great Britain. It is intended to form a company with a capital of £100,000, and if the concession is granted the station would be working within twelve months.

The most powerful wireless telegraph station yet installed was opened at Coltano, Italy, about a week ago. The available power is 1,000 kw., and some idea of its range can be had from the fact that the 500-kw. station at Clifden, Ireland, recently succeeded in communicating with Buenos Ayres, a distance of 7,000 miles. We mentioned in ELECTRICAL ENGINEERING, October 26th, p. 587, that the Spanish Government intend to carry on internal wireless telegraphy, for which purpose stations are to be erected at Cadiz and Barcelona, and also in Teneriffe and Las Palmas for external telegrams. When these stations are in working order, they will open a service with the Coltano station, which will put them in touch with England and other countries.

West Indian cables have once more practically been placed in working order, for the Jamaica-Colon, Mole St. Nicholas-Guantanamo, New York-Haiti, and Martinique-Paramaribo sections have been repaired, leaving only the Paramaribo-Cayenne cable to be attended to.—Censorship has been proclaimed by the San Domingo Government.—The *Henry Holmes* left Jamaica for St. Lucia.—Communication with Lubango is restored, while the lines between Teheran and Chahroud failed, and were repaired on 25th inst.—Telegrams for Astrabad and Khorasan region must be sent *viâ* Russia.—The cable between Saigon and Pontianak gave out on 24th inst. between the latter place and the island of Poulocondore.—The land lines of the Indo-European Telegraph Company between Rowne and Odessa ceased working on 27th inst., and on the same day we learn that radio-telegrams from ships at sea to Italian coast stations can only be sent at sender's risk, and they must be in plain language.

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PATENTS.

The Proprietors of Letters Patent No. 27,236 of 1908, relating to electric generators, desires to dispose of the patent or to grant licences to interested parties on reasonable terms, with a view to the adequate working of the patent in this country. Enquiries to be addressed to :—

CRUIKSHANK & FAIRWEATHER, LIMITED,
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Chartered Patent Agent.

REMOVAL. MR. J. G. LORRAIN, M.I.E.E., M.I.Mech.E., Chartered Patent Agent, has removed his office from Norfolk House, Norfolk Street, Strand, W.C., to
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LOCAL NOTES

Aldeburgh: *Electric Supply.*—Mr. A. P. Trotter, Electrical Adviser to the Board of Trade, held a public meeting last week to inquire into certain objections raised by residents and owners of property close to the site of the proposed power station of the Aldeburgh Electric Supply Co. The power station is to be erected near the Great Eastern Railway Co., and Diesel engines are to be employed. Most of the objections are mainly due to a feeling that there will be vibration and nuisance from the working of the power station, and a representative of the company explained what is intended in order to meet these objections. Mr. Trotter will report to the Board of Trade in due course.

Blackpool: *Street Lighting.*—It has been decided to put up an additional ten Metroflam arc lamps on the promenade.

Brighton: *Electrical Exhibition.*—The Electrical Exhibition organised by the Electricity Department closed on Saturday. During its three weeks' run it was attended by upwards of 40,000 people, practically one-third of the population of Brighton. During that time thirty-two practical demonstrations were given in electric cooking, two of them being on an exceptionally large scale. Very considerable interest has been roused amongst consumers in the possibilities which electrical apparatus now offers in connection with the cooking operations of an ordinary house with electricity at 1d. per unit. Copies of some photographs which we have seen show that the arrangement and display of the exhibits at this local exhibition fell little, if at all, short of its recent prototype in London.

Municipal Wiring.—The proposal of the Incorporated Municipal Electrical Association to promote a Bill in Parliament conferring wiring powers upon all municipalities, was discussed at some length at the Council meeting last week. The Electric Lighting Committee recommend the Council to co-operate in this promotion, but after a long discussion this suggestion was not agreed to. The opponents of the proposal made good use of the opinions of Mr. J. Christie, the Borough Electrical Engineer, on this matter, and it may be remembered in his Presidential Address to the Incorporated Municipal Electrical Association, in June, he clearly pointed out that he was not in favour of municipalities undertaking the wiring of consumers' premises. Particulars of the Bill will be found on page 654.

Dundalk: *Electric Lighting Works.*—Good progress is being made with the erection of the electricity works. The main walls of the engine-room are now finished, and a start has been made upon the foundations for the generating sets. A scheme of street lighting is being inquired into. Messrs. Miller, Wilson & Pegg are the consulting engineers.

Dundee: *Municipal Wiring.*—The Electricity Committee have discussed the Bill conferring municipal wiring powers to all local authorities which the Incorporated Municipal Electrical Association have brought forward. The Convener of the Electricity Committee stated that the Dundee contractors were not pushing electricity as they should. During the last four years the work done by them represented barely £13,000, and £36,000 worth of work had gone outside the city. Mr. H. Richardson, the City Electrical Engineer, reporting upon the provisions of the Bill, said that many corporations already possessed the powers that it was now sought to make general, and they were absolutely necessary for the advancement of municipal electrical undertakings. The Committee are in favour of supporting the Bill to the extent of subscribing their share of the promotion expenses.

London: *Islington: Shop Lighting.*—The Electricity Committee propose to set aside £250 in connection with a hiring-out scheme for shop-front lighting.

North Berwick: *Electric Lighting.*—The Council have agreed to an extension by six months of the time within which Messrs. Crompton & Co. had agreed to give a supply of electricity in the district.

St. Anne's-on-Sea: *Electric Lighting Accounts.*—The accounts of the electric lighting department for the year to March 31st, show a net surplus of £971 after meeting capital charges. The sum of £600 has been transferred to relief of rates, and the balance placed to reserve fund. The latter now stands at £4,899, which is equivalent to 9·4 per cent. of the capital expenditure. The increase in the number of units sold over the previous year was 11,298, which is equivalent to 1·4 per cent.

Uruguay: *Electric Supply.*—According to a *Times* correspondent at Montevideo, the Government have presented a Bill for the nationalisation of electric supply throughout the Republic. Existing concessions, it is said, are to be redeemed on a financial basis by the issue of 5 per cent. bonds.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Australia.—The Sydney City Council have decided to make arrangements for borrowing to the extent of £250,000 in connection with the electricity undertaking.

Beauly (N.B.).—Mr. Williams, an electrical engineer of Inverness, has placed a scheme of electric lighting before the Council. The estimated capital expenditure is £850.

Bolton.—We understand that extensions of the electricity undertaking will be put in hand very shortly.

Dartford.—It is proposed to apply for sanction to a loan of £8,500 for additional machinery at the electricity works.

Greenock.—The Borough Electrical Engineer estimates that an expenditure of £3,700 will be necessary in order to give supply to the works of Messrs. Dunlop, Bremner & Co.

London: *Hammersmith.*—The Finance Committee of the L.C.C. recommend sanction to a loan of £750 for the conversion of public gas lamps to electric lamps.

St. Pancras.—The Finance Committee of the L.C.C. recommend sanction to a loan of £9,964 for mains, generating plant, house services and meters.

Redditch.—A Local Government Board inquiry was held last week concerning a loan of £5,850 for extensions to the electricity undertaking. New generating plant to the extent of 250 kw. is to be installed.

Singapore.—The Municipal Commissioners are floating a loan of £116,700 for the purposes of an electrical installation, among other things.

Swinton.—A Local Government Board inquiry was held last week regarding a loan of £3,323 for the purposes of the electricity undertaking.

OSRAM·LAMPS

Worcester.—New mains are to be laid at an estimated cost of £1,400 in connection with electric pumping at the waterworks.

Worsley.—The Council are in communication with the Lancashire Electric Power Co. with regard to electric supply.

Wrexham.—Tenders are invited by December 5th for a main switchboard. Particulars from the Electrical Engineer, and tenders to the Town Clerk.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Barnsley.—Mechanics' Institute, Hanson Street. Architects, Messrs. Crawshaw & Wilkinson, 13 Regent Street.

Brighouse.—New municipal baths.

Cambridge.—Schools in Melbourne Place. Borough Engineer.

Derby.—Enlargement of Pear Tree Council School. Architects, Naylor & Sale, Smith's Bank Chambers, Market Place.

Grassington.—Tenders are invited for the electric lighting of the Wesleyan Chapel. Rev. A. Pritchard, Rock House.

Greenock.—Large building in Bogle Street as a trades hotel.

Lancaster.—Girls' Grammar School on High Street estate. Architect, H. Littler, 16 Ribblesdale Place, Preston.

Leicester.—Public Hall for the Corporation. Borough Surveyor.

London.—New branch post and sorting office at E. Ham. J. Rutherford, 22 Carlisle Place, S.W.

Newquay.—Pavilion. Borough Surveyor.

Swansea.—Business premises in Castle Street. Architect, S. Williams, Wharton Street, Cardiff.

Tottenham.—The Architect to the Education Committee has been instructed to report with regard to the wiring of new schools for electric lighting.

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TENDERS RECEIVED AND ACCEPTED

Blackpool.—The tender of the United Electric Car Co. for six toast-rack cars has been accepted.

Dundee.—The Tramways Sub-committee have accepted a tender by the Railless Electric Traction Co. for two trolley omnibuses at £700 each.

Jerusalem.—It is stated that the contract for an electric tramway and lighting system has been placed with a French firm.

APPOINTMENTS AND PERSONAL NOTES

Mr. E. V. Johnson, late technical representative for Messrs. Willans & Robinson in South Wales, has joined the firm of Messrs. W. V. Waite & Co., Ltd., Cardiff.

A representative gathering of Mr. Hamilton Dixon's electrical friends met at the Florence Restaurant, on Friday, November 24th, on the occasion of a farewell dinner to Mr. Dixon prior to his departure for Manchester, where he is about to take up an important position. Mr. Dixon, who is well known as a genial character in the electrical industry, has for some years been connected with his brother-in-law, Mr. Haydn Harrison, in his business at 11 Victoria Street. All those who have come in contact with him will wish him success in his new venture.

The Stepney Electricity Department require an assistant installation inspector at a salary of 30s. per week. (See an advertisement on another page.)

Mr. John D. MacKenzie, 217, West George Street, Glasgow, has been appointed sole Scottish agent for Sykes & Sugden, Ltd., Huddersfield, who manufacture service fuses, joint boxes, feeder pillars, &c.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £61 to £61 10s. (last week, £59 10s. to £59 15s.).

The J.-L. Manufacturing Co., Ltd.—To avoid any misconception which might be occasioned by the recent notice of the voluntary liquidation of this company, we are asked to call attention to the fact that this is occasioned by the amalgamation of the company with Submersible Motors, Ltd., as announced in ELECTRICAL ENGINEERING, October 19th, page 574.

Board of Trade Commercial Intelligence Department.—A Commercial Information Bureau is now attached to the Board of Trade Commissioner's Office, Norwich Union Buildings, Cape Town. Commercial information dealing with trade in the United Kingdom and South Africa will be given free of charge to those interested in British trade.

Canadian Agency Wanted.—The *Board of Trade Journal* states that a Winnipeg correspondent, who is a large dealer in metal filament lamps, desires to receive quotations and samples from British manufacturers.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

MOTORS.—A sheet from the Electrical Company, Ltd. (122-4 Charing Cross Road, W.C.) gives a list of D.-C. motors in stock for voltages of 100-120, 200-250, and 400-500, as well as new machines of 6 and 10 h.p. for 220 volts, and speeds of 840 and 1,060 respectively.

CARBONS.—In another leaflet from the same firm, various qualities of Plania carbons, and the uses to which they can be put, are outlined. The flame type, which can be had with or without a metal core, is dimensioned in millimetres and inches, and the price per length of 100 pieces is given.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

STEAM TRAP.—Details of a steam trap of the "spirit expansion" type are to hand from Geipel & Co. (Vulcan Works, 72A St. Thomas' Street, London, S.E.). It is small and compact, has a rotating valve, and a large valve opening. It is made for steam pressures up to 100 lbs., and a number are already in use. A special form is made for railway carriage heating.

BOOKS.—A catalogue of technical books from W. & G. Foyle (135 Charing Cross Road, W.C.), contains all the latest editions. Second-hand copies, however, can be obtained of all the books at about half published price.

MOTORS.—A neatly arranged catalogue from Scholey & Co., Ltd. (151 Queen Victoria Street, London, E.C.), gives a general description, with very clear diagrams, and full particulars of a series of A.-C. motors. The usual types of single, two, and three phase machines, with slip ring or squirrel cage rotors are shown, and efficiencies and power factors are also given, while the approximate weights and shipping particulars and the dimensions at the end make it a very useful guide.

FANS AND TATTERSALL AIR HEATERS.—Leaflets from C. Whittaker & Co., Ltd. (Union Foundry, Haslingden, Lancs.), describe a radiator type of air heater or cooler, which consists of a number of flat thin corrugated tubes, bent zig-zag fashion to give a large surface to the heating fluid and the air, which flow respectively through and between the tubes in thin streams. It can be connected to a fan either of the centrifugal or propeller type, both of which are referred to on separate sheets. The combination is equally adapted for cooling liquids, to cool gas engines, condensing water, &c. The Tattersall surface condenser, in which air, with evaporated cooling, is used instead of water, is also described.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Automatic Telephone Manufacturing Co.—Applications are being invited for an issue of 200,000 6 per cent. cumulative preference shares and 360,000 ordinary shares of £1 each. The dividend on the preference shares is guaranteed by the British Insulated & Helsby Cables, Ltd.

Hadley Engineering Co.—This Company, which has been formed to take over, among other things, the manufacture of the Tilling-Stevens petrol electric omnibuses, is issuing capital to the extent of 120,000 preference shares and 12,000 ordinary shares of £1 each. We referred to the new 'buses in our last issue.

South America Light & Power Co.—An issue is being made of £150,000 5 per cent. first debentures at 96. The company holds a perpetual contract for the supply of electricity for all purposes in Bahia Blanca, in addition to a number of other concessions.

Aron Electricity Meter.—The transfer books will be closed from December 7th to 14th inclusive.

Adelaide Electric Supply Co.—The net profit for the year to August 31st was £40,983. After meeting debenture interest and the dividend of 6 per cent. on the preference shares, a final dividend of 6½ per cent., making 10 per cent. for the year, is declared on the ordinary shares, together with a bonus of 2s. per share. The sum of £5,000 is transferred to general reserve, £5,000 to dividend equalisation fund, and £4,385 carried forward.

NEW COMPANIES

LOND & CRAWFORD, registered by Jordan & Sons, 116 Chancery Lane, W.C. Capital £1,000. Electrical engineers and contractors.

UNIVERSAL CHEAP CABLES, 40 King Street, Cheapside, E.C. Capital, £100,000. To acquire the patents of the Johnson Secret Wireless Telegraph and Telephone Testing Syndicate and to carry on the business of wireless and other telegraphists and telephonists.

Witton-Kramer Lifting Magnets.—We have received from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), an excellent view of the part of their stand at the Olympia Electrical Exhibition, on which they demonstrated the working of the Witton-Kramer crane magnet. An account of these demonstrations, with an illustration of the apparatus, appeared in the special Exhibition Supplement to ELECTRICAL ENGINEERING, October 12th, p. 59.

Osram Lamps.—The General Electric Co. (67 Queen Victoria Street), have sent us a striking illustration reproduced from an untouched photograph, showing the result of a recent collision between a motor-omnibus and a lamp standard in Great Portland Street. Although the lantern was bent over to a considerable angle, the Osram lamps therein remained intact, and lighted up when the current was next switched on.

NOTICE is hereby given that the TRANSFER BOOKS and REGISTER of members of ARON ELECTRICITY METER, LTD., will be closed from Thursday, the 7th December, to Thursday, the 14th December, 1911, both days inclusive.

By Order,

M. ARON, F.C.I.S.,
Secretary.



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ELECTRICAL ENGINEERING

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WHEATLEY KIRK, PRICE & CO.,

[Established 1850]

AUCTIONEERS

and Valuers of

Electrical Works, Plant and Stock.

46, WATLING STREET, LONDON, E.C.

16, Albert Square, Manchester.

26, Collingwood Street, Newcastle-on-Tyne.

ELECTRICAL ENGINEERING.

The Engineering Journal of the Electrical Industry

Published every Thursday. Price **1d.**

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Official Notices and Technical College Announcements are inserted at the rate of Ninepence per line (column width).

Other Advertisement Rates on Application.

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Corrections in Standing Advertisements, *Monday first post.*

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SUMMARY

An article dealing with the Coal Mines Bill, which passed its third reading on Tuesday in the House of Commons, occupies the first position in our monthly supplement on Electrical Engineering in Mines, and besides critical comment contains a report of the debate on the clause limiting the use of electricity to places in mines where the proportion of inflammable gas does not exceed 1¼ per cent. An abstract is also given of a report on electricity in mines in 1910, and further articles deal with a new safety lamp and a system of automatically controlled mining locomotives.

A few notes are given on the career of Prof. E. Arnold, of Karlsruhe, who died last month. (Page 665.)

A Paper by Mr. Roger T. Smith, read recently before the Institution of Civil Engineers, describes the brake vehicle method of train lighting employed on the Great Western Railway. (Page 665.)

A correspondent discusses the method of appointing the council of the Institution of Electrical Engineers, objecting to the principle of self-nomination, and bringing forward the example of another body, in which this system was rejected. (Page 666.)

Mr. R. Rankin's Paper on "Automatic Reversible Battery Boosters" has been further discussed by the Manchester Local Section of the Institution of Electrical Engineers. (Page 667.)

In the Appeal Court on Monday, the appeal of the British Westinghouse Co. against the arbitrator's award regarding the Lots Road turbines was dismissed with costs. The Westinghouse Co. will have to bear the whole cost of installing the Parsons turbines, plus the difference between the actual and guaranteed steam consumption of the Westinghouse turbines. (Page 667.)

At the last meeting of the City Corporation a combined scheme of electric and gas lighting for the whole of the streets in the City was approved. The contract is for ten years, and is divided between the City of London Electric Lighting Co. and the Gas Light and Coke Co. The total illumination will be increased by 601,765 c.p., with a decrease in cost of £6,832 per annum. (Page 667.)

A generator driven by a paraffin engine is to be used for the lighting of the Royal train in India. (Page 668.)

Some evidences of the strength of wire drawn tungsten filaments are given on page 668.

A time element attachment for circuit-breakers is discussed in an illustrated article. (Page 669.)

A cheap method of supporting metal filaments has been devised, in which mica discs are used instead of platinum or iridium wires. Another patent published last week was for a mercury contact-breaker, which utilises the heating effect of the spark on an extinguishing fluid to rapidly break the circuit. A process for enamelling wires by a series of thin uniform coatings is also protected, as well as a connection device for attaching terminals to cases containing apparatus. Two patents expire during the coming week relating to

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wireless telegraphy, including one of Sir Oliver Lodge's in which the apparatus is connected up on the Wheatstone bridge principle, and the coherer is contained in a metal casing to avoid outside influences; the other, by G. Marconi, also encloses the coherer in a metal box with openings closed by screens, which are actuated by a pivoted lever for putting it in circuit. (Page 670.)

UNDER "Telephony and Telegraphy" we mention the reason why the Post Office cannot see their way to erect an experimental automatic exchange in Ireland. Mr. Charles Bright's lecture to the London Chamber of Commerce on the Atlantic cable position is also referred to. (Page 670.)

IN "Electric Traction Notes" we report the concluding stage of the arbitration concerning the Hammersmith lines of the London United Tramways; and give Col. Yorke's opinion as to the recent accident on the Birmingham and Midland tramways. (Page 671.)

A NUMBER of corporations are promising support to the I.M.E.A. Wiring Bill.—The Frome Electricity Works are to be transferred to Messrs. Edmundson's Electricity Corporation.—In consequence of the recent change of policy in the Newport (Mon.) Electricity Department, the Chairman of the Electricity Committee has declined to continue in the office. (Page 672.)

SOME illustrations show the improvement in lighting that has been effected in some of the tube railway stations. (Page 671.)

THE West Hartlepool scheme of utilising blast furnace gases for generating electricity has been sanctioned. Loans are to be taken up at Darlington (£3,220); Erith (£11,761); Sheffield (£61,099); and Blackpool (£4,200). A 3,000 kw. turbine is required at Stalybridge; cables at Middleton; a high-tension switchboard at Croydon, and a 750 h.p. motor at Brighton. (Page 673.)

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, DECEMBER 7TH.

Institution of Electrical Engineers.

8 p.m. "Notes on National and International Standards for Electrical Machinery," by Dr. R. Pohl.

FRIDAY, DECEMBER 8TH.

Royal Astronomical Society.

5 p.m. At Burlington House. "The New 'Synchronome' Astronomical Regulator," by F. Hope Jones

Northampton Institute.

6.30 to 11 p.m. Prize distribution.

Royal Automobile Club.

9 p.m. "London to Brighton in 45 Minutes by Electric Train," by Philip Dawson.

Electrical Engineers' Dance

9 p.m. At Midland Hotel, Manchester.

SATURDAY, DECEMBER 9TH.

Northampton Institute.

6.30 to 11 p.m. Annual Conversazione.

Birmingham and District Electric Club.

7 p.m. Annual meeting at Colonnade Hotel, New Street.

MONDAY, DECEMBER 11TH.

Institution of Post Office Electrical Engineers.

6 p.m. At Institution of Electrical Engineers. "Distribution by Means of Parallel Cables," by E. A. Pink.

Institution of Electrical Engineers: Newcastle Local Section.

7.30 p.m. At Armstrong College of Science.

TUESDAY, DECEMBER 12TH.

Institution of Electrical Engineers: Glasgow Section.

7 p.m. Annual dinner at "The Grosvenor," Gordon Street.

Institution of Electrical Engineers: Manchester Section.

7.30 p.m. At the University. "Heat Conductivity in Electrical Machinery," by Miles Walker and H. D. Symons.

WEDNESDAY, DECEMBER 13TH.

Dynamicables.

7.30 p.m. Dinner at Trocadero.

Institution of Electrical Engineers: Birmingham Section.

7.30 p.m. At Municipal Technical School. (1) "Automatic Starting of Asynchronous Motors," by N. Pensabene-Perez; (2) "Some Notes on the Circle Diagram," by T. F. Wall.

Royal Society of Arts.

8 p.m. "Continuous Service in Passenger Transportation," by W. Yorath Lewis.

Association of Engineers-in-Charge.

8 p.m. At St. Bride's Institute, London. "Methods of Dealing with Losses in Steam Plant due to Condensation," by G. Wilkinson and J. Rendell Wilkinson.



ONE REASON WHY THE PRICE OF COAL WILL GO UP.

MINER:—Get out! I don't understand you and I don't want you, and besides you are a labour-saving device.

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OBITUARY

E. Arnold.

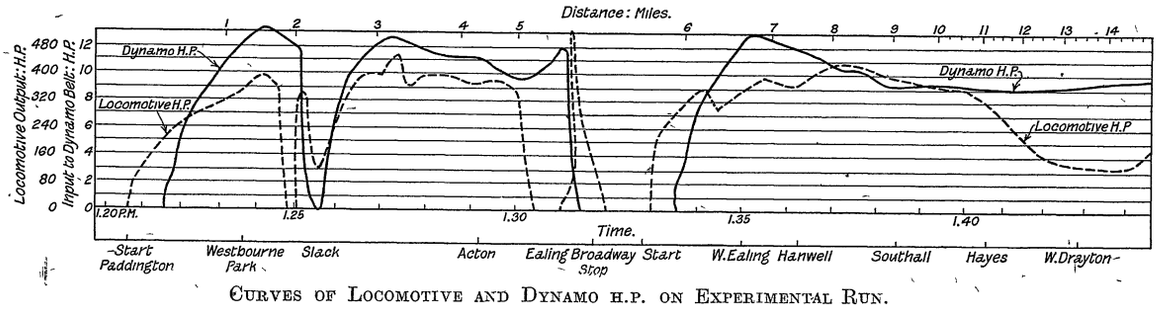
PROF. ENGELBERT ARNOLD, who died on November 14th last, was as well known through his writings on dynamo design and kindred subjects as he was as head of the electrical department of the Technical University at Karlsruhe, the high-standing of which was in a great measure due to his personal work. Of his books, his two-volume "Die Gleichstrommaschine" is perhaps the best known, and by many he was regarded as the authority *par excellence* on continuous current design, and more particularly on the theory of commutation. He wrote, however, also extensively on alternating current matters, partly in collaboration with Mr. J. L. de la Cour. There are not a few English electrical engineers who received their training in his laboratory at Karlsruhe, and in many ways the influence of his teaching was far-reaching. Prior to his work in the development of the Karlsruhe College, Dr. Arnold was for a while chief electrical designer to the Oerlikon Co., which firm he joined after six years' experience at a manufacturing works at Riga, founded by himself and H. Dettmann. His connection with Riga, however, commenced in 1880 on his taking an appointment at the Riga Polytechnic, in addition to the duties of which he was able to practise engineering generally. Although the greater part of his career was thus passed in Germany and Russia, he was by birth a Swiss, having been born near Lucerne in 1856, and it was at the famous Zurich Polytechnicum that he received his early technical training.

THE BRAKE VEHICLE METHOD OF TRAIN LIGHTING

MR. ROGER T. SMITH (Chief Electrical Engineer, Great Western Railway) read a Paper entitled "Electric Lighting of Railway Trains: the Brake-Vehicle Method," on November 28th, before the Institution of Civil Engineers. He referred briefly to methods that had been used from 1881 onwards for electric train lighting, including block-train methods with a single equipment, and the self-lit coach method with a dynamo on every vehicle, and proceeded to consider the different parts of the problem in detail. Considering first the provisions of adequate illumination in the carriages, he recommended an illumination, measured on a horizontal plane at eye-level, of 2 foot-candles in 3rd class, and 2½ foot-candles in 1st class compartments. Glare or dazzle would be minimised if not entirely prevented by keeping lamps out of the line of sight, by providing a white background behind the glowing filament, or by reducing the intrinsic brilliancy of the filament, by enclosing the lamp in a diffusing globe or Holophane globe, the latter at the same time improving distribution. The tungsten lamp had now replaced the carbon lamp, its most economical efficiency with present train-lighting lamps being 1·3 watt per candle. On the average, tungsten lamps, with a useful life of 850 hours, now had to be changed only once a year in the electrically-lit coaches on the Great Western Railway, where lamp-voltage was regulated within ±2½ per cent. In the latest corridor coaches on the G.W.R. each first-class compartment has five 10 c.p. lamps in pine-shaped diffusing globes. Four of these are placed in the roof in positions convenient for reading, and the other, in the centre, is provided with a dimming switch, so that it can be turned down at night. In the third-class carriages three 10-c.p. lamps are placed in clear glass globes, with white reflectors, and a switch places these in series for dimming them at night. The lamp pressure adopted is 22 volts, so that 12 cell batteries can be employed.

Some notes follow on the accumulator, which is an essential part of any system, considering only the lead cell. The two extremes among methods of charging lead cells are charging at constant voltage and charging at constant current, but a method of charging which combines the advantages of both extremes, while avoiding their disadvantages, is recommended, the charge being completely under the control of an automatic regulator set to give the proper compromise. The arrangement consists in starting with a heavy charge and gradually reducing it until, after proper gasing has taken place so as to mix the electrolyte, the charge is stopped when the cells are full, or the battery is left floating on the load while lights are on. Automatic regulation is necessary to secure a long and healthy life for the lead cell, and to reduce maintenance it is essential; when properly arranged, 10 per cent. per annum of the initial cost of the whole cell will provide for both maintenance and renewals of the plates and boxes. At the present time, the active material in the lead cell seems limited to a life of about five to seven years, only attaining the latter age when carefully nursed. The variable-speed dynamo is only dealt with briefly from the electrical point of view, but several details as regards belt driving and suspension are gone into. Electro-magnetic cut-in and cut-out switches are preferred by the author, and can be combined with the functions of a reverse-current circuit-breaker. The functions of the automatic regulator are as follows:—It must control the lamp-voltage within ±2½ per cent., independently of lamp-load and entirely independently of battery-voltage. When lamps are off, it must control the generator-field so as to provide the full output of the dynamo for charging an empty battery; and when lamps are on, the balance of the full output must be available for charging. As charging proceeds the regulator must control the inherent regulation of the dynamo so that its voltage only rises sufficiently to give a diminishing charging current. With a fully charged battery and lamps off, the regulator should reduce the charging current to zero, and with a fully charged battery and lamps on, the dynamo output must be adjusted to equal the lamp load, leaving the battery in a floating condition with current neither entering nor leaving it.

It was mainly to reduce the number of equipments and battery cells per train, and thus to minimise both initial cost and expenses of maintenance, that the brake-vehicle system has been adopted in preference to equipping every coach as a self-lit vehicle. The conditions of traffic, however, always require a certain number of self-lit vehicles.



Curves of Locomotive and Dynamo H.P. on Experimental Run.

An experimental six-coach train lit on this method has been run nearly continuously for two years in all sorts of traffic, varying from fast main-line services to slow, stopping, local services. Two brake-vehicles, equipped with 45-ampere dynamos, regulators, and 180-ampere batteries, light themselves and three dependents. A self-lit detachable coach completes the train. The Leitner system provided the only available apparatus able to meet the special conditions. All the equipments are in parallel, coupled through cables along the whole train providing for this. For the lighting circuits the through wiring and method of coupling is arranged on the loop-positive system, one regulator controlling the lamp-voltage on each side of the loop.

In the Leitner system the variable-speed generator ensures approximately constant voltage at all speeds and outputs above cutting-in speed by connecting the shunt field through the armature to a pair of auxiliary brushes which bear on electrically opposite sides of the commutator. Main and auxiliary brushes are given a forward lead. The field-current may therefore be

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said to pass through the armature twice, in directions electrically at right angles to each other. When the dynamo revolves slowly the pressure across the auxiliary brushes is added to that across the main brushes, so that the field-current is large and the machine builds up quickly. As, with increased speed, armature-reaction distorts the magnetic flux in the direction of rotation, the effect of the auxiliary brushes first diminishes to zero and then reverses and the field-current is reduced. By this means the voltage of the machine can be kept practically constant for all speeds from, say, 500 to 2,000 revolutions per minute, though the inherent regulation of the machine will allow its voltage to rise independently of speed when charging a battery.

The cut-in switch is actuated by an armature rotating in two field windings, one of thick and the other of thin wire, both in series between the dynamo and the battery. The armature winding is connected across the battery. The fine series winding is short-circuited by the coarse winding when the switch is closed. The device also acts as a reverse-current circuit-breaker. The automatic regulator is controlled by an accurate voltmeter switch of the beam-balance type, the pull of a solenoid acting against an adjustable control spring. Any increase in voltage above the normal makes a contact on one side of the beam-balance, while any decrease makes a contact on the other side. The contacts work relays, and the relays supply current to move, through a small motor and gearing, a slider on four rows of variable-resistance contacts. One variable resistance is in series with the lamps, each of two others in series with one half of the dynamo-field, and a fourth is in series with the voltmeter-coil itself. One slider moving over all four rows of contacts adds or subtracts resistance simultaneously in each circuit, each section of the slider being insulated from its neighbour or neighbours on adjacent contacts.

The results of experimental runs with this equipment are detailed at some length in the Paper, and a curve relating to one of these is reproduced here. The system has been since applied to several other trains on the Great Western Railway, and on these a bus-bar system of through wiring is being adopted.

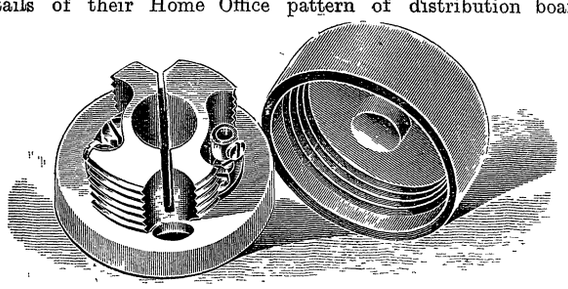
The total annual cost of lighting a six-coach train on the looped-positive brake-vehicle method as deduced from the runs of the experimental equipment is as follows. The cost of the initial equipment would be £761, inclusive of all carriage-work charges; adding working costs, extra cost of locomotive power—determined experimentally—and capital charges, the total annual cost becomes :—

	£
Working-costs	45
Power to drive dynamos, 1½ per cent. on £875 ...	13
Haulage of extra weight, 1·7 per cent. on £875	15
Interest on £761 at 4 per cent.	30
Reproduction of capital in 20 years at 3 per cent.	23
Total annual cost of lighting a six-coach train	£126

In conclusion the author points out the great safety of the system from the point of view of fire risk.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

LIGHTING SUPPLIES.—A catalogue from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), contains details of their Home Office pattern of distribution boards,



CIRCULAR DETACHABLE FUSE.

shielded fuses, branch switches, including the "Slick" flat switch, wall plugs and adaptors, cut-outs, "Coates'" lamp-holder shields, and china lampholders. The wall plugs are also supplied in midget, standard, and union gauges, and are all interchangeable. Among the cut-outs, we understand that the plaster-lined type and the new circular detachable fuse illustrated above have been reduced in price. Sign flashers are also included, and these can be had in the motor-driven or "thermic" types.

ELECTRIC LAMPS AND LIGHTING ACCESSORIES.—The British Westinghouse Electric and Manufacturing Co., Ltd. (Trafford Park, Manchester) has issued a series of lists neatly arranged in a leather binder. It is divided into sections, covering the "Arcturus" flame arc, and the Auriga metal filament lamps, general accessories, fittings, and glassware, cables, wires, and conduits, aerial fans, and cooking and heating apparatus.

CORRESPONDENCE

THE INSTITUTION OF ELECTRICAL ENGINEERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Most of this discussion appears to be directed to details, and neglects the real cause of the present unfortunate state of the I.E.E.—the non-election of the Council.

If one asks "who gave the Council the power to rule us?" everyone knows the true answer: "it rules because it was nominated by the previous one," and the previous one because nominated by the one before, and so back into the dark ages, till one comes to the original meeting of the founders in 1871, to whom we are all grateful. The present body rules us to-day solely because it is the great[38]-grandson of the 1871 Council. I strongly support the hereditary principle in government, but this is heredity gone mad! Who would ever suggest the House of Lords as the sole ruler of the nation without King or Commons?

I know the argument on the other side—the Civils do it. I would meet it thus. I am a strong Conservative, and never want to change an old custom that gives good results. In the case of the Civils, the system is bad, and tends to bad results; but in their case they have fine old traditions behind them which neutralise those tendencies: the result is good—let well alone. In our case there is the same bad system: no counteracting influences; all the bad effects such a system tends to produce; the result is bad: change that system.

But any alternative should be a well-tried one; and there is a remedy which has stood the test of time. I belong to another Institution, a far stronger one than the I.E.E.; one that does everything for its members, and the industry in which they are interested, that the I.E.E. does for theirs, and a great deal more; *e.g.*, every Bill that comes before Parliament that affects that industry is scrutinised minutely, and every objectionable point is fought hard. If a decision is given in any court making a new principle to the detriment of that industry, it sees that case is taken to appeal, and generally pays most or all the cost. Now, some years back that body was suffering from the same disease as ourselves—a self-nominating Council, and with the same results. That Council was doing things of which the members strongly disapproved, though that Council never went to such extreme lengths as ours has done.

The members rose, swept the Council away, and put in a new one. This is too strong medicine for any but a very strong and healthy body, which we are not; moreover, on personal grounds I would deprecate it.

But they did more. They prevented any recurrence of the disease. They passed a new article: "No candidate shall be nominated by more than two members. No candidate can be nominated by the Council." This is a direct blow at the root of the evil, and we ought to do likewise. An over-crowded ballot sheet was prophesied, and to obviate it some said twenty supporters should be required. I have the certified figures for the last five years. Number of vacancies each year, 25 (a Council of 50, half retire annually); number of candidates, 35, 33, 33, 31, 32. The percentage of votes received by the *lowest* rejected candidate of those received by the *highest* elected one were for the last five years 41 per cent., 33 per cent., 32 per cent., 37 per cent., 24 per cent. The fact is, men are not such fools as to stand when they have no chance, it is merely to hold themselves up to ridicule. The effect on the composition of the Council is somewhat unexpected. It remains the same every year to just the same extent as before. The retiring members who stand again are almost always re-elected; the figures for the five years are, not re-elected, 2, 1, 0, 0, 1. It may be urged "if the result is the same, why change?" The result is not the same. In the self-nominating Council, when any measure is proposed, the self-interest of every member of it makes him say to himself, "Is the majority of the Council in favour of this? if so, and I oppose it, I make myself unpopular, and risk not being renominated." What the whole Institution wants does not affect his self-interest at all.

In the elected Council he asks: "Is the majority of the Institution in favour of this? If not, and the Council passes it, I lose my seat at the next election."

Moreover, if he does not know, he takes pains to find out; and in that other institution he can find out. There is none of the "secrecy of the Council Chamber" which has such a blighting effect on ours. With the exception of matters which it would be obviously inexpedient to publish at the moment—and they are few—a full report of every Council and every Committee meeting is published; everything is open and above-board, and every member knows what is being done, and can take an interest in it.

If we make this change, all other matters can be left. They will be dealt with by our own elected representatives, not by an alien body. Those representatives might well be—I hope they will be—the present members of Council, and they will carry out the wishes of the Institution, to whom they are responsible.

ONE WHO HAS BELONGED FOR TWENTY-EIGHT YEARS.

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"Electrical Engineering"
December 7, 1911.

ELECTRICAL ENGINEERING

IN

MINES

Correspondence on any of the subjects dealt with in this Supplement is cordially invited from our Readers.

The Editor is willing to insert letters over a *nom de plume*, but Correspondents should send their full names and addresses in all cases.

Letters should be addressed, "THE EDITOR, ELECTRICAL ENGINEERING, 203–206 Temple Chambers, London, E.C.," and should reach this office by the 21st of the month.

Correspondents are requested to write on one side of the paper only.

THE COAL MINES BILL

AS was briefly reported in our last issue, the House of Commons has decided that the use of electricity in mines shall be restricted to mines or parts of mines in which the proportion of inflammable gas in the air currents does not exceed 1¼ per cent. This is to apply both in the case of existing installations and new ones. The Bill was read a third time in the House of Commons at a late hour on Tuesday night. It has still to be passed by the House of Lords, but it is unlikely that any amendment as to the application of electricity will be made there.

All those with expert knowledge who listened to the debate and the previous discussion by the Standing Committee last summer will have been impressed with the mistake made by the Government in departing from their original intention and in permitting regulations as to detail to be made by Act of Parliament, instead of leaving such matters to be dealt with by Home Office regulations in the ordinary way.

Before coming to the debate on the Clause relating to the use of electricity, reference must be made to the Clauses in which the use of unprotected lights are referred to. The first of these to be discussed (Clause 32) restricted the use of naked lights to those seams in which the air-current in the return air-way does not normally contain more than half per cent. of inflammable gas. The desirability of this Clause was strongly insisted upon, and it was passed. When, however, Clause 42, relating to travelling roads and haulage, was discussed, the Government admitted that they had taken samples of air from the main air-way of six or seven mines in all parts of the country, and in nearly all there was over half per cent. of gas. It would seem, therefore, that the mines in which naked lights are employed—chiefly in Scotland, where there are 71·8 per cent. of naked lights (the small "Scotch" lamp worn in the miner's cap), as against 8·4 per cent. in England—will gradually discontinue this practice. It is, therefore, particularly regrettable that throughout the subsequent debate the "dangers" of electric power should have been discussed as equivalent to the danger from naked lights. There has been considerable confusion between Clause 32 and Clause 66, relating to the withdrawal of workmen when the presence of gas is observed. Mr. Patchell, in his remarks on the Bill at the dinner of the Birmingham Section of the Institution of Electrical Engineers, and the recent circular of the British Electrical and Allied Manufacturers' Association, both conveyed the impression that naked lights were permitted if the proportion of gas was less than 1¼ per cent., but this is not the case. The almost unmeasurable and practically universal ½ per cent. "normally" is to be the limit for naked lights, but if 1¼ per cent. is detected in naked light seams it is to be the signal for the immediate withdrawal of the men. We regret that Sir A. Markham, who is almost fanatically opposed to the use of electricity in any but the safest mines, and who, nevertheless, being a mine-owner himself, must certainly be in a position to appreciate thoroughly the difference between Clauses 32 and 66, rather promoted this confusion, for in proposing the 1¼ per cent. law for electrical installations, he insisted on the contention that electricity was as dangerous as naked lights, and should be used only under similar conditions.

To Clause 32, restricting the use of naked lights to seams in which the percentage of gas does not exceed ½ per cent., a useful addition was made on the proposal of Mr. Masterman on behalf of the Government. The addition is as follows:—

Provided that, subject always to the provisions of this Act and any regulations made thereunder as to the use of electricity in mines, electric lamps, if enclosed in airtight fittings and having the lamp globes hermetically sealed, may be used on main haulage roads and elsewhere within such limits as may be fixed by the regulations of the mine.

It is seen that this will encourage the further use of electric lighting in main roads and pumping stations in which the proportion of gas may exceed ½ per cent., but is less than 1¼ per cent., and considerable extension of electric lighting in the Scottish mines may therefore be anticipated. The words "or elsewhere" were inserted at the suggestion of Mr. S. Roberts so as to include pumping stations. Mr. Atherley-Jones, in the discussion on this amendment, referred to the coal-dust experiments of Prof. Thornton and the "extreme danger in terminals from short-circuit," and asked for an assurance from Mr. Masterman that the necessary safety regulation would be insisted on by the inspectors, and Mr. Masterman replied that the Home Office "will lean to the side of extreme caution in the matter."

We give below a report of the discussion on Clause 59 (Clause 60 in the original Bill) relating to the use of electricity. The clause as finally amended reads as follows:—

(1) Electricity shall not be used in any part of a mine where, on account of the risk of explosion of gas or coal dust, the use of electricity would be dangerous to life, and if the owner of a mine, on being required by an inspector of the division not to use, or to desist from using electricity in the mine or any part thereof on such ground as aforesaid, refuses to do so, the question as to the application of this Section to the mine or part thereof shall be settled in manner provided by this Act for settling disputes.

(2) If in any place of a mine, or part of a ventilating district of a mine, the amount of inflammable gas in the air currents exceeds 1¼ per cent., the use of electricity shall at once be discontinued in such place or part of such ventilating district where the inflammable gas exists till the air current is clear of the same, or shall not exceed one-half per cent.

(3) When any question under this Section is to be settled by arbitration, the owner shall, pending the settlement of the question, comply with the requirement of the inspector subject to an appeal to the Chief Inspector.

(4) The use of electricity in any mine shall be subject to general regulations under this Act.

Mr. NEWMAN (Unionist) moved that Sub-section (2) should be deleted. He referred to the recent report of the Depart-

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mental Committee on the Use of Electricity in Mines, in which it had been pointed out that, although the employment of electricity should be prohibited where inflammable gas occurred daily or frequently, prohibition was not required when from all the evidence available gas was likely to be of rare occurrence. The danger would only arise in the latter case in the unlikely event of a simultaneous coincidence of the presence of gas or a dense cloud of coal dust, a sufficient failure of apparatus to produce intense sparking, and failure of the officials or workmen to observe the rules. These rules made this sub-section redundant. They included a provision that each motor, when working, should have a safety lamp by it, and that pressure should be cut off from the motor immediately the lamp indicated the presence of fire-damp.

Mr. J. E. GORDON (Unionist) seconded the amendment.

This amendment was subsequently withdrawn, and an amendment proposed by Mr. Lyell (Radical) and Sir A. Markham was accepted, altering the Clause to read as it stands above. When it came down from the Standing Committee, electricity was (at the suggestion of Sir A. Markham himself) prohibited if the percentage of gas exceeded ½ per cent., but he now proposed that this should be increased to 1¼ per cent.

Sir A. MARKHAM (Radical) in opposing Mr. Newman's proposal, said that there was no such thing on the market as a gas-tight motor. In any mine with which he was associated, if a motor were taken in where gas existed in any quantities, the manager would very soon cease to occupy his position. He explained that when a motor cooled down after a run it breathed in the air through the journals and along the shaft, and said that one could not prevent open sparking as one could on the surface. The Clause would give security against something which the men throughout the country regarded as the most dangerous thing introduced into mines for many years. Every inspector, he said, regarded the advent of electricity into mines with the greatest amount of alarm, and he had not met a single mine owner who wanted to work a motor where a mixture of gas and air was present. The electrical industry, he said, did not know what they were talking about. No sane manager would introduce what might at any time cause open sparking, but there were certain madmen who wished to use motors in mines where gas was present. The representatives of the miners asked that the use of electricity should be abolished altogether, and he hoped the House would allow it only under conditions where a naked light was used in mines at the present time.

Sir F. BANBURY (Unionist) said that, having listened to the arguments, he thought there was a great deal to be said against the withdrawal of the Clause.

Mr. T. E. HARVEY (Labour) said that although there were over a million workmen they did not differ on this question. The greatest dread of the miners was of electricity being introduced into the mine at all. He was convinced that the West Stanley explosion had been the result of electricity. At one colliery he knew of a case in which electric coal-cutters were giving off sparks and flames.

Mr. MASTERMAN (on behalf of the Government), said: "I am sure the mover and seconder of this amendment did not intend to convey the impression that on such a Bill as this we should pay any attention whatever to the demands of the electrical industry. Our sole concern is with the safety of the mine, and, if we are quite convinced that some such provision as this is necessary in the interests of the safety of the mines, the electrical industry will have to adapt itself to that limitation." Interviews with divisional inspectors and others had convinced him that, with the best provision in the world, there was danger of electricity producing what would be similar to a naked light. They were providing new and drastic regulations which, he was glad to say, would be accepted by the coal-owners without arbitration. In those regulations they did very largely apply the standard which they were now putting into a general Sub-section. Such rules provided that the pressure should be cut off from any motor when the safety lamp showed any indication of fire-damp. Where they could not use naked lights the mines should be cut off from the electrical machinery, which should not be worked until the district affected was free of gas.

Viscount CASTLEREAGH (Unionist) pointed out that the Home Office Regulations provided for under Subsection (4) would deal with the matter far better than by Act of Parliament.

Viscount WOLMER (Unionist) said that it was quite possible for the machinery to get out of gear between the visits of inspectors.

Mr. FENWICK (Radical), speaking as a practical miner, thought that users of electricity should be placed in the same position as users of naked lights, but considered that the Subsection might well have been omitted from the Bill, and the matter dealt with by the Special Rules.

Colonel HICKMAN (Unionist) said that there were sufficient safeguards without this subsection, *e.g.*, Subsection (1), and the provision for arbitration in the case of difference between the mine-owner and the inspector.

Sir A. MARKHAM interposed the remark that in all cases in which the Home Office had gone to arbitration it had been beaten.

Colonel HICKMAN, continuing, pointed out that fresh inventions were being evolved to improve the applications of electricity, and it would be easier to apply these improvements if this sort of thing were arranged by Regulations than by a strict clause in an Act, which could only be altered by another Act of Parliament.

Sir HILDRED CARLILE (Unionist) complained that Mr. Masterman's statement had confused the issue so far as men like himself, with no technical knowledge, were concerned. It had been shown that naked lights were unsafe in almost every mine, and yet Mr. Masterman laid it down that electricity should not be used except where a naked light was safe. From what he knew of electrical engineers, he thought they would fasten on the difficulty and clear it up.

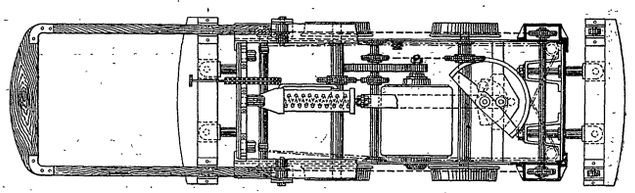
Mr. ENOCH EDWARDS (Labour), urged that it was well to keep on the safe side in a subject which they did not understand. The men felt that there was a danger and dreaded it.

Sir C. CORY (Radical) agreed that electricity was dangerous. He generally preferred rules to be laid down by Parliament, but the use of electricity was in such a transitional stage that he thought it would be better to leave it to regulations to be made from time to time.

Mr. NEWMAN then formally withdrew his amendment, and the amendment proposed by Mr. Lyell and Sir A. Markham was agreed to.

A MINING LOCOMOTIVE WITHOUT A DRIVER

A SOMEWHAT curious system of underground transport used in a mine at Von de Heydt, in the Saar district (Germany) is described in *Elektrische Kraftbetriebe und Bahnen*. Electric accumulator locomotives are employed, with an automatic controlling arrangement, instead of a driver. The locomotives are small in size, and are under 2½ tons in weight, and draw from 10 to 16 tubs. As shown in the figure, the locomotive has a long projecting bow-shaped buffer, which, when it meets an obstacle, is pushed in and thereby puts the controller through the off position into the braking position, stopping the train before the buffer has reached its



PLAN OF AUTOMATIC MINING LOCOMOTIVE.

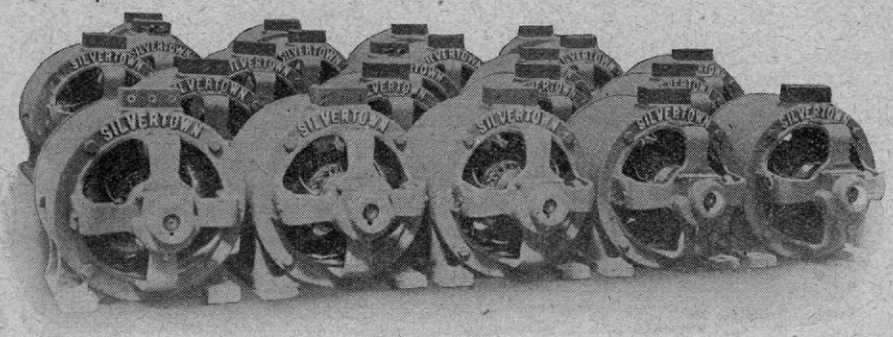
innermost position. As soon as the obstruction is removed the buffer is pushed out again by its springs, and the locomotive starts again. The speed does not exceed about 2¼ miles per hour. Special arrangements are provided for opening ventilation doors automatically before the locomotive reaches them, and an automatic gate is employed at junctions, which is locked by the pressure of a train fouling the junction, and released as soon as it has passed, permitting the branch train to proceed and follow the train from the main line.

Association of Mining Electrical Engineers.—A meeting of the West of Scotland Branch was held on Friday evening, November 17th, in the Technical College, Glasgow. Mr. A. Anderson presided. The Chairman and Professor Burns explained the system and method of examination for the Association certificate. An animated discussion ensued regarding the status and qualifications of a competent person as referred to in the Home Office Rules. Two Papers, "Electricity in Connection with Explosives," by E. Kilburn Scott, and "Lessons to be Learned from the Electrical Mining Accidents in Scotland," by C. A. Carlow, were considered, and discussion on them was adjourned to the next meeting. It was resolved to take a ballot of members to ascertain whether future meeting should be held on Saturday afternoons instead of Friday evenings.

Electricity in Mines in France.—In view of the amendments to the Coal Mines Bill, the following extract from the French mining regulations, reproduced in the *Iron and Coal Trades Review*, will be of interest. The use of electricity is prohibited in mines in which sudden outbursts of firedamp are liable to occur, except for portable electric lamps and for electric shot-firing. In other fiery mines, the only places in which electrical installations are permitted are the intake air shafts, in or near the bottoms of these shafts, and in or near galleries into which the ventilating current penetrates directly from the intake shaft without having passed through any working place. With the authorisation of the Government mining authorities of the locality, sheathed cables may be laid in the return airways of slightly gassy mines.

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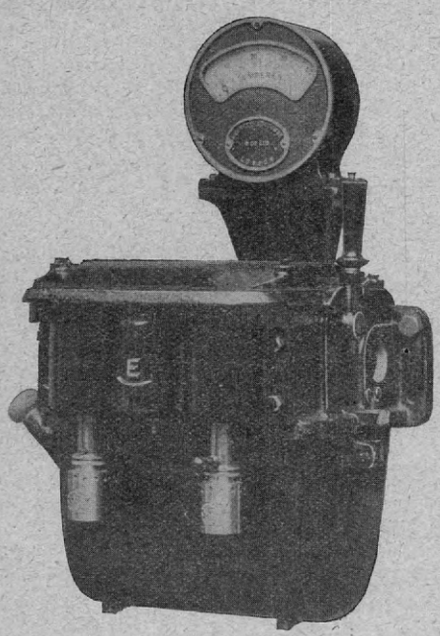
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ELECTRICITY IN MINES DURING 1910

PART II. of the General Report on Mines and Quarries for 1910, by the Chief Inspector of Mines, includes a report by Mr. R. Nelson (H.M. Electrical Inspector of Mines). In this report it is mentioned that electricity was newly introduced into forty mines during the year. Attention is also drawn to the installation of a new shaft signalling apparatus with electrically illuminated visual signals in a large colliery in the north of England.

Accidents.—During 1910 there were twenty-one fatal accidents as a result of the use of electricity in coal mines, causing twenty-one deaths. No fatal accidents attending the use of electricity in metalliferous mines were reported. Of the above twenty-one accidents twenty were due to electric shock, the remaining one being due to suffocation as a result of an underground fire. There were no fatal ignitions of firedamp caused by electricity throughout the year. During 1909 there were in all fifteen fatal accidents causing twenty-three deaths: there were, therefore, on the whole, two deaths fewer in 1910 than in 1909.

Some details are given of two slight underground fires, which originated in motor rooms, and the use of timber and other inflammable material is deprecated. Of the twenty electric shock accidents already referred to, four took place on the surface and sixteen below ground. Of the four surface accidents, all occurred on three-phase systems, three of medium pressure, and the other of high pressure. Two took place at coking plants, and in each case the victim made contact with live trolley wires, normally inaccessible, while oiling the machinery without switching off the pressure first. A third was due to contact with a live part of high-pressure switchgear, the deceased having presumably attempted to make some adjustment, without, however, having first switched off the pressure. The remaining surface accident was caused by the breaking of an insulator on an overhead line, which allowed a live medium pressure wire to make contact with a steel stay wire. Of the sixteen underground accidents, eleven occurred on three-phase systems, two of low pressure, seven of medium pressure, and two of high pressure, and the remaining five on medium pressure continuous current. The causes of these fatalities are summarised as follows:—Absence of, or inefficient earth connection, six; defective insulation of cable system, six; contact with uninsulated live parts, three; misadventure, one. The last mentioned is supposed to have been caused by the curiosity of the victim in probing the inside of a starting switch with a piece of copper wire. Of the fatal cable accidents, one was from an armoured cable, and the remainder from unarmoured cables. In this connection it is interesting to note that the total fatalities from unarmoured cables from 1905 to 1910 were twenty, while only two occurred from armoured cable and two from concentric cables.

Three non-fatal underground fires caused by electricity were reported in 1910, one due to passing tubs knocking over a timber support to a junction box, and another by a cable breakdown setting fire to timber in a pump-room. There were also forty-eight non-fatal shock accidents generally trifling in their results. In one case the victim was restored by Silvester's method of artificial respiration.

Mr. Nelson concludes as follows:—

The admission that much of the electrical plant in use below ground is not by any means all it might be is quite commonly made by those well qualified to offer an opinion, and I agree with that view; but that those accidents which occur are thereby explained does not, as is frequently assumed to be the case, immediately follow. Though it is probable that something remains to be done in replacing plant which is actively or potentially dangerous from the point of view of the risk of electric shock, it is certain that there is much more to be done in improving the standard of upkeep of electrical plant below ground. A great proportion of accidents might have been avoided by systematic and thorough inspection and maintenance of the various plants. So high a proportion of preventable accidents is not creditable to colliery electricians. H.M. Electrical Inspector of Factories has to report nine fatal electric shock accidents in factories throughout the United Kingdom during the year 1910, as against 48 electric shock accidents in and about mines. It is hardly possible to suggest that those responsible for the upkeep of electrical plants below ground are less conscientious than those occupying similar positions on the surface, but from personal observation I do doubt whether all colliery electricians are thoroughly alive to some of the dangers which commonly occur in underground working, and the figures just quoted are, I think, some confirmation of that view. I would mention specifically the casual and obviously inefficient way in which earth connections are so often made; the tendency to dispense with systematic inspection and testing of apparatus, or in other words, the tendency to assume that everything is right until something is shown by an accident or breakdown to be wrong; and, finally, the very common failure to protect unarmoured cables during shot-firing operations. Each of these causes is directly or indirectly responsible every year for some accidents, and yet a colliery electrician would be likely to repudiate any personal responsibility for an accident so contributed to or so caused. Nevertheless such responsibility has existed and does exist in greater or less measure in many cases, and the occasion for it is damaging to the electrical industry, as undue weight thereby attaches to the arguments of those who would prohibit the use of electricity below ground, in spite of its advantage from an economic standpoint, and in spite of its advantage to the workmen in saving what would otherwise be arduous labour. However small when expressed as a percentage of the total number of fatal accidents in mines those due to the use of electricity may be, there still remains room for improvement.

Electric Miners' Lamps.—In dealing with the question of safety lamps, the Chief Inspector says: There seems every probability that had electric hand lamps been in use at the Whitehaven and Hulton Collieries the disasters which took place there during the year would not have occurred, as, in the case of both these disasters, there is little or no doubt that the igniting cause of the explosion was a gauze safety lamp.

The total number of miners' electric hand lamps in use during the year 1910 was 2,055, or 0·28 per cent. of the total, as compared with 2,155, or 0·32 per cent. of the total in use during the preceding year. A great majority of the lamps are used in Durham—namely, 1,797—and their use is practically restricted to one colliery.

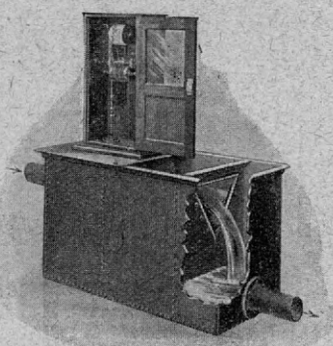
Attention is drawn to the prize that is being offered for the best design of electric miner's lamp (see ELECTRICAL ENGINEERING IN MINES, June 1st, page xli.).

Electric Coal Cutters.—Figures are also given in the report of the number of coal cutters of various kinds in use. It appears that a total of 873 electrically-driven machines are employed, as compared with 777 in the previous year. Of these 504 are disc machines, 261 are of the bar type, 207 have chain cutters, and only one percussion machine is in use. The Scotland district and the York and North Midland district take the lead as regards the number of machines employed, more than 54 per cent. of the total number of machines in use being employed in these two districts.

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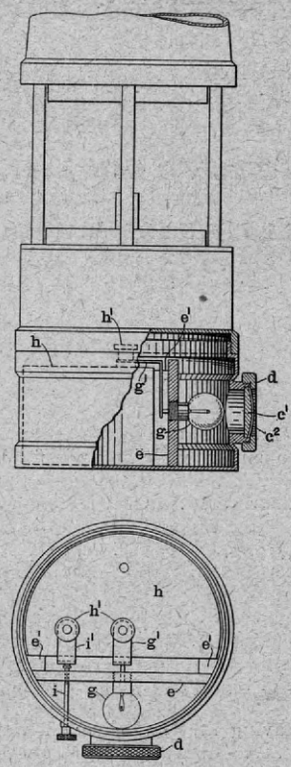
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MINERS' SAFETY LAMP



MINERS' SAFETY LAMP.

THE patents published last month of interest to mining engineers, included a specification, No. 4,722 of 1911, by T. Jones and T. R. Davies, relating to a safety lamp. This is provided with an emergency electric lamp, g, which, with its accumulator, is arranged in a small brass or aluminium casing, adapted to be screwed on or preferably locked to the bottom of the oil container, which can be done by a ratchet and pawl device operated by a key or by magnetism. The opening in the side of the casing is provided with a ring seating, to take a lens c^1, which is protected by wire gauze, c^2, and both are secured by a ring cap d. The figure shows the lamp g carried by a socket in the bridge piece e, which also acts as a reflector. Distance pieces e^1, placed between this and the accumulator, serve to keep the latter in position, and also provides a space for the contact pieces i^1 and g^1, which are attached to the terminals h^1. One of these is connected to the centre contact of the lamp, and the circuit is completed through the adjustable contact switch i, which may be in the form of a screw pin.

Articles of Interest to Mining Electrical Engineers published in "Electrical Engineering" during November.

November 2nd.—Monthly supplement on "ELECTRICAL ENGINEERING IN MINES," opening with notes on the electric power plant of a group of shale mines and oil works in Scotland, and containing a long article describing the electrical equipment of the Rhymney Valley collieries of the Powell Duffryn Steam Coal Co., which include generating plant driven by coke oven gas and exhaust steam, as well as two of the largest electric winding plants in the world at a colliery which is entirely without boilers. Reports are given of the annual meeting of the Association of Mining Electrical Engineers, and several branch meetings. Other articles include some notes on Electricity in Mines in Scotland, and a discussion on the avoidance of electrical accidents in mines.

November 9th.—Notes on a large South American power plant and some plant extensions in a London generating station.

November 16th.—Literary supplement containing reviews of books and a selected list of works in all branches of electrical engineering. Papers and discussions on high-voltage transformers and turbo-generators. References to the Coal Mines Bill at the Birmingham dinner of the Institution of Electrical Engineers.

November 23rd.—Action taken by the B.E.A.M.A. with regard to the Coal Mines Bill.

Electric Lamps for Mines.—At a dinner of the Scottish Branch of the National Association of Colliery Managers in Edinburgh recently, Mr. W. Walker, in replying to the toast of H.M. Inspectors of Mines, said that the new Mines Bill would, if it became law, put more responsibility on both the manager and the inspector. He also referred to the large number of preventable accidents caused by ignition of gas from naked lights, and said that there was a better light than either the naked light or the safety lamp, and that was the electric light. There was a great future for portable electric lights in mines, and he would like to see the colliery managers devoting their energy to devising a lamp to meet all conditions.

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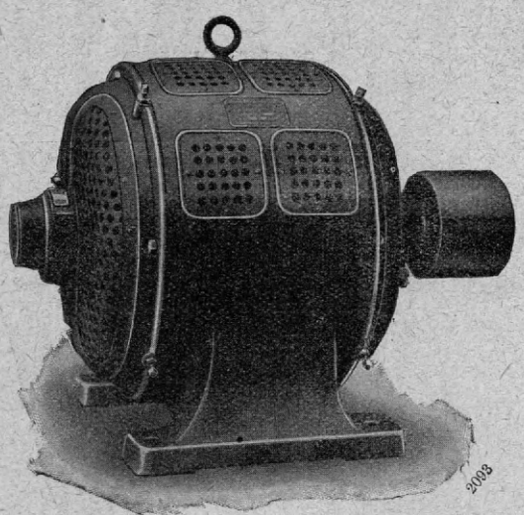
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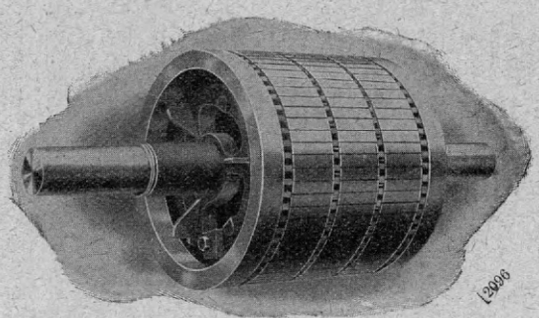
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AUTOMATIC REVERSIBLE BATTERY BOOSTERS

MR. R. RANKIN'S Paper on automatic reversible battery boosters, read before the Institution of Electrical Engineers on November 23rd, was discussed at Manchester on Tuesday, November 28th (see ELECTRICAL ENGINEERING, November 30th, page 655).

Mr. E. C. MCKINNON (Chloride Electrical Storage Co.), who opened the discussion, drew attention to the wide use of boosters in this country, the United States, the Colonies, Japan, and China, although on the Continent end cells and regulating switches were much more usual. It was a pity that there were so many systems in competition, and it would really be advantageous if some of the less efficacious types were removed from the market.

Mr. A. G. COOPER (Borough Electrical Engineer, Colne) said that at Colne the battery had been scrapped long ago, but he was pleased to hear that they were now so much improved.

Mr. P. P. WHEELWRIGHT (Borough Electrical Engineers, Blackburn) spoke of two years' satisfactory experience of an Entz booster which was very rapid in action.

Mr. C. L. E. STEWART (Borough Electrical Engineer, Rawtenstall) had had a Lancashire booster running for 2¾ years, and had found it quite quick enough in action for a traction load. The voltage regulation was also good enough to connect lighting consumers to the traction circuit.

Mr. H. T. WILKINSON (Wardle Engineering Co.) deprecated the Continental regulating switches, and wished to know why there were not greater developments in this country in the regulation of alternating systems by batteries and boosters.

Mr. H. C. CREWS (Crews and Handford) recorded his satisfactory experience with a Lancashire booster in an installation containing several large lifts.

Mr. C. C. ATCHISON (Borough Electrical Engineer, Rochdale) was not sure that extreme rapidity of response was always essential, and thought that different types of boosters might be best for different circumstances. He looked forward to great developments in connection with alternating current supply.

Mr. J. Frith also made a few remarks on diverter boosters, and the author replied briefly.

THE LOTS ROAD TURBINES

JUDGMENT was delivered on Monday in the dispute between the British Westinghouse Electric & Manufacturing Co., Ltd., and the Underground Electric Railways Co. of London, Ltd., regarding the substitution of Parsons turbines for Westinghouse turbines at the Lots Road generating station. We gave details of the case in our issue for November 9th, p. 610. Briefly, the facts are that certain Westinghouse steam turbines failed to come up to the contract figures for steam consumption, and Parsons turbines were substituted. This was done by agreement between the parties, but a dispute arose as to the amount the Westinghouse Co. should pay as damages for the failure of their turbines to come up to contract. The arbitrator, the Hon. Alfred Lyttelton, K.C., acting upon directions from the High Court, to which he appealed for advice, assessed damages on the basis of the difference between the actual and guaranteed steam consumption of the Westinghouse turbines during the five years they were at work, *plus* the whole cost of the Parsons turbines. An important legal point in the case was as to whether an arbitrator's award, when based upon directions from the High Court, as in this instance, is appealable. The Westinghouse Co. appealed to have the arbitrator's award set aside or remitted to him on the ground that these directions were wrong in law.

LORD JUSTICE VAUGHAN WILLIAMS, in giving his judgment, held that under Section 19 of the Arbitration Act of 1889 there is no appeal from a decision of the King's Bench Division when embodied in an arbitrator's award. Such a decision did not amount to a judgment or an order, and he quoted a judgment by Lord Esher to the effect that the Arbitration Act would be a "snare and a delusion" if an appeal under such circumstances were allowed. There never had been, he said, a case in which an appeal had been entertained against an arbitrator's award, because, as was contended by the Westinghouse Co. in this case, the advice given to the arbitrator by the High Court was wrong in law. The fact that the arbitrator had made the advice of the High Court part of his award made no difference. At the same time, he held that the advice given by the High Court in this case was perfectly right, and that the appeal should be dismissed with costs.

LORD JUSTICE KENNEDY agreed with Lord Justice Vaughan Williams on the main question as to the method of assessing the damages, but held that where the advice given by the High Court to an arbitrator was a mistake in law, that was good ground for the Appeal Court to set aside or remit the award to the arbitrator.

LORD JUSTICE BUCKLEY also took this latter view, but held that the appeal should be allowed for the following reason:—In his opinion the arbitrator had admitted in his award that not only was it a reasonable and prudent thing for the Underground Railway Co. to substitute Parsons for Westinghouse machines in consequence of the breach of contract, but that even if the Westinghouse machines had given the contract figures for steam consumption it would still have been a reasonable and prudent thing for the Underground Co. to instal Parsons machines, owing to their greater efficiency. He therefore thought the Westinghouse Co. were entitled to an order remitting the award to the arbitrator, as in his opinion the advice of the High Court was wrong in law, and that the arbitrator had been misdirected as to the basis upon which to assess damages. By a majority, however, the appeal was dismissed with costs.

STREET LIGHTING IN THE CITY OF LONDON

AFTER a long period of investigation and experiment, the City Corporation at its last meeting decided upon a scheme of street lighting for the next ten years. This scheme is the direct outcome of a visit by a deputation of the City Corporation to the Continent in 1908 (ELECTRICAL ENGINEERING, Vol. V., page 645). During the past four or five years there has been keen competition between the City of London Electric Lighting Co. and the Gas Light & Coke Co. for the street lighting of the City, and experimental demonstrations of modern methods of street lighting have been carried on by both companies. After one or two more or less minor experiments, a large scheme was put into use last year with a view, mainly, to testing the practical usefulness of lamps suspended across streets, central standards, and side brackets. As a result of the inquiries of the deputation mentioned above, there was a strong prejudice in favour of using centrally hung lamps, wherever possible, and the experiments with electric lighting in this connection were fully described in ELECTRICAL ENGINEERING, December 22nd, 1910, Vol. VI., page 803. Similar experiments with gas lighting were being carried out simultaneously.

With the results of these later experiments before them, the City Corporation were able to draw up a scheme for the complete lighting of their area, and tenders were invited for the work from the electric and gas lighting companies. In view of what took place in Holborn, where the electricity and gas companies decided to prepare a joint tender rather than continue a disastrous competition, it is not without some significance that in the case of the City lighting neither company was prepared to quote for the whole, but preferred to continue lighting the portions already dealt with by each. The official reason given for this attitude is that it is due to the large capital expenditure which would be involved. Therefore, a joint scheme of electric and gas lighting has been accepted which will give a total increase of 601,765 c.p. for a decreased cost of £6,832. The City of London Electric Lighting Co. will receive £7,322 per annum for a much increased illumination, as against £10,744 at present, and the Gas Light & Coke Co. £6,709, against £10,099, making a total of £14,041 per annum against the present figure of £20,873. The increased candle-power is almost double the present aggregate. Although the Charing Cross, West End, and City Electricity Supply Co. fitted some experimental centrally hung arc lamps in Cannon Street, they did not tender for the larger scheme.

So far as the main thoroughfares are concerned, we believe it is the intention to adopt lamps of 2,000 c.p. suspended from span wires, similar to those now used in Cheapside, it having been found that these throw no shadows, and give a very efficient illumination.

Students' Section of the Institution of Electrical Engineers.—Some changes have been made in the Committee of the Students' Section, which is now composed of Messrs. E. F. Hetherington (*Chairman*), P. G. Ryder (*Vice-Chairman*), H. C. Burrowes, E. L. Emtage, J. F. Forrest, R. N. James, C. G. Shaw, H. W. Gregory, E. W. Moss, D. Betts, J. C. Rennie, and G. W. P. Page. Mr. J. B. Sparks, 27 Mowbray Road, N.W., is Honorary Secretary, and Mr. J. Mould is Honorary Assistant Secretary. Programmes of Papers have been arranged for the London, Manchester, and Glasgow Students' Sections, but so far no visits to works have been announced.

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A TRAIN LIGHTING SET FOR INDIA

We are able to illustrate here, through the courtesy of the British Thomson-Houston Co. (Rugby) a train-lighting plant driven by a paraffin engine, which they have supplied to Messrs. Turner, Hoare & Co., of Bombay, for use in the royal train to be used by his Majesty King George V.

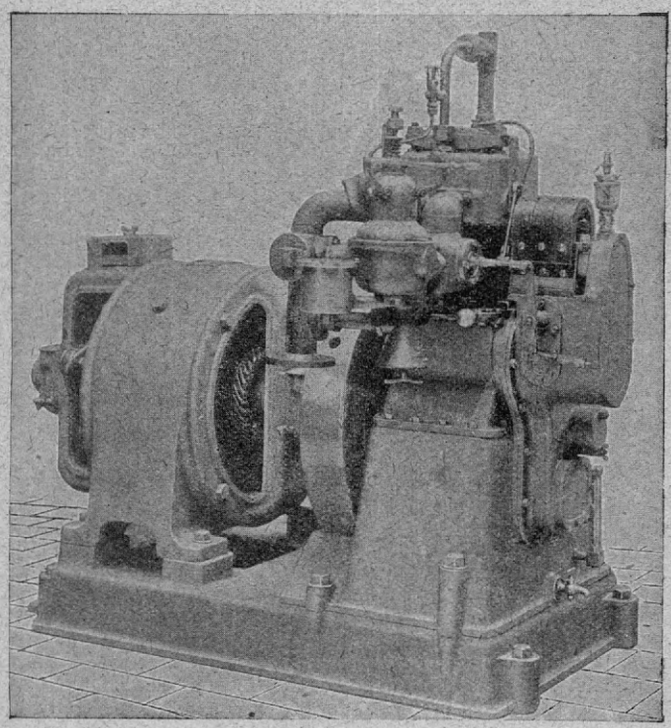


Fig. 1.—Paraffin Engine and Dynamo.

in travelling in India to and from the Durbar. This set will be installed in one of the cars composing the royal train, from which all other cars will be lighted. We understand that a special train has been built for his Majesty's sole use during all of his journeys in India. The generating plant which is shown in Fig. 1 consists of a 4·8-kw. 25-32-volt

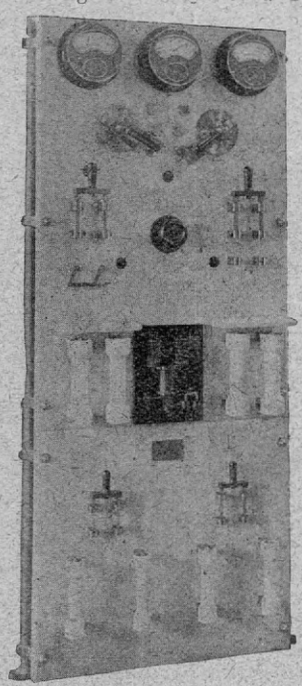


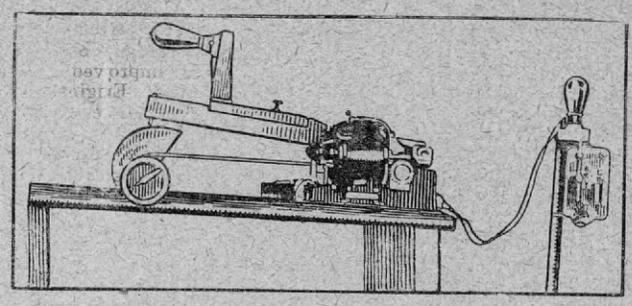
Fig. 2.—Switchboard.

B.T.-H. generator, direct coupled, and mounted on a combination base to a paraffin engine. The marble panel for controlling this set is shown in Fig. 2, and consists of a combination generator and accumulator panel, which was equipped with the necessary instruments, rheostat, cut-outs, switches, and charging and discharging switch.

WIRE DRAWN LAMP FILAMENTS

Some tests in America with the special apparatus illustrated here have shown clearly the strength of the Mazda drawn tungsten filament. In this apparatus the arm upon which the lamp is mounted is brought to a constant position by each revolution of a small cam, and is allowed to drop freely from this position upon a second cam constructed according to the principle of the spiral. The drop increased from 1/100 of an inch at the start to four inches maximum, having a constant increment of 1/100 in. per revolution. The fall at which the filament breaks is indicated directly upon a dial in hundredths of an inch by a pointer attached to the large cam.

In a comparative test of 25-watt lamps with the old squirted filament and the new drawn-wire filament, the old style of lamp



Lamp-testing Machine.

broke at 0·06 in., while the new one was dropped 3·75 in. before it broke. Similarly, a 60-watt lamp with the old filament could only reach 1·15 in., while a 4-in. drop failed to break the drawn filament of the same size. In another test reported from America, some 100-volt lamps were placed on a rack which was hinged at one end and permitted to drop periodically upon a solid surface from heights varying from 6 to 24 inches, and withstood 3,697 such shocks without breaking.

The British Thomson-Houston Co. also send us some extracts of letters they have received showing the durability of the drawn filament. One of these describes the successful use of Mazda lamps at the top of a colliery pit-head having a continual vibratory lateral movement of about 2 in. Another from South Africa states that the breakages in a batch of 1,200 lamps shipped in cardboard boxes in crates did not exceed 1 per cent., while a contractor writes that of a batch of lamps which arrived in a box badly damaged in transport, only one arrived broken.

Tests have also been conducted during the past year by the United States Navy on drawn wire Mazda lamps to determine their serviceability for use on warships. The formal test, which was started in November, 1910, was continued until July 1st, 1911. Since that time, however, the officers on the ships have kept the lamps under observation, and many are still burning which were installed in November and December, 1910. The following table gives a summary of the results for the period from November and December, 1910, up to July 1st, 1911:—

Size of lamp in use.	Total Mazda Lamps installed.	Average life of Mazda Lamps to July 1st, 1911.	Lamps broken during target practice.
25 Watt.	375	755 hours	12 lamps or 4%
40 ,,	842	1155 ,,	28 ,, ,, 3%
60 ,,	36	1677 ,,	1 ,, ,, 0·3%
400 ,,	8	1386 ,,	—
500 ,,	9	2563 ,,	—

The Electrical Engineers' Ball.—The Electrical Engineers' Ball for 1912 will be held at the Hotel Cecil on Friday, February 16th. A strong Committee has been formed, consisting of the following gentlemen:—H. Alabaster, Leonard Andrews, Frank Bailey, O. H. Baldwin, R. Belfield, W. W. Blunt, J. H. Bowden, T. Browett, C. S. Vesey Brown, E. S. Byng, Jas. Callender, A. C. Cramb, F. R. Davenport, Harold Dickinson, Sydney Dobson, R. S. Erskine, S. Z. de Ferranti, E. J. Fox, E. Garcke, T. E. Gatehouse, Sir J. Gavey, Jas. Gray, R. Kaye Gray, A. E. Hadley, R. Hammond, Charles Hill, J. S. Highfield, H. Hirst, Col. H. Capel Holden, J. E. Kingsbury, E. M. Lacey, W. E. Lane, H. M. Leaf, F. A. C. Leigh, W. L. Magden, W. Lee Matthews, W. M. Mordey, P. V. McMahon, Lee Murray, F. H. Nalder, E. A. Nash, Major O'Meara, Hugh A. Pearson, T. Petersen, M. J. Railing, J. E. Raworth, Martin F. Roberts, W. Rutherford, G. F. Rowell, Sydney Sharp, J. Shepherd, Alex. Siemens, A. M. Sillar, H. Scholey, J. E. Spagnoletti, C. P. Sparks, J. J. Steinitz, G. Sutton, J. Taylor, R. J. Wallis-Jones, C. H. Wordingham. The Executive Committee consists of Messrs. Baldwin, Fox, McMahon, and Wallis-Jones. The Hon. Secretaries are Messrs. H. Alabaster and A. M. Sillar, and Mr. J. E. Kingsbury is Hon. Treasurer.

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TIME ELEMENT CIRCUIT-BREAKERS

THERE is a mistaken idea that time-element circuit-breakers of the dash-pot pattern are not reliable at different temperatures, and that the range of adjustment is adversely affected by local conditions. This may be the case with some makes of circuit-breakers, but from curves and data placed at our disposal by Messrs. G. Ellison (Victoria Works, Warstone Lane, Birmingham), it is evident that the device which this firm employs gives practical immunity from these defects. The curves, some of which we reproduce, are from tests made at the National Physical Laboratory.

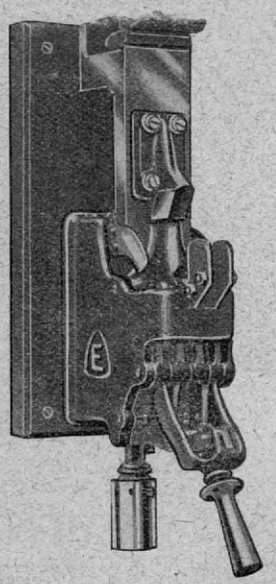


FIG. 1.—CIRCUIT-BREAKER WITH ADJUSTABLE TIME LAG.

Fig. 1 is a general view of the circuit-breaker, and Fig. 2 shows the construction of the adjustable dash-pot. The piston of the latter and the lower end of the cylinder in which it moves are tapered, so that the retardation can be decreased or increased by lowering or raising the cylinder, and thus varying the clearance and the rate of flow of the oil. The screw thread, S, of fairly small pitch, enables the height of the cylinder to be accurately adjusted, and it is locked in position by the set screw, A, which will engage in any one of a series of numbered tapped holes shown in the elevation. This gives a very wide range of extremely fine adjustment. Another feature of this circuit-breaker is that the retardation of the plunger only takes place during about $\frac{1}{8}$ in. of the stroke, so that it is free during the remainder of the stroke to travel up quickly and to deliver the necessary sharp blow to the retaining hook of the circuit-breaker.

Fig. 3 shows the results of a test made with different oils at two different temperatures, to ascertain the effect of changes of temperature on the time-element adjustment.

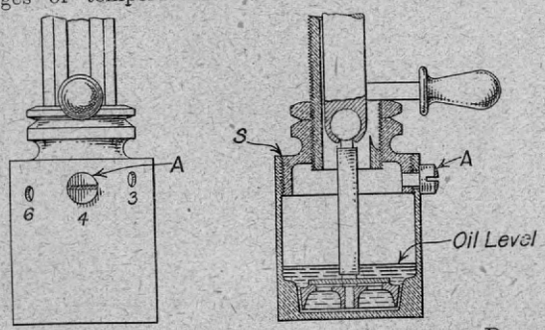


FIG. 2.—ELEVATION AND SECTION OF ADJUSTABLE DASHPOT.

The third curve in which thin cycle oil is employed—the oil recommended by Mr. Ellison in ordinary circumstances—shows that with 10° C. difference of temperature it is unnecessary to change the adjustment. Thicker oils and glycerine would only be used when long retardations are required, and, although with these the effect of the change of temperature is more marked, it is evident that the wide range and accuracy of adjustment quite compensates for this. These curves are for a 10-ampere circuit-breaker, tested with 13 amperes.

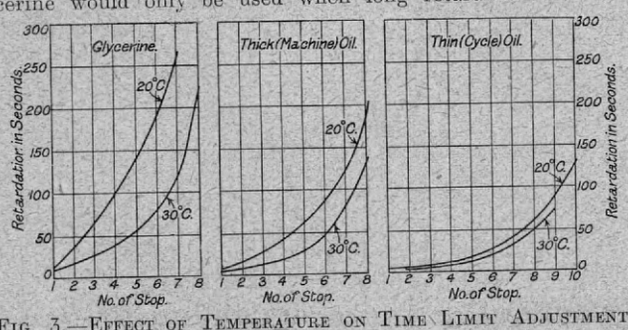


FIG. 3.—EFFECT OF TEMPERATURE ON TIME LIMIT ADJUSTMENT.

Fig. 4 is the record of a series of tests on the effect of considerable vibration. It is seen that in situations where the circuit-breaker is subjected to serious vibration the retardation is diminished about 50%, but the shape of the curve shows that the adjustment can easily be altered to suit the different conditions. A further test was made to ascertain the effect of slow oscillation, such as would be met with on board ship. The circuit-breaker was suspended on hooks, and tested at the different settings, while oscillating slowly over an arc of 17°, the only difference in the adjustment being that the amount of oil in the cylinder was increased to ensure that the piston was covered with oil at all times. It was found that there was no observable difference between the results and those in which the circuit-breaker was securely fixed without vibration.

Fig. 5, showing a series of tests on a 10-ampere circuit-breaker with overload, demonstrates that the circuit-breaker possesses a true inverse time-element; that is to say, that, as the overload increases, the time that elapses before the circuit is broken decreases. The curve with the thin oil indicates the conditions usually required in practice, but the retardation at higher loads can be increased by using a still thicker oil than heavy machine or by employing glycerine.

A modified form of dash-pot is also applied in some cases in connection with the firm's star-delta starting switch,

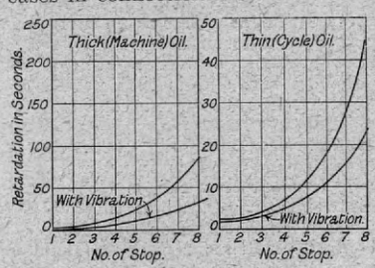


FIG. 4.—EFFECT OF VIBRATION.

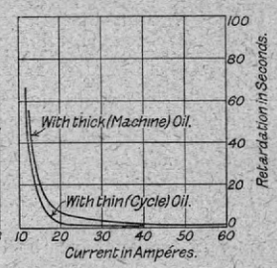


FIG. 5.—SHOWING INVERSE TIME ELEMENT EFFECT ON HEAVY OVERLOADS.

to prevent switching over too soon from the starting to the running position. After switching on to the starting position the handle of the switch is locked by a cam until the dash-pot has had time to set. The switches are also so designed that they cannot be put on to the running position first, so that the addition of the dash-pot device renders them absolutely fool-proof.

In addition to the foregoing, we are informed that this patent time-limit device can be fitted to almost any make of circuit-breaker. Although up to the present the device has not been widely advertised, we understand that it has been extensively used with good results.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

In the House of Commons on Wednesday last week Mr. Lardner asked the Postmaster-General whether an experimental automatic telephone exchange will be set up in Ireland in view of the fact that there are many small exchanges there for which the automatic system will be suitable both in efficiency and economy. He further asked as to the estimated cost of the experiments now being carried on with automatic telephones. The Postmaster-General stated that three experimental automatic exchanges were about to be established at Epsom, Caterham, and the General Post Office, London, where they can all be watched conveniently by the technical officers in the engineer-in-chief's department. This would not apply to an exchange in Ireland. No precise estimate of the cost of working the experimental exchanges was at present available; indeed, it is one of the objects of the experiments to ascertain that cost.

At the London Chamber of Commerce on Nov. 29th Mr. Charles Bright, F.R.S.E., gave an address on "The Atlantic Cable Position and its Moral." He referred to the amalgamation of the Western Union Telegraph Co. of America with the American Telephone & Telegraph Co., and pointed out the effect this has on British commerce. He urged the necessity of being able to carry on private communications with our Colonies, which was impossible under the present conditions. Again, in the event of misunderstandings with America, we could not rely on the companies' lines remaining neutral, which meant that we might be cut off at any time. A reso-

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Nov. 30, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

26,077/10. **Terminal Connections.** A. MUIRHEAD and C. F. C. WILKINS. A device for fixing terminals to cases containing electrical apparatus, consists in moulding an insulating body into a metal collar provided with a flange, which is soldered to the metallic lid of the casing. In one form, for additional security, the collar extends up the sides of the body, and is sometimes provided with a jamb nut which screws into the lid. The conductor passes through a central passage in the body, and is soldered to the usual metal socket, which is firmly secured. Six figures.

26,142/10. **Enamelling Wire.** A. COSTAR, D. BATES, and THE BRITISH INSULATED & HELSBY CABLES, LTD. The wire is passed in succession from the coating tank through a series of tubes arranged in a heating retort, the temperature of which is regulated by an air-admitting device. The lower ends of the tubes are immersed in the liquid, and just above, in the tubes, rubbers are fitted, which produce a firm, smooth pressure on the material, and obtain a uniform thickness free from air bubbles. They also remove all superfluous material and return it to the tank. The wire passes out at the top over a pulley, which carries water for cooling the coating, and is then passed down over other pulleys to the tank for the next coating. Four figures.

26,341/10. **Mercury Contact Breakers.** REINIGER, GEBBERT, and SCHALL AKT.-GES. The feature of this invention is that the contact is broken inside a chamber which is closed at the top, the bottom dipping into mercury on which alcohol floats. This generates gas when the circuit is broken, and forces the mercury away from the contact pin, thus rapidly extinguishing the spark. A solenoid actuates the contact pin. Four figures.

26,667/10. **Filament Supports.** E. R. GROTE. Thin mica discs attached to the central rod are perforated at regular intervals along the edges to take the filaments, and are slit radially between each pair of filaments to render them elastic. The upper disc is provided with conductors for joining each adjacent pair of filaments together. Instead of slitting the discs, they may be mounted with springs above and below the point of support, or mica rings held in spring wire supports may be used instead of the discs. Four figures.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

29,069 of December 8th, 1897. **Syntonic Telegraphy.** O. J. LODGE and A. MUIRHEAD. A system of signalling by Hertzian waves has receiving areas bridged by the coherer, inductance, and condenser, which are arranged in two parallel circuits in one arm of a Wheatstone bridge system, while the receiver and battery are across the diameters. By means of a rotating cylindrical switch, actuated by a switch lever, the coherer is automatically connected first to the receiving areas, to the receiver-signal circuits, or to a decohering apparatus which can be either mechanical or electrical. The areas are provided with a spark-gap and a latch, which is opened for transmitting and closed for receiving. The signalling is preferably done through a relay circuit, either by key or automatic transmission. The coherer apparatus is protected from outside disturbances by being enclosed in a metal casing.

29,306 of December 10th, 1897. **Wireless Telegraphy.** WIRELESS TELEGRAPH & SIGNAL CO. and G. MARCONI. This relates to certain improvements, in which the coherer is enclosed in a thick metal box provided with two openings. These are closed by shutters actuated by a lever, which carries two sets of contacts connected to earth and the conductor respectively. When transmitting the openings are closed, and the spark balls are in circuit, but for receiving the coherer is connected up by reversing the lever, which is pivoted.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad. Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: JOHNSON & PHILLIPS, LTD., and BROCKIE [Globes] 402/11; CONRADTY and CONRADTY [Electrodes] 14,729/11.

Distributing Systems: HOPE [Circuit fuse boxes] 29,631/10.

Dynamos, Motors, and Transformers: BROOKS and ALSTON [Machines for winding armatures] 26,225/10; FREEMAN [Dynamos] 26,393/10; ADAMS MANUFACTURING CO. (*Cutler Hammer Manufacturing Co.*) [Speed controlling device] 26,420/10; BRITISH THOMSON-HOUSTON CO. (*Allgemeine Electricitäts Ges.*) [Motor control] 5,289/11; SIEMENS SCHUCKERTWERKE GES. [Driving rotary field induction motors] 17,768/11; HAEFELY [Transformers] 20,524/11.

Electric Ignition: PODSZUS, 3,821/11; MEA FABRIK MAGNEI-ELEKTRISCHER APPARATE GES., 4,085/11.

Electrochemistry: VON BROCKDORFF [Electrolysis of liquids] 27,562/10.

Incandescent Lamps: BRITISH THOMSON-HOUSTON CO (*General Electric Co., U.S.A.*) [Incandescing bodies for lamps, &c.] 13,021/11.

Switchgear and Fittings: JONES, JOPP and SUNNUCKS [Globe or shade support] 26,410/10; DICKSON [Switches] 26,627/10; LEITNER [Electric regulators] 27,037/10; DICKSON [Thermally-actuated switch] 27,277/10; WALKER [Rheostats] 3,510/11; SANTO [Cut-out] 19,120/11.

Telephony, Telegraphy, and Signalling: DAVISON, and CHANCE BROS. & Co. [Submarine audible signalling apparatus] 26,657/10; DUNTON [Signalling devices for telephone systems] 12,898/11; STEINBERGER [Telephone mouthpieces] 14,591/11; WESTERN ELECTRIC CO. (*Western Electric Co., U.S.A.*) [Telephone receivers] 17,875/11.

Miscellaneous: BRITISH INSULATED and HELSBY CABLES, LTD., and BUCHER [Electric welding machines] 26,478/10; CANNING [Electric apparatus for gas lighting] 27,986/10; SWIFT and BAXTER [Electric clock] 29,747/10; TANNER [Automatic electric advertising] 30,176/10; WATSON, and MORRIS & LISTER, LTD. [Electrostatic machines] 1,036/11; R. WAYGOOD & Co., and WALKER [Lifts and hoists] 1,168/11, and [Brake mechanism of lifts, cranes, &c.] 4,167/11; BONNET [Bell pushes] 3,514/11; TRIQUET [Sterilising liquids by ultra violet rays] 9,047/11; J. HALDEN & Co., and WATTS [Electric photographic printing machines] 10,702/11; KNOWLES [Purification of electrolytic gases] 21,600/11; HELBRONNER, and VON RECKLINGHAUSEN [Sterilising liquids by ultra violet rays, 21,829/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electric Ignition: DIEHL, 24,970/11.

Fittings: SIEMENS SCHUCKERTWERKE GES. [Buffer machines for electrical conduits] 24,744/11.

Telephony and Signalling: SIEMENS & HALSKE AKT.-GES. [Semi and automatic exchanges] 19,456/11; AKTIEBOLAGET L. M. ERICSSON & Co. [Common battery system] 23,823/11 and 23,824/11; DE BRAAM [Automatic railway signalling] 24,128/11 and 24,237/11; WEISSMANN [Device for giving signals, &c., at a distance] 25,165/11.

Miscellaneous: COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATERIEL D'USINES À GAZ [Current-limiting apparatus] 13,315/11.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: S. SZUBERT [Thermal feed] 18,243/07; W. J. DAVY [Globe with ash-tray] 18,513/07.

Dynamos and Motors: J. F. JOHNSON (*Felten and Guilleaume Lahmeyerwerke Akt.-Ges.*) [Armatures, &c.] 18,156/06; M. COUADE [Electromotors] 3,927/07; R. B. RANSFORD (*Compagnie Parisienne des Voitures Électriques Procédès Krieger*) [Regulation and control] 18,245/07.

Electric Ignition: A. DE DION and G. BOUTON, 24,572/04; L. K. LEAHY, 16,916/06.

Electrochemistry: J. H. MONGE and C. ARZANO [Electroplating] 18,210/07.

Incandescent Lamps: R. and E. BOHM [Bulbs] 17,678/02.

Storage Batteries: E. M. SCHNEIDER [Secondary batteries] 18,565/06; W. FENNELL and W. P. PERRY [Secondary batteries] 18,348/07.

Switchgear and Fittings: S. S. BERRY [Flexible conductor protection] 18,304/06; L. M. WATERHOUSE [Lamp holder] 18,445/06; G. DAVIS [Lamp holders] 18,227/07; J. O. GIRDLESTONE and J. W. JONES [Automatic make-and-break switch] 18,319/07; J. B. M. P. H. R. D'IVRY [Switch operated by current impulses] 18,332/07; C. W. DAWSON [Shades, reflectors, and holders for lamps] 18,346/07; J. EWART [Tumbler switch] 18,406/07.

Telephony, Telegraphy and Signalling: BULLERS, LTD. and E. J. CHAMBERS. [Telegraph poles] 17,630/03; S. EISENSTEIN [Wireless telegraphy and telephony transmission] 16,435/05; G. E. GRIMM [Guard for telephone mouthpieces] 13,201/06; G. A. BAILEY [Tramway signalling] 18,187/07; C. H. ELLISON and C. M. JACOBS [Telegraph and telephone calls] 18,308/07.

Traction: J. S. RAWORTH [Electrically-propelled vehicles] 17,975/04; J. F. and J. WOOTTON [Electric signal contacts] 18,452/07; G. NEALE [Railway signals] 18,527/07.

Miscellaneous: E. A. HAILWOOD [Miners' safety lamps] 18,195/06; O. SCHÖPPE [Electric fire alarms] 18,242/07; B. P. HAIGH [Marine steering gear, electric control] 18,444/07; M. W. ROBERTSON [Carbon-brush connections] 18,462/07; L. D. J. A. DUNOYER [Magnetic measurements] 18,571/07; J. COLE [Electric signs] 18,573/07.

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lution was passed urging the Government for national as well as Imperial reasons not to transfer to any foreign corporation the licences formerly granted to British Atlantic companies. If this is impossible, then the Governments of our Dominions, especially Canada, should be co-operated with for the establishment of an independent and strictly all-British Trans-atlantic cable, and land line connecting with the Imperial Pacific Cable, this being in duplicate (on different routes), and worked on a low-rate basis, and further urges that this course be pursued in any case, even if favourable terms are secured under the present system.

A Conference of representatives of Metropolitan Borough Councils met at the Guildhall on Monday morning to appoint a deputation to wait upon the Postmaster-General to ask him to restrict the use of overhead telephone wires in London. In reply to this deputation later in the day, the Postmaster-General pointed out what a small proportion of the Post Office wires in the Metropolitan area is at present overhead, viz., only 330 miles out of 1,090 miles. Further, all the poles are situated on private property, and only 50 miles of overhead wire are along public roads. He once more pointed out that the whole question was one of cost. The cost per mile of the laying an underground wire was, he said, from five to ten times as much as that of an overhead line, and whilst he recognised the importance of putting wires underground where this policy could be economically justified, we still had to bear in mind the loss of £1,000,000 upon the telegraph system. He was anxious to avoid any friction between the Borough Councils and the Post Office, and suggested that a committee should be appointed by the former to confer with the Chief Engineer to the Post Office. One of the points which they might consider was whether the Boroughs would contribute towards the cost of placing the wires underground.

The lines of the Indo-European Telegraph Company, reported down in our last week's issue, are now working again. —The lines between Teheran and Chahroud were down on 29th ult. between Meshed and Astrabad, as were also the lines of the same company between Odessa and Kertch.—The French Government is about to open cables between Konakry, Monrovia, and Grand Bassam on the West Coast of Africa, which are apparently leading to competition between the Eastern African companies and the Government, for the latter have stated that the rates from Kotonon are the same as from Konakry for all traffic exchanged between Swakopmund and places south, and Canary Islands, Senegal, and Europe.—The Portuguese Government has also now taken control of the acceptance of telegrams from the public at Quelimane, Mozambique, and Lorenco Marques. This means that the Eastern and South African Telegraph Company is debarred from dealing with the public. Apparently the Portuguese Government possessed the right they have taken advantage of, under the old concessions.

ELECTRIC TRACTION NOTES

The Board of Trade report by Colonel Yorke on the fatal accident on the Birmingham and Midland tramways system on October 3rd has been published. It will be remembered that a car belonging to the Birmingham Corporation, after stopping to set down, ran back down Cape Hill, Smethwick, colliding with a Birmingham and Midland Tramways Co.'s car, carrying it down the hill, and causing it to collide with a third car belonging to the Corporation. Colonel Yorke is of opinion that there was no "failure" of brakes, but that the run back of the first car was caused by the driver carelessly allowing his hand-brake to become released before giving the car power, and failing to re-apply the hand-brake. He then probably got confused, and failed to reverse the reversing handle before applying the magnetic track-brake, the car at that time being on the move backwards, so that the magnetic brake was inoperative. If this was the case the car would be entirely unbraked, and the speed would rapidly increase. The driver says he subsequently reversed the motors, causing the canopy switch to fly out. This, the inspector points out, would merely cause the wheels to skid, and would have little effect on a car moving at high speed.

Further evidence has been heard with regard to the purchase of the Hammersmith lines of the London & United Tramways Co. by the London County Council. Mr. A. Dickinson, for the L.C.C., has put the value of the permanent way at £23,887 against £42,278; ducts, cables, manholes, &c., £14,604 against £21,843: workshop equipment, £3,456 against £4,256: and generating plant, £52,024 against £107,704. He also stated that 40 cars will be sufficient, and taking 10 kw. as the power used per car, 400 kw. of generating plant would suffice. Allowing for peak loads and spare plant, he considered that the two 500 kw. D.C. sets at Chiswick will be all that would be required. Mr. J. F. C. Snell also gave evidence for the L.C.C., and gave figures of valuation of the various portions of the equipment closely approximating to those given by Mr. Dickinson. From an examination of the log readings, he had come to the conclusion that 40 cars on the Hammersmith lines would require about 570 kw. as a maximum, which could well be supplied by one 500-kw. machine. The capacity of the Chiswick power house was in his opinion far in excess of what was required for the Hammersmith lines, and was, therefore, quite unsuitable for the undertaking. Mr. A. Baker, General Manager of the Birmingham Corporation tramways, expressed the opinion that 36 cars would be sufficient for the Hammersmith lines. The evidence was concluded on Tuesday, and Mr. Hutchinson will deliver his final speech for the L.C.C. to-morrow, whilst Mr. Balfour Browne will make his speech for the Company on Monday.

UNDERGROUND STATION LIGHTING

THE illustrations given here which we have received from Messrs. Siemens Brothers' Dynamo Works, Tyssen Street, Dalston, show the improvement in methods of station lighting



Fig. 1.—Bank Station Lighted by Arc Lamps.

on the Central London Railway. Fig. 1 shows the earlier system employed, where small arc lamps were used, and is from a photograph at the Bank station. In Fig. 2, which represents the latest method, metal filament lamps in holophane reflectors are used, the lamps being of the well-known Siemens "Onewatt" type of 100 c.p. each. The use of these small



Fig. 2.—Oxford Circus Station Lighted by One-watt Lamps in Holophane Reflectors.

units with suitable reflectors has resulted in a very uniform distribution, and the illumination averages about 4½ candle feet at a height of four feet above the platform. We are also informed that the metal filament lamp installation consumes less than a quarter of the current that was used with the earlier arrangement of arc lamps.

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AUTOMATIC TELEPHONE EQUIPMENT

An immediate connection at any time of the day or night.

An instantaneous intimation either that the connection has been effected or that the telephone is engaged.

Certainty of connection with the right number.

Freedom from interruption in the middle of a conversation.

No operators to overhear conversations.

Great reduction in operating expenses, as manual labour is no longer required to deal with each message.

The manual system to secure operating efficiency and economy requires concentration, and therefore the installation of costly and unwieldy multiple switch-boards. In the Automatic System the sub-division of the Exchange presents no difficulties and thereby substantial savings can be effected in cables, etc.

Substantial savings in repairs and replacements.

A diminution in the cost of providing Exchange Switch Rooms and Sub-Offices as the space occupied by the Automatic Apparatus is much less than that required for the Manual System.

Installations can be provided for any number of lines.

Please address enquiries to:

BRITISH INSULATED & HELSBY CABLES,

LIMITED,

Head Office: PRESCOT, LANCASHIRE.

BRANCH OFFICES:

LONDON—Lennox House, Norfolk Street, Strand.
MANCHESTER—2, Parsonage, Blackfriars.
GLASGOW—177, West George Street.
BIRMINGHAM—19, Barwick Street.
CARDIFF—1 & 2, Western Mail Chambers.
NEWCASTLE-ON-TYNE—33, High Bridge.
DUBLIN—17, Crow Street.
BELFAST—11, Queen Street.

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LOCAL NOTES

Bolton: *I.M.E.A. Bill.*—The Electricity Committee are in favour of contributing *pro rata* towards the expenses of promoting the municipal wiring Bill of the Incorporated Municipal Electrical Association.

Frome: *Transfer of Electricity Works.*—When the electricity works were first installed by Messrs. Edmundson's Electricity Corporation, Ltd., it was intended that they should be managed for twenty-five years by the contractors, who were to repay, by half-yearly instalments, the principal and interest, and at the end of that period to hand over the works to the Council free. This arrangement, however, has not been found to work satisfactorily, and a new agreement has now been approved transferring the works completely to Messrs. Edmundson's.

Horsham: *I.M.E.A. Bill.*—The Electric Lighting Committee at the last meeting recommended the Council to support the I.M.E.A. Bill, the terms of which we gave in our last issue, relating to municipal wiring, &c. Councillor Roberts moved an amendment to the effect that the Council should not support the Bill whilst it contained Clauses 1 and 2, relating to municipal wiring, and this opposition had a certain amount of support. Eventually, however, upon the Chairman of the Electricity Committee undertaking to limit the Council's liability for costs to £2, the recommendation to support the Bill was carried by a two to one majority.

London: *Holborn: Street Lighting.*—The Finance Committee of the L.C.C. recommends sanction to a loan of £8,000 for the purposes of the joint scheme of electric and gas lighting which brought the Holborn Council prominently before the public a short time ago.

Newport (Mon.): *Policy of Electricity Committee.*—It will be remembered that the Electricity and Tramways Committee recently decided to rearrange the managerial duties of the two undertakings, in order that Mr. H. Collings Bishop, the Electrical Engineer, should devote himself entirely to the technical side. Alderman Phillips, Chairman of the Committee, however, disagrees with this policy, and has refused an invitation to continue the Chairmanship of the Committee under the new Council.

Oldham: *Assessment of Electricity Works.*—The Electricity Committee object to the assessment of the electricity works at the high figure of £3,581. The Borough valuer states that this figure has been arrived at in the usual way by assessing the undertaking on the income less certain deductions, but the Electricity Committee have instructed the Chairman to confer with the Electrical Engineer and Town Clerk with a view to calling in an outside valuer.

Swansea: *Action by Gas Company.*—It is understood that the Swansea Gas Light Co. have issued a writ against the Swansea Rural District Council, asking for an injunction restraining the Council from using electricity for lighting purposes within certain districts. The contention of the Gas Company is that the Council are debarred from using electricity by an agreement with the Gas Company. A point will possibly arise as to whether the company have exercised reasonable expedition in meeting the needs of the district, says a local contemporary.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Accrington.—The Council have under consideration the installation of a gas-engine plant for further extensions of the electricity works. We understand that an endeavour is being made to secure the service of Mr. Percy Allen of the Castner-Kellner Alkali Co., as consulting engineer in connection with the project.

Brighton.—Tenders are invited by Dec. 11th for a 750-h.p. three-phase induction motor to be coupled to a 440-kw. generator, which latter will be provided by the Corporation. Particulars from Borough Electrical Engineer.

Croydon.—Tenders are invited for high-tension switchboards (see an advertisement on another page).

Darlington.—A Local Government Board inquiry has been held with regard to a loan of £3,220 for the installation of an additional 500-kw. generating set.

Eccles.—The Electrical Engineer has submitted an estimate of the cost of fitting automatic and mechanical stokers to the boilers at the electricity works.

Erith.—In addition to a loan of £7,671 for extensions at the electricity works which the Council has decided to apply for, an additional sum of £4,000 is to be added as the cost of the necessary mains to supply current to the contractors at the Crossness Sewage Works of the L.C.C.

Great Harwood.—The Council propose to erect a generating station at an estimated cost of £8,085, a loan for which is to be applied for.

Heston and Isleworth.—An application is to be made to the Local Government Board for sanction to borrow £2,000 for house services and £5,000 for additional generating machinery.

India.—According to the *Times of India*, considerable extensions of the Cauvery electric power scheme have been sanctioned. The estimated expenditure is put at about £1,687,000. Additional generating plant to the extent of 5,000 h.p. is to be installed.

London: *Fulham.*—The Finance Committee of the L.C.C. recommend sanction to a loan of £9,280 for extensions to the electricity undertaking.

Hackney.—The Finance Committee of the L.C.C. recommend sanction to a loan of £4,364 for extensions to the electricity undertaking.

Middleton.—Tenders are invited by Dec. 22nd for a supply of feeder and distributor cable. Particulars from Borough Electrical Engineer.

Sheffield.—A Local Government Board inquiry will be held to-day concerning a loan of £61,099 for extensions at the Neepsend electricity works.

Stalybridge, Hyde, &c.—The Joint Tramways and Electricity Board contemplate installing a second 3,000-kw. turbine.

West Hartlepool.—The scheme of the West Hartlepool Corporation, involving an expenditure of £38,000 for utilising blast furnace gases in connection with generating electricity, has received the sanction of the Local Government Board. The Council will erect their plant at the Seaton Carew Iron Works Company's premises, and use their existing power station as a reserve.

MISCELLANEOUS

Aberdare.—The Council have decided to ask Mr. Stephen Sellon to advise them with regard to tramways.

Blackpool.—A loan of £4,200 is to be applied for in connection with the purchase of six new tramcars.

South Shields.—Tenders are invited by Dec. 13th for the supply and erection of an up-to-date X-ray installation at the workhouse hospital for the Guardians. Particulars from the Clerk, Union Offices, Barrington Street.

TENDERS RECEIVED AND ACCEPTED

Dunfermline.—The contract for the electrical installation at the new women's institute has been given to Messrs. Melville, Robb & Scott, of Dunfermline, at £428.

Liverpool.—The Liverpool Tramways Committee recommend the acceptance of the following tenders:—British Westinghouse Co., two 2,000-kw. D.-C. turbo-generators; British Thomson-Houston Co., two 3,500-kw. turbo-alternators; Worthington Pump Co., four cooling towers and pipes. The total amount of these tenders is about £100,000. The recommendation of the Committee, which was discussed at the Council meeting on Friday, met with some criticism, and the meeting was adjourned until Saturday, when the tenders mentioned above were accepted. Mr. Bromley-Holmes, the Council's consulting engineer, had the alternative of erecting



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a new station or installing additional plant at Lister-Drive, and he decided upon the latter course.

London: *L.C.C.*—The Stores Committee recommend the acceptance of tenders by Messrs. Plutte Scheele & Co., and Messrs. Ship Carbons, Ltd., for the supply of electric carbons during 1912.

The Highways Committee recommend the acceptance of the tender of the Bambridge Patent Flexible Shaft Co. for three portable electric grinding machines at £73 6s. each. The following tenders have been received for five electric motors for the above :—Electric Construction Co., £377 11s.; British Westinghouse Co., £456 17s.; General Electric Co., £551; Lancashire Dynamo & Motor Co., Ltd., £571; Dick, Kerr & Co., £625 11s. A tender was also submitted by the British Thomson-Houston Co., which was not to specification. The tender of the Electric Construction Co. is recommended for acceptance. For the switchgear the following were received :—Evered & Co., £86 8s., less 2½ per cent.; Spagnoletti, £94; Johnson & Phillips, £95; Edison & Swan United Electric Light Co., £97 19s., less 2½ per cent.; Electric Construction Co., £109 7s.; General Electric Co., £114 4s., less 2½ per cent.; British Westinghouse Co., £149 15s., less 2½ per cent. The tender of Messrs. Evered & Co. is recommended for acceptance.

In view of the great interest now taken in Diesel engines for central station work, the following list of orders recently obtained by the Diesel Engine Co., Ltd., of 179, Queen Victoria Street, London, will prove interesting :—Bath Electricity Works, one 680-b.h.p. engine; Oxford Electricity Supply Co., one 650-b.h.p. engine; Isle of Thanet Electric Tramways & Lighting Co., one 600-b.h.p. engine; North Metropolitan Electric Power Supply Co. (repeat order), one 400-b.h.p. engine; Sheerness & District Electric Supply Co. (repeat order), one 400-b.h.p. engine; Messrs. C. H. Walker & Co., Ltd., four 1,000-b.h.p. engines; the Great Northern Railway Co. (repeat order), one 420-b.h.p. engine; Punta Arenas Electricity Supply Co., one 250-b.h.p. engine; General Electric Co., Ltd., one 200-b.h.p. and two 400-b.h.p. engines; Dacca Electricity Supply Co., three 350-b.h.p. engines; Messrs. Agar Cross & Co., for Argentine, four 650-b.h.p. engines; for the Canadian Government (repeat order), two 400-b.h.p. engines; Aldershot Electricity Works, one 200-b.h.p. engine; Bridgwater Electric Power & Traction Co., one 150-b.h.p. engine; Bangor Electricity Works, one 140-b.h.p. engine; Bude Electricity Supply Co., one 130-b.h.p. engine. The majority of the above orders are for the latest type of Diesel engine, which the Diesel Engine Co., Ltd., have specially designed to meet the requirements of Central Stations.

PATENT
LOUD SPEAKING TELEPHONES
COMPLETE INSTALLATIONS FOR
WARSHIPS, MERCANTILE VESSELS, MINES, POWER STATIONS, ETC.
Adopted by the British Admiralty, Foreign Governments, the Leading Shipping Companies, and as used in many Electrical Generating Stations.
ALFRED GRAHAM & CO.,
ELECTRICAL ENGINEERS AND CONTRACTORS,
ST. ANDREW'S WORKS, CROFTON PARK, LONDON.



APPOINTMENTS AND PERSONAL NOTES

The following short list of candidates for the position of Borough Electrical Engineer to the South Shields Corporation has been prepared :—J. H. Bolam, Borough Electrical Engineer, Weymouth; S. R. Windle, Chief Assistant Electrical Engineer, Sunderland; R. M. Torpy, Chief Assistant Electrical Engineer, Wimbledon; A. G. Cooper, Borough Electrical Engineer, Colne; E. S. Rayner, Borough Electrical Engineer and Tramways Manager, Doncaster; H. S. Ellis, Deputy City Electrical Engineer, Bradford. The salary is £400 per annum.

Mr. S. J. Hollinrake, of Hebden Bridge, has been appointed Electrical Engineer to the Bispham Council.

Mr. J. Christie, Engineer and Manager of the Brighton electricity undertaking, has prepared a scheme for dealing with the vacancy caused by the resignation of Mr. C. C. Fowler, which the Electricity Committee have adopted. Under this scheme, Mr. G. T. Joyce will be designated "Assistant Manager," and have power to act in Mr. Christie's absence in all matters connected with the commercial side of the undertaking, and Mr. G. Claughton will be rated as "Assistant Engineer," with powers to act in Mr. Christie's absence in all matters connected with the engineering side. The salary of these two officials is to be increased by £50 per annum at once, with two further annual increases of £25, making the maximum £350 and £400 per annum respectively.

A log-book keeper is required by the Stepney Electricity Department (see an advertisement on another page).

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £61 to £61 10s. (last week the same).

Hart Accumulators.—The Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E., have been appointed by Royal Warrant purveyors of accumulators to his Majesty King George.

Change of Address.—We are asked to announce that in future the address of the Stoke-on-Trent Electricity Department will be St. Peter's Chambers, Glebe Street, where the central offices of the Electricity Supply Department are now situated. In these offices all business connected with the electricity works in Burslem, Hanley, Longton, and Stoke will be transacted.

Liquidations.—A petition by Messrs. Ransomes & Rapier, Ltd., for the winding up of the Kearney High Speed Railway Co., Ltd., will be heard in the High Courts on December 12th.

A meeting of the Solium Electrical Co., Ltd., will be held at 23 King Street, Nottingham, on Friday, January 12th, at 11 a.m., to hear the liquidator's account of the winding up.

Bankruptcies.—A. P. Parker, Electrical Engineer, 8 Mary Street and 57 Yorkshire Street, Burnley, has been adjudicated bankrupt.

Lectures on Illumination.—Mr. W. C. Clinton, B.Sc., Assistant Professor of Electrical Engineering at the University College, London, commences a course of eight lectures on Illumination and Photometry, on Wednesday, January 10th, at 6.30 p.m. The fee for the course is two guineas. Application for tickets should be made to the Secretary, Mr. W. W. Seton, University College, Gower Street, London.

Royal Institution.—Among the lecture arrangements announced to take place at the Royal Institution before Easter, we note that Professor Sir J. J. Thomson, Professor of Natural Philosophy, R.I., will give six lectures on "Molecular Physics."

The Physical Society.—The seventh annual exhibition of the Physical Society, at which some thirty firms will be exhibiting, will be held at the Imperial College of Science, South Kensington, on Tuesday, December 19th, in the afternoon (from 3 to 6), and in the evening (from 7 to 10). A discourse on "The Electric Discharge and the Luminosity which survives it," will be given by Prof. the Hon. R. J. Strutt, F.R.S., at 4.30, and again at 8 p.m. Admission will be by ticket only, so that members of the Faraday, Iptical, Röntgen, and Physical Societies, and the Institution of Electrical Engineers wishing to attend should apply to the Society to which they belong.

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ELECTRICAL ENGINEERING

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ELECTRICAL ENGINEERING.

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SUMMARY

At the last meeting of the Institution of Electrical Engineers, Mr. Ferranti announced that no further suggestions regarding the new articles of association would be made till early next year. (Page 677.)

We announce the death of Dr. M. Kallmann, of Berlin. (Page 677.)

An article describes the new wholesale stores and switchboard manufacturing works of Drake & Gorham, Ltd. (Page 678.)

Demonstrations of electric cooking are being given at the showrooms of the County of London Electric Supply Co. (Page 678.)

A paper by Dr. R. Pohl on standards for electrical machinery has been discussed by the Institution of Electrical Engineers at Leeds and in London. The author considered that a suitable degree of standardisation of performance, ratings, tests, and sizes of machines would be of great assistance to the industry, but criticised strongly the rules proposed by the Engineering Standards Committee, setting forth in detail modifications which he thought desirable. We give a report of the discussion in London, but owing to pressure on our space we are obliged to hold over our report of the Leeds discussion till next week. (Page 679.)

A number of new electrical supplies and accessories are described on pages 680 and 681.

A note on improved methods of illumination and a description of a new process of electroplating on china and glass are given on page 681.

The British Thomson-Houston Co. has patented a pure graphite conductor with a high density, obtained from a mixture of graphite with a pitch binder, suitable for furnaces, &c., and especially for incandescent lamps. Other patents published last week include a lamp-shade support, by means of spring clips attached to the casing, as well as an improved method of arranging spiral grooves on arc lamp electrodes for taking the active material; and a weather-proof electric contact push. Two patents relating to traction motors expire during the coming week; one deals with a design of bearing and its lubrication, while the other covers a general construction, in which inwardly projecting bearings are provided to economise space. (Page 682.)

Under "Electric Traction Notes" we report the Paper read by Mr. Philip Dawson on Friday upon the proposed conversion of the line to Brighton to single-phase electric traction. Mr. Dawson explained why the original tenders for the single-phase in the south of London were given to a German firm, and some interesting figures were also given showing the manner in which the Brighton Corporation have regained their traffic since electric traction was introduced. The annual report of the London Traffic Branch of the Board of Trade refers to a proposed tube railway from East to West of London, dealing solely with Post Office traffic. The Leeds Corporation have adopted the report expressing confidence in Mr. Hamilton, the manager of the tramway system. The arbitration with regard to the purchase of the London United Tramway system in London has been concluded, and the award will be delivered later. (Page 683.)

In our "Telephony and Telegraphy (including Wireless)" we give some detailed particulars of the arrangements which have been made for the changing over of the National Telephone Company's subscribers to the Post Office system. We also mention a Bill for making a payment on account of the purchase money to the National Telephone Co.; an appeal for telephonic com-

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munication with the Isle of Man; a report that the Telefunken and Marconi systems of wireless telegraphy have been abandoned in Australia, and the work that has been done with automatic telephones. (Page 684.)

THE Accrington Corporation has decided to instal gas plant at the electricity works at a cost of £27,000.—After many months' discussion, the street electric lighting scheme at Carnarvon has been rejected.—A scheme for the hiring of lamps and fittings for shop lighting has been prepared at Hammersmith.—An offer to purchase the Worthing Electricity Works has been refused.—The Topsham Electricity Works were practically destroyed by fire on Sunday. (Page 685.)

LOCAL GOVERNMENT BOARD inquiries have been or will be held at Bexhill (£3,200); Bootle (£41,255); Burton-on-Trent (£17,000); Greenock (£25,000); Turton (£4,500); and Tunbridge Wells (£6,000). A high-tension feeder is required at Blackpool; a new power house is to be erected at Bolton; cables, lighting battery, switchgear, &c., are required at Carlisle; switchboards, cables, and boiler extensions at Croydon; generating set at Hornsey; and mains at Hackney, Nelson, and Wrexham. (Page 685.)

THE India Rubber, Gutta Percha & Telegraph Works, Ltd., made a loss of £55,457 last year. (Page 688.)

The I.M.E.A. Bill.—In our last few issues we have noted the action of certain Local Authorities with regard to the I.M.E.A. Wiring Bill. We are now informed by the Hon. Secretary of the Association that, so far, 29 per cent. of the Local Authorities have replied to the Association defining their action in the matter. Many of these have fixed a definite maximum to their guarantee of financial assistance, whilst others have simply promised to support on a *pro rata* basis. The definite guarantees amount to over £700, whilst the total, if the sums which have been recommended but not yet confirmed are added, amounts to about £1,000. There, therefore, seems every probability of the Association getting a guarantee for the full amount of the cost of promoting the Bill.

ARRANGEMENTS FOR THE WEEK

(TO-DAY) THURSDAY, DECEMBER 14TH.

Institution of Electrical Engineers.

8 p.m. "Residence Tariffs," by A. H. Seabrook.

Institution of Electrical Engineers: Dublin Section.

8 p.m. At New Royal College of Science. "Small Electricity Undertakings," by P. L. Spalding.

FRIDAY, DECEMBER 15TH.

Manchester Association of Engineers.

7.30 p.m. Conversazione with Local Section I.E.E. at Whitworth Institute.

Electro-Harmonic Society.

8 p.m. Smoking concert at Holborn Restaurant.

SATURDAY, DECEMBER 16TH.

Association of Mining Electrical Engineers.

5 p.m. Yorkshire Branch. At Royal Hotel, Sheffield. (1) "Pit Shaft Signalling," by E. E. Beadsmoore; (2) "Earthing, Earth Plates, and Leakage Detectors," by C. Jones.

Association of Mining Electrical Engineers.

6 p.m. At Pontypridd Town Hall. "The Threatened Shortage of Coal: What Engineers are doing to meet it, and what Electricity has done and is doing," by S. F. Walker.

TUESDAY, DECEMBER 19TH.

Institution of Electrical Engineers: Manchester Students.

7.30 p.m. At Municipal School of Technology. Debate on "D.C. versus A.C. for Industrial Purposes."

Institution of Electrical Engineers: Glasgow Section.

8 p.m. At Heriot Watt College, Edinburgh. "The Heriot Watt College Laboratories," by Prof. F. G. Baily.

Illuminating Engineering Society.

8 p.m. At Royal Society of Arts. "Some Aspects of Railway Station and Goods Yard Illumination," by Haydn T. Harrison.

Physical Society of London.

Annual exhibition. Afternoon and evening.

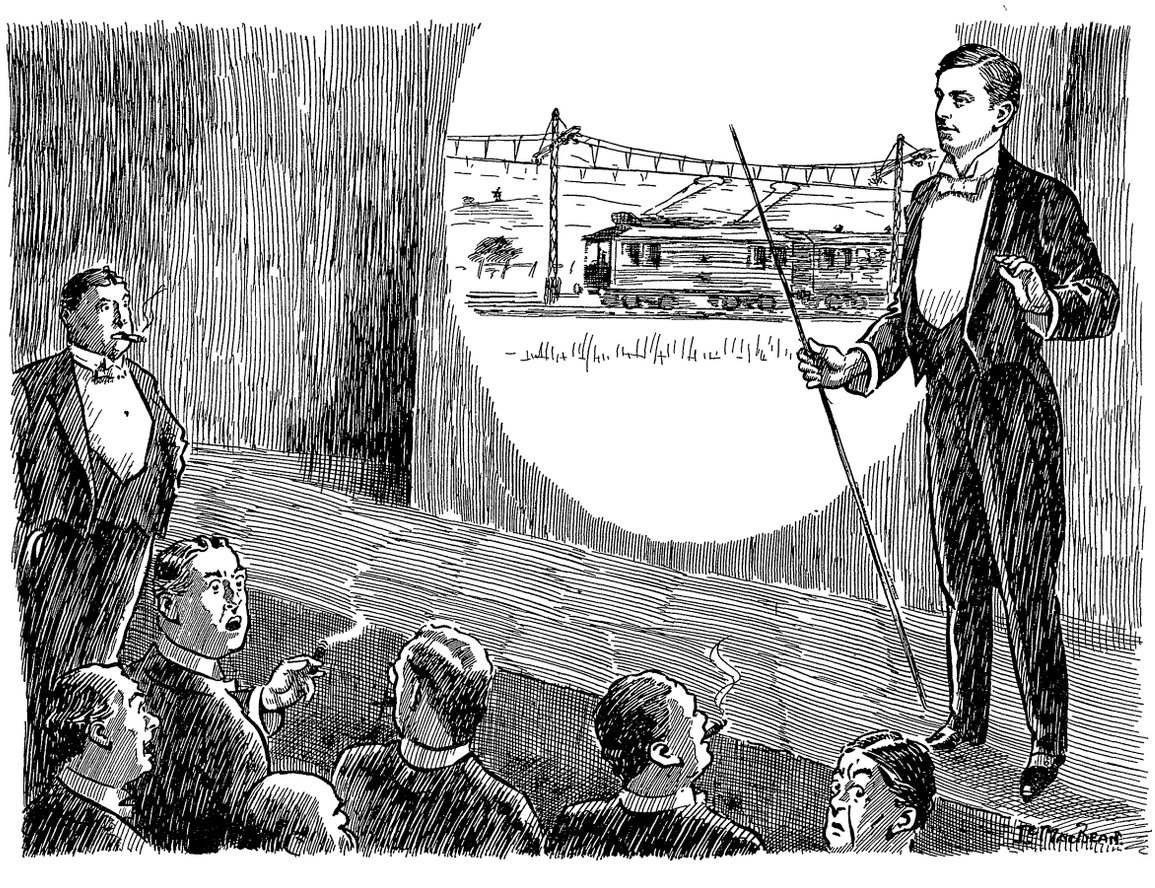
WEDNESDAY, DECEMBER 20TH.

Institution of Electrical Engineers: Students' Section.

7.45 p.m. "Some Experiments with Wireless Telegraphy Transmitters," by P. R. Cowsey and G. G. Dawson.

Institution of Electrical Engineers: Newcastle Section.

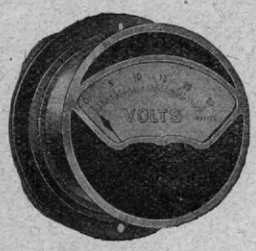
Annual dinner.



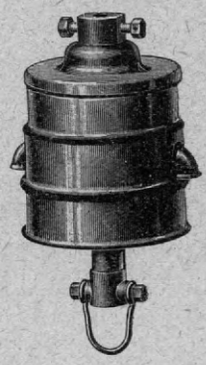
THE NEW PHASE OF THE BRIGHTON RAILWAY.

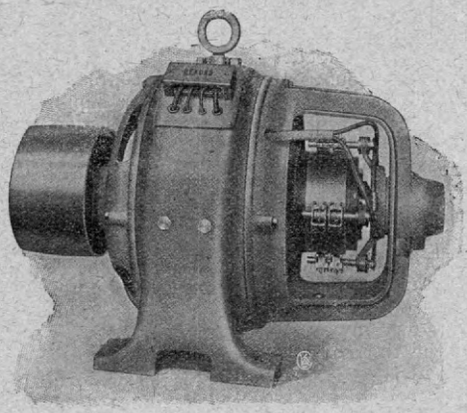
Mr. Philip Dawson, in his lecture at the Royal Automobile Club, expressed the hope that he would be able before long to drive his friends from London to Brighton by single-phase traction in forty-five minutes.—Envy of the law-abiding members of the Club.

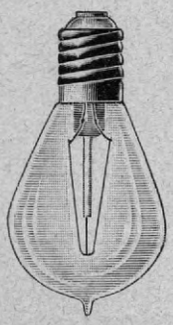
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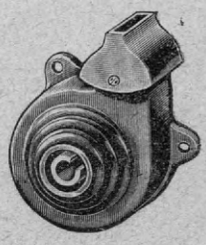


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THE INSTITUTION OF ELECTRICAL ENGINEERS

AT the meeting of the Institution in London on Thursday, Mr. S. Z. de Ferranti announced, with reference to the revised Articles of Association, that since the last informal meeting the Council had taken further steps to ascertain the views of the members. They had received a number of suggestions, which are being carefully considered to see how far it is possible to reconcile the different views and to embody them in the revised Articles. The time required to give these suggestions adequate consideration rendered it impossible to make any further suggestion until early next year.

We would suggest that the Council would have been better advised to have adopted at once our recommendations as to subscriptions (see ELECTRICAL ENGINEERING, November 23rd, page 637), and to have announced that no subscriptions of existing members at January 1st, 1913, would be raised, so as to encourage a large number of new members and transfers to full membership and associate-membership during the year. As we have already pointed out, the raising of subscriptions generally at once will undoubtedly bring about wholesale resignations, so that while, on the one hand endeavouring to extend the membership by their "broadening" proposals, the Council would be working in precisely the opposite direction by promoting a reduction of the present membership.

Midland Electrical Engineers' Ball.—The first Midland Electrical Engineers' Ball is to be held at the Grand Hotel, Birmingham, on Friday, January 19th, 1912, under the patronage of the Lord Mayor and Lady Mayoress of Birmingham. An influential committee has been formed, of which Mr. R. A. Chattock is chairman. Mr. H. Foulds, 14 Dale End, Birmingham, is hon. treasurer, and applications for tickets at one guinea each, which include supper, &c., can be made to him. The hon. secretary is Mr. H. B. Matthews.

OBITUARY

We regret to record the death, after a long illness, on November 29th, of Dr. M. Kallmann, Electrical Adviser to the Municipality of Berlin and Professor at Charlottenburg Technical College. Dr. Kallman was a prolific writer of papers dealing with electric supply distribution, cable testing &c., and was a frequent contributor to the German technical press. Latterly he took up the subject of motor regulation, &c., by iron wire resistances or "variators." Before his appointment as muncipal engineer he had charge of the testing department of the Berlin central stations.

Honour to Mr. Ferranti.—The opening of the new Physical Laboratory of the Victoria University, Manchester, has been made the occasion for conferring an honorary D.Sc. degree on Mr. S. Z. de Ferranti, and also upon Madame Curie.

Manchester Local Section of the Institution of Electrical Engineers.—A Paper, by Mr. Miles Walker and Mr. H. D. Symonds, on Heat Paths in Electrical Machinery, was read and discussed at Manchester on Tuesday. At the Council's request, we are refraining from publishing the Paper and discussion until the Paper has been read in London, which is to be done in January. We would suggest that it would have been advantageous rather than the reverse if the Press had been allowed to publish reports of both Paper and discussion, as the members would then have had good time to study its contents before the London discussion, and would also have been enabled to avoid going over the same ground as in the Manchester discussion. We can only hope that the Institution will now itself prepare a full printed report of the Manchester discussion well before the London meeting to circulate with the Paper to intending speakers. If the Press are always to be forbidden to report Local Section discussions preceding those in London on a Paper, this course might be made a regular procedure.

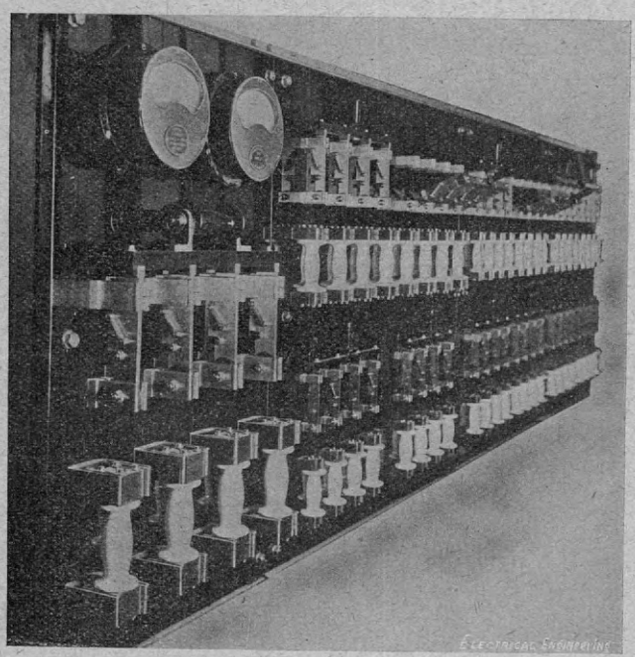
Faraday House Students' Society.—Dr. Alexander Russell has been appointed president of this society, E. B. Ritson, vice-president, F. T. Chapman, B.Sc., treasurer, and B. P. K. Walsh, secretary. The next meeting will be held on January 17th, 1912, at 4.45 p.m., when Mr. E. B. Ritson will give an account of his personal experiences when an engineer with the High-Tension, Hydro-Electric Power Company at Necaxa, Mexico.

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THE NEW WHOLESALE OFFICES AND STORES OF DRAKE AND GORHAM, LTD.

OWING to the rapid increase in their wholesale business, Drake & Gorham, Ltd., have found it necessary to open special offices and stores to deal with this branch of their work. A building adjoining their old works in Felix Street, S.E., has been taken and equipped in such a manner as to enable the firm to deal promptly with all orders. By the courtesy of Mr. R. W. Smith, who is manager of the wholesale business, we are enabled to give a few details of our recent visit to the new premises. The offices are spacious and include, besides general offices, the offices of the manager and sub-manager, with special rooms for a staff of typists, keeping of records, &c. A private telephone exchange has been provided for with a good service of lines, so that customers need experience no delay. The extensive basement and ground floor, as well as the whole of another part of the building, has been fitted out as a stores for the wholsale business, and judging by the amount of stock of all classes of material which we saw, we should say that the firm should have no difficulty in dealing promptly with any order.

In the works adjoining some of the well-known manufactures of this firm were being dealt with at the time of our visit. Prominent amongst these are switchboards. We



DRAKE & GORHAM SWITCHBOARD.

reproduce here an illustration of an important switchboard recently supplied by this firm to the order of "The Greenwich Inlaid Linoleum Co." for use at their works. This board is designed to control 600 h.p. two-phase four-wire at 440 volts. The switches are standard D. & G. quick-break knife type, and the fuses are the firm's standard square-ended type. The main switch is made to carry 600 amperes, four of the distributing switches are of 200-ampere size each, and the remaining eight of 100 amperes each. The switchboard conforms to all the requirements of modern practice, the four 'bus-bars at the back being mounted on porcelain insulators, which are supported at the top of the board on cast-iron brackets.

Amongst the switchboards going through the works at the time of our visit was one for the town lighting of Bantry. This is a D.-C. board on three large white marble panels designed to control two generators, a battery, and twelve feeders. The firm have also recently concluded important switchboard contracts for Carlow, Belturbet, &c. That for Carlow consisted of twenty-four panels, and was designed to control both D.C. and A.C. We also saw a great number of smaller boards for battery control and other purposes, as well as boards enclosed in sheet-iron cases for mining work, &c. Other articles we saw in process of manufacture were the D. & G. fool-proof pattern battery regulator, Cardew earthing devices, cast-iron fuse-boxes, and a host of other articles too numerous for specific mention.

Another part of the building is set off for the manufacture of the firm's complete automatic set for petrol lighting of country houses. These sets are entirely automatic, and once started can be kept going day and night without attention. We understand that there is a big demand for these sets.

With regard to cast-iron boxes, a very large stock of all sizes and designs is kept, so that any ordinary order can be dealt with at once.

In the fittings department a great business is done in the conversion of old fittings. We saw a large number of silver, copper, wrought-iron, and other fittings in the process of being adapted for the more modern illuminant. New fittings are, of course, also dealt with in this department, as well as smaller supplies such as switches, fuses, &c. Adjoining the fittings department is the dipping department, where all the various effects and colours on metals are obtained by means of chemical processing, and leading out of this room is the lacquering department. The equipment of the works, offices, and stores is very complete, and judging by the general bustle and hurry on the day of our visit, Messrs. Drake & Gorham are well justified in extending their premises.

DEMONSTRATIONS OF ELECTRIC COOKING

THE County of London Electric Supply Co. are at present giving a demonstration of the household uses of electricity at their district showrooms, Upper Richmond Road, Putney. The particular features are vacuum cleaning and cooking. The district adjacent to the showroom consists of good residential property, where there is a particular opening for the use of the electric supply for cooking and vacuum cleaning. A fully



COUNTY OF LONDON ELECTRIC SUPPLY CO.'S SHOWROOM.

qualified lady lecturer is in charge of the cooking demonstrations, which are given at 11.30, 3, and 6 o'clock daily, in the electric kitchen, which is attached permanently to the showroom, of which a view is given here. The lectures are proving very popular, due in part to the attractive window, which has been fitted up as a kitchen, and which has created wide interest. The neighbourhood has also been well circularised with personal invitations to the demonstrations, and posters have been put up on the hoardings in the district.

Linking up of the London Stations.—The Joint Conference of London Electric Supply Authorities held a further Conference at the Cannon Street Hotel last Thursday, which was well attended. Mr. W. F. Fladgate occupied the chair. Among those present were Aldermen and Councillors representing the following Boroughs: Battersea, Fulham, Hammersmith, Hampstead, Islington, Poplar, St. Marylebone, Shoreditch, Stepney; and there were also present directors of the following companies: The Charing Cross Electricity Supply Co., the Chelsea Electricity Supply Co., the City of London Electric Lighting Co., the County of London Electric Supply Co., the Metropolitan Electric Supply Co., and the South Metropolitan Electric Light Co. The Chairman addressed the meeting, and after reviewing the work of the past year, gave a forecast of their future programme, especially with regard to the important question of linking up the supply undertakings of London under the powers conferred by the London Electric Supply Act, 1908. The Executive Committee's report was unanimously adopted.

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STANDARDS FOR ELECTRICAL MACHINERY

A PAPER by Dr. R. Pohl, entitled "Notes on National and International Standards for Electrical Machinery," was discussed at last Thursday's meeting of the Institution of Electrical Engineers in London, and also on the previous Wednesday by the Yorkshire Local Section at Leeds. The Paper dealt in some detail with the standards for electrical machinery proposed by the Engineering Standard Committee tentatively in 1907, and made various suggestions for their modification. After some remarks showing the great assistance that properly drawn-up standards are both to manufacturers and customers, he dealt first with the question of rating. Ratings based on "continuous" and "intermittent" working were recognised by the Committee, but a third "short-period" rating figured in the German and Belgian standards. For continuous working the author preferred the following definition to the six-hour run:—"The output of machines for continuous working shall be the output at which, with suitable attention, they can work continuously from week-end to week-end. Their suitability for this shall be proved by their passing the prescribed tests." For intermittent working he submitted the following definition:—"The output of motors for intermittent working shall be the output at which, with suitable attention, they can work from week-end to week-end intermittently with the specified load factor. Their suitability for this shall be proved by their passing the prescribed tests." He further suggested that only three standard load factors be adopted—namely, ½ for lifts and severe crane and hoist work; ¼ for ordinary shop cranes; ⅛ for traversing and other light duty.

Among other points which he touched on were classification of types, to which "flame proof" should be added, and wearing depth allowed on commutators, which can be much less than those specified in the standards. Regarding sparklessness, he suggested the following clause:—"There shall be practically no sparking at the brushes of commutators or slip-rings at any load up to and including full load, and no injurious sparking at the specified overloads, and the position of the brushes, except where otherwise stated, shall remain fixed for all loads."

The overload capacity called for in British practice was very much higher than that in the French, Belgian, and German standards. The author suggested that 25 per cent. for one hour, 100 per cent. momentarily, be adopted for machines for continuous rating, and 25 per cent. for five minutes, 50 per cent, momentarily, for intermittently working machines. Generators should be capable of maintaining their full voltage up to 25 per cent. overload (15 per cent. in the German specification) when running at their full-load speed, the power factor in the case of alternating current generators being equal to the normal power factor.

With regard to voltage regulation, the author saw no reason for departing from the present rule that the regulation of alternators shall not exceed 6 per cent. on a non-inductive load and 20 per cent. on an inductive load having a power factor of 0·8, except in cases where a much larger pressure rise is permissible in view of the employment of quick-acting automatic regulators. Generators compounded for constant pressure at all loads should maintain this pressure within 2 per cent., and the voltage of overcompounded generators, for a rise in pressure from no load to full load not exceeding 10 per cent. of the no-load pressure, should not depart at any load more than 3 per cent. from the ideal linear load characteristic.

There was considerable variation in the loads at which efficiency and power factors were to be guaranteed, but the author thought that full and half load was sufficient, and the method of measurement of the individual losses should be the standard test. For insulation a flash test was of more value than a measurement of insulation resistance, and he suggested that all windings for working pressures above 200 volts be flashed to earth with alternating current of twice the working pressure, but not less than 1,500 volts; windings for less than 200 volts with 1,000-volt alternating current. The pressure should be raised gradually for this flash test, and the full voltage be applied for one minute.

The question of temperature rise was dealt with at some length, and finally it was recommended that the permissible temperature rise, as ascertained by the specified tests, must be such as to ensure that in the interior of field coils the actual temperature of 125° C., and in distributed windings 110° C., is not exceeded. The air temperature should be taken as 35° C. The highest rise must, in consequence, not exceed 125−35=90° C. and 110−35=75° C. respectively. For distributed windings, such as direct-current armatures, alternating-current stator and rotor coils, which must be measured by thermometer on the surface, an allowance must be made for the temperature drop in the outer insulation and in the interior of the coil. The sum of these is not likely to exceed 20° C. In addition we are to allow 5° C. to meet the discrepancy due to reducing the durations of the test, or a total of 25° C., leaving a rise of 50° C. In the case of field coils for direct-current machines and alternators if measured by internal thermometer, the margin to be allowed consists of 10° C. possible error due to the thermometer not being placed at the point of highest temperature, and 5° on account of the reduced length of run, leaving a rise of 75° C. Where special materials designed to resist high temperatures are employed, a much higher temperature rise is rightly permitted by the present standards. Single-layer windings of heavy copper strip, wound on edge, would also be quite safe if one allowed a temperature rise of 75° C. as measured by thermometer on the surface. There need further be no limit to the temperature of squirrel-cage rotors, unless ordinary soldered joints are employed, for which the approximate limit of safety is a temperature of 150° C.

With regard to the duration of the test run, he suggested the following rule: The duration of the full-load test shall be such that the temperature rise shall not increase by more than 2 per cent. during the last half hour of the run. In order to ascertain this, a thermometer fixed to a suitable stationary part of the machine shall be employed.

With regard to the standardisation of pressures, frequencies, outputs, and speeds, he suggested the omission of 110 and 115 volts as standard pressures, except for exciters, and the replacing of 525 and 500 volts for generators and motors respectively of the Engineering Standards Committee by 580 and 550 volts. The only standard frequency should be 50 cycles. He analysed the tables of outputs and speeds proposed by the Engineering Standards Committee, and suggested more uniform steps between the sizes on the basis of a 25 per cent. step in output wherever possible.

DISCUSSION IN LONDON.

Mr. T. Harding Churton saw serious difficulties in the way of general standardisation in view of the large number of frequencies and voltages. There was, nevertheless, scope for rules which would be universally recognised for the rating and testing of machines. He agreed that the existing rules of the Standards Committee were not sound, and mentioned some experiments he had made with a view to seeing what the one-hour test came to as an equivalent in intermittent work. A ventilated motor if run for one hour continuously had the same temperature rise as if run with an intermittency of three to four. If it were running for half an hour it was equivalent to an intermittency of one in four, which was nearer the actual requirements of practice. With the motor totally enclosed, a half-hour was equivalent to one in six intermittency. This rather showed a necessity for making separate rules for different classes of electrical machinery.

Mr. W. E. Robson agreed that the Standards Committee regulations were a dead letter, but there were several difficulties to be overcome before standards could be adopted. One of the main ideas in standardisation was to improve the standard of performance, but before anything definite in this direction was done it would be necessary for manufacturers to agree amongst themselves as to observing these standards, and also for it to be made an offence against the law for foreign manufacturers to sell machines here which did not conform to our ideas of performance. During the last few years orders for electrical machinery had been plentiful, but prices were such that manufacturers were not in the position he would like them to be as regards profits. At the same time there was not a sufficient volume of work in this country to enable what he called real manufacture to be carried on. There were so many firms making certain classes of machinery that it was quite impossible for them to carry on manufacture on a large scale. One way out of this might be for the larger firms to come to an agreement to pool their orders for particular sizes of motors. This would be one great move towards real "manufacture," and would enable better technical men to be employed at better salaries, as the profits would be increased and money could be spent upon development work. With regard to the ratings given in the Paper, he agreed that machines going for six hours at full load were practically always good for continuous operation, but he did not see any reason why the six hours should be left out. He thought it was unnecessary to have a smaller time rating than one hour. With regard to classification, electric motors, in his opinion, would eventually be pro-

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hibited in places in mines where there was the slightest danger of explosion, and for this reason he thought flame-proof motors could very well be left out from any standard classification, because eventually they might not be wanted. The present regulations with regard to wear on commutators were unnecessarily hard. He usually allowed a wearing depth of three-eighths of an inch for commutators up to six inches diameter; half an inch from six to ten inches diameter; five-eighths of an inch from ten to eighteen inches diameter; three-quarters of an inch from eighteen to twenty-four inches diameter; and one inch above twenty-four inches.

Mr. ROBERT HAMMOND thought it due to the Standards Committee to say a few words in defence of what they had done. Their object had been to cheapen the cost whilst having efficiency thoroughly in view. He heartily appreciated the Paper, for only by such criticism was the Standards Committee able to keep in touch with those who knew. The Committee would shortly make a fresh start, and the Paper would be very valuable to them, but it must not be thought that the Committee had arrived at its previous conclusions in a haphazard manner. The Committee had endeavoured to select sizes of machines for which most of the manufacturers already had patterns in their shops, and to lay down conditions of tests which would hold the consulting engineer in check, a test based on Dr. Pohl's ratings, would require the consulting engineer to take a three weeks' holiday with all his staff at hand whilst tests were being carried out. He would have liked Dr. Pohl to have acknowledged one thing in the standard specification, and that was that for the first time the Committee had swept away the absurd idea of overload. It was absurd to say that a machine should have a certain temperature rise, and then specify that it should stand 25 per cent. more.

Professor SILVANUS P. THOMPSON disagreed with Dr. Pohl's suggestion to eliminate machines working at 100 or 115 volts in view of the utility of that pressure for lighting circuits. It was unnecessary to have a long run in order to find out the output and temperature of a machine under conditions of regular operation. Temperature rise followed a perfectly regular law, and he had adopted the plan of making a few observations at the beginning of the test to find out the temperature rise per minute, and when the rise had got to a point at which it was only half as fast as it was at first, he then stopped. They were then half-way up to the final temperature.

Mr. H. JONES said that it was in the bigger and special schemes that foreign competition was most noticeable. For motors from 5 to 100 h.p. the Germans had not a look in at present English prices. Standardisation carried too far stultified design. He thought it was a dangerous thing to say that there should be "practically no sparking." That depended entirely upon the gullibility of the buyer and the plausibility of the seller, and it had involved many firms in more serious losses than they would admit. Again, "momentary overload" should be more exactly defined. With a high permissible temperature rise, they would be a steeper curve from cold to hot.

Mr. W. E. BURNAND endorsed the author's conclusions, and hoped that he would continue his efforts to introduce standards.

Dr. POHL, in reply, said that his main object was to aim at shortening the duration of tests rather than lengthening them. In many cases six hours was too long for small machines, and too short for large machines. He did not agree with Mr. Hammond that the committee had swept away overload. The fact that it was not mentioned in the specification did not sweep it away. An overload of 25 per cent. for two hours and 50 per cent. for one hour was the general practice. His complaint was that manufacturing costs in this country were too high, and an effort must be made to bring the manufacture down. He did not believe in hiding their weakness by political methods, and he did not like to do away with the sting of competition. It would be very much better for the buying public if the Institution of Electrical Engineers and the Standards Committee would take the matter in hand and give the English firms the advantages which the greater American and German firms possessed from their vast productions. The Standards Committee should be a standing committee, to which any development should be referred so as to bring the standards up to the requirements of the times.

ELECTRIC LIGHTING SUPPLIES

WE referred briefly last week to the comprehensive new catalogue of electric lighting supplies which has been issued by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), and we are now able to illustrate some of the newer or more important items therein. With regard to the fuses which we mentioned last week, we regret that the wrong block was inserted as illustrating the new pattern of circular detachable fuse. This neat piece of apparatus is shown here in Fig. 1. These have removable covers which carry the fuse terminals; operators have not, therefore, to insert new fuses when standing on steps, ladders, or in other insecure or dangerous positions. They can, by a simple half-turn, remove the cover with its fuse chamber and terminals affixed, and conveniently and rapidly insert a new fuse at the bench or table. When replacing the cover they are efficiently pro-

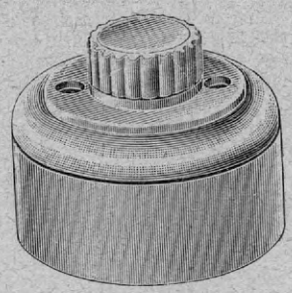


FIG. 1.—DETACHABLE TYPE PLASTER-LINED FUSE.

tected against injury due to the fuse again blowing, by the patent combined cover and hand shield.

The fuse illustrated last week was the older non-detachable

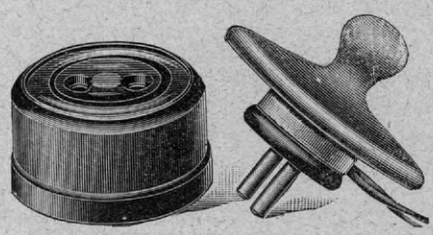


FIG. 2.—HOME OFFICE PATTERN PLUG.

type, and it is these which it should have been stated were reduced in price.

We also illustrate in Fig. 2 one of the special Home Office pattern of wall plug, which is being sold in large numbers. As with all the patterns of plug, these are made in three gauges,

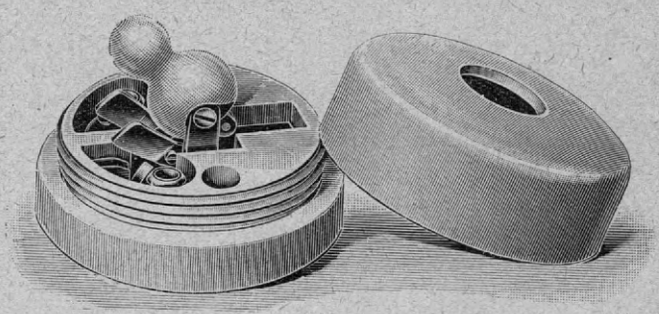


FIG. 3.—PORCELAIN-HANDLED "SLICK" SWITCH.

named midget, standard, and union respectively; all are interchangeable with others of the same gauge.

Another speciality is the "Slick" type of flat switch, a porcelain-cased and porcelain-handled form of which, also designed specially to meet Home Office requirements, is



FIG. 4.—"COATES" INSULATED LAMP-HOLDER.

shown in Fig. 3. The insulating "Coates" shields for lamp-holders, illustrated in Fig. 4, is also well known. It is entirely fireproof, and can be attached to existing lamp-holders without unwiring them. Another interesting lamp-holder, which is quite new, is the "Goliath" Edison screw socket, in china and metal case, for high candle-power Osram lamps.

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CATALOGUES AND PAMPHLETS, &c., RECEIVED

LACQUERS AND VARNISHES.—We have received from the Fred. Crane Chemical Co. (22 and 23 Newhall Hill, Birmingham) a price list dealing with a number of special preparations for the use of metal workers, electrical manufacturers, &c. These include frosting and coloured lacquers for incandescent lamps, aluminium paints, celluloid enamels, bronzes, &c. Particular attention should be called to the company's "Zapon" cold brushing and dipping enamels for brass, copper, or silver, giving a celluloid skin, "Brassoline" cold lacquer, and the dull black "Enameloid." A separate list deals with spraying machines for spray bronzing, lacquering, varnishing, &c.

DECORATIVE OUTFITS.—The Electrical and Engineering Supplies Co., Ltd. (36 & 37 Upper Thames Street, London, E.C.), has issued a pamphlet relating to outfits for decorating Christmas trees and shop windows. All live parts are totally enclosed, and each holder has two soft brass clips for fixing in any desired position. They can be had for voltages from 100 to 250.

BOILER-FEED PUMPS.—A pamphlet (in German) from the Allgemeine Elektricitäts-Gesellschaft describes a compact form of centrifugal boiler-feed pump driven by a miniature steam turbine.

INSULATION TESTER.—A simple form of self-contained insulation testing instrument working with dry cells is described in a leaflet from the same firm.

ELECTRIC SIGNS.—We understand that Simplex Conduits, Limited (116 Charing Cross Road, London, W.C.), are making a special offer in connection with their signs. They are prepared to design a suitable advertisement for any class of goods at a nominal charge of five shillings. The price of these signs has also been reduced.

INSULATING VARNISH.—We have received from Messrs. Major & Co., Ltd., of Sculcoates, Hull, a copy of a new booklet entitled "The Manufacture of Insulating Varnish." This is an attractive little publication, describing, with the aid of excellent illustrations, the firm's methods, and should appeal to electrical engineers and all users of varnish. The view of the firm's electrical laboratory, where insulating varnish is tested up to 42,000 volts, is of particular interest. Besides finishing varnishes for motor coils, &c., the firm makes black japan varnishes, acid-proof enamel, tinting varnishes for lamp bulbs, core plate varnishes, mica building varnishes, and fireproof fusebox paint.

ELECTRIC SIGNS.—We have received from the Electrical & Engineering Supplies Co., Ltd. (36 and 37 Upper Thames Street, London, E.C.), a new list of electric signs illustrating a few of the various patterns made by them.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

LANTERN SLIDES.—Siemens Brothers Dynamo Works, Ltd. (Caxton House, Westminster, S.W.), have prepared a revised list of the series of lantern slides of technical subjects which they keep in stock and are willing to lend to lecturers and others free of charge. The series includes some 180 different slides, and illustrates some of the most up-to-date electrical plant. Those dealing with electric railway work and electric drive of rolling mills are particularly compete.

SMALL ALTERNATORS.—The Crypto Electrical Co., 155–159 Bermondsey Street, S.E., have put on the market a new pattern of self-contained motor-driven alternator, with an output of 100 to 2,000 watts, for such uses as ozone generation, insulation testing, and Röntgen-ray apparatus, voltages from 50 to 250, and frequencies from 40 to 125 can be arranged for, and the apparatus can be driven by a belt, using the continuous current side as an exciter if required.

DIESEL ENGINES.—A copy of a new pamphlet from the Diesel Engine Co., Ltd. (179 Queen Victoria Street, London, E.C.), gives some important figures obtained under working conditions which show the low cost of running and maintaining these engines. A long list of central stations, both home and abroad, equipped with Diesel plant, show that it is well suited to this work. We understand that at the present time some 600,000 b.h.p. are in use. Some of the larger plants installed are beautifully illustrated on art paper in a separate pamphlet. Our readers should obtain copies of these pamphlets.

AUTOMATIC SIGN SWITCHES.—A leaflet giving particulars of motor-driven switches of this type, with prices of several patterns, has been issued by the Electrical Engineering & Supplies Co., Ltd. (36 and 37 Upper Thames Street, London, E.C.). A feature of these switches is that all parts are standardised and are interchangeable, spare parts being kept in stock for quick delivery. They are made for dealing with current up to 25 amperes per way. Prices for several patterns are given.

RADIATORS.—The Dowsing Radiant Heat Co., Ltd. (105 Great Portland Street, London, W.), are bringing out some new designs of Bastian quartz heaters, which give a pure red heat. The heating elements can be easily replaced, and a good circulation of heated air is also maintained.

STEEL REFLECTORS

THE Benjamin Electric, Ltd., have prepared, and are about to issue, a new catalogue of the "Holophane-Benjamin" line of steel reflectors for industrial lighting. These reflectors, which are of stamped steel enamelled outside and coated with a special diffusing and reflecting surface inside, are specially suitable for the lighting of mills, factories, workshops, dockyards, railway stations, &c. Five different patterns are made, four of which are for pendant use in four different sizes, with lamps from 17 to 300 watt, while the fifth type, which is parabolic in three styles, is designed for local lighting with small lamps, say from 17 to 35 watt. A reflector of the focussing type is illustrated here. These reflectors are for use with the ordinary shade carrier lampholder, and no gallery is required, or they can be supplied equipped with the "Benco" weatherproof lampholder (see ELECTRICAL ENGINEERING, September 14th, page 509), making a most satisfactory and efficient line for outdoor work. They are entirely British made, and are covered by patents and registrations and pending applications.



"HOLOPHANE-BENJAMIN" FOCUSSING STEEL REFLECTOR.

ILLUMINATION

WITH a view to checking the use of incandescent lamps in unsuitable ways, a matter of greater importance since the introduction of metal filament lamps with their high intensity, the British Thomson-Houston Co. have organised an Illuminating Engineering Department as a permanent branch of their organisation, to study the subject of scientific illumination, and to disseminate correct principles among the public, thus enabling full advantage to be taken of the fine effects which their Mazda lamps render possible. They point out the great waste of light common with unsuitable reflectors, and consider that both the Continent and the United States are in advance of this country. With these objects they have issued a publication entitled "Ready Rules for Lighting Works," in which their recommendations are clearly put. As is well known, the company have produced a complete series of reflector fittings with Mazda lamps, arranged in suitable fittings to be in the correct optical position in relation to the scientifically constructed reflectors, be they of glass or metal, and they designate each complete combination of lamp, reflector, and gallery as a "Mazdalier." The reflectors are divided into three main groups, those giving a "focussing" or concentrated stream of light, those with an "extensive" or widespread distribution, and an intermediate or "intensive" form suited to a large range of purpose when spaced correctly apart according to the rules given. The trade name of "Mazdalux" is given to the metal form of reflector employed in these combinations.

ELECTRO-PLATING ON CHINA AND GLASS, Etc.

THROUGH the courtesy of the Harvey Electrochemical Co., we were able to inspect an interesting exhibit of china and glass ware electroplated by the Marino patent process, which was on view at their office in Norfolk House, Laurence Pountney Hill, E.C. As is well known, in work of this kind the article must be prepared with a metallic coating before it can be electroplated. Two half-plated samples were shown, so that the old and new processes could be closely examined. In the former, the surface of the article only is treated, with plumbago as the conducting medium, which, once started, is likely to cause the plating to peel off easily. In the latter, however, a flux is used which permeates the pores, so that when the metal is deposited it forms an integral part of the article, which no efforts will disturb without bringing off the china as well. The process is very simple, cheap, and quick. The unglazed article, after being prepared, is placed in the bath of metal, through which a current passes, and in about half an hour it is richly coated, and can then be polished, burnished, oxidised, or lacquered. Plated rims can also be formed on glass, &c., by first roughening the lip to be plated, and then immersing in the bath. Samples of salad bowls, flower vases, scent bottles, demonstrated this. The firm carry on other forms of electroplating, including the preparation of tin-plated aluminium cooking utensils. They have also a cold electro-galvanising process.

Meters Approved.—The Board of Trade have approved of the E.A.C. ampere-hour meter and the B.T.-H. A.C. single-phase meter.

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"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Dec. 7, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.
Names in italics indicate communicators of inventions from abroad.

26,410/10. **Lamp Shade Supports.** T. M. Jones, A. G. Jopp, and G. Sunnucks. For fixing lamp shades, three flat spring steel slips are fitted at one end to the inside of the casing or gallery by screws, the other end being formed with an upward bend projecting inwards, which laps over and around the edge of the globe, gripping it firmly. One clip, in combination with a projection on the casing, can be used with the same effect. Three figures.

3,514/11. **Electric Bell Push.** L. Bonnet. Two contact strips are mounted on an insulating block enclosed in a metal box, which has a tubular socket in the side to take the live wires. The push-button passes through the centre of a plate, which seals the front of the box. This is rendered waterproof by means of a shoulder attached to the button, and which is kept pressed against a rubber washer by the usual spring used in bell-pushes. Four figures.

13,021/11. **Graphite Conductors.** British Thomson-Houston Co. (*General Electric Co., U.S.A.*). This covers a process for producing pure graphite conductors, especially for use in incandescent lamp filaments, having a density approximating to 2·26. These are squirted or otherwise shaped from a mixture of finely divided pure graphite with a binder, which is subsequently carbonised or graphitised. A suitable binder consists of coal-tar pitch soluble in benzol, which becomes sufficiently liquid to flow at about 180° C.

14,729/11. **Arc Lamp Electrodes.** P. and E. Conradty. To secure regular and slow burning in electrodes of this type, the active material is arranged in spiral grooves formed on the outside of the electrode, so that the arc follows the spirals and is carried gradually round. Five figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.
Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: Blondel [Automatic, for light projections] 5,502/11; Worsley [Clutch mechanism for the attachment of] 15,862/11; Chemische Fabrik Buckau [Manufacture of magnetite electrodes] 16,902/11.

Distributing Systems, Cables, and Wires: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Circuit controlling devices] 178/11; Morgan [Wire terminals] 15,091/11; Graham [Circuit fuses] 16,228/11.

Dynamos and Motors: Electrical Construction Co., and Pensabene [Means for carrying brushes] 27,205/10; Bottone [Current generators] 28,611/10; Siemens Bros. Dynamo Works, Ltd., and Lydall [Speed control] 8,591/11; Siemens Bros. Dynamo Works [Means for obtaining constant speed in D.-C. motors] 10,342/11; Oliver Imray [Static frequency converter] 11,526/11.

Storage Batteries: Bayer and Hubbard, 16,859/11.

Switchgear and Fuses: Garside [Switches and controllers] 5,856/11; British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Electrically-operated switch control] 6,663/11; Kallmann [Safety fuses] 15,646/11.

Telephony and Telegraphy: Graham and Rickets [Impedance coil for telephony] 10,045/11; Steinberger [Telephone mouthpieces] 13,641/11; Bann [Telephone receiver holders] 13,948/11; Siemens Bros & Co. (*Siemens & Halske Akt.-Ges.*) [Mountings for wall telephone sets] 18,462/11.

Traction: Munro and Railless Electric Traction Co. [Crossings for conductors] 29,706/10 and [Current collectors for electric-vehicles] 2,889/11; Sieper [Motor-vehicle controllers] 1,776/11; Siemens Bros. & Co. (*Siemens & Halske Akt.-Ges.*) [Circuit for railway points and signals] 18,293/11 and [Railway signals] 18,776/11.

Miscellaneous: Billon Daguerre [Producing hyper-ultra violet rays] 24,025/10; Johnson (*Badische Anilin & Soda Fabrik*) [Electrical purification of gases] 60/11; Morris & Lister, Ltd., and Morris & Watson [Electrical influence machines] 2,591/11; Lake (*C. B. Cottrell & Sons Co.*) [Manufacture of electrotype plates] 13,515/11 and 13,542/11; Hertzberg, Low, and Wohl [Electrocuting trap] 16,065/11; Allgemeine Elektricitäts-Ges. [Device for locking H.-T. chamber of motor vehicles] 17,304/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: Harlé et Cie [Lighting and regulating] 25,138/11; Heimann and Schäffer [Regulating device for three-phase lamp] 25,586/11.

Cables and Wires: Stephenson [Apparatus for localising faults] 25,683/11.

Heating: Monnot [Devices] 22,992/11.

Telephony: Betulander [Automatic systems] 25,216/11.

Miscellaneous: Quastenberg [Magnets] 24,146/11; Abraham and Carpentier [A.-C. galvanometer circuits] 25,044/11; Jahr [Woven fabric electrode for utilising heating effect of a current] 25,477/11.

Amendment

17,010/10. **Braking Induction Motors.** E. Rosenberg and J. S. Peck. As a result of the extended investigation under section 8, the above-mentioned specification has been amended by way of disclaimer. It was abstracted in Electrical Engineering, August 10th, 1911, p. 450.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

29,587 and 29,590 of December 14th, 1897. **Traction Motors.** British Thomson-Houston Co. (*E. D. Priest, U.S.A.*). The first of these two patents deals particularly with the bearings and means of lubricating them. The field-magnet frame, which is made in two parts and bolted together, is supported at one end on the car axle and at the other on the truck by means of a spring-supported bar. The bearings are mounted in detachable boxes on the lower half of the frame, with lugs projecting inwardly to form guides for the brasses. These have adjusting screws adapted to be locked at the outer ends by cotter pins. The bearing box is divided into two compartments, which are packed with oil-saturated cotton waste. The oil is confined to the bearing by means of a flange round the oil thrower, whilst just behind there is a second thrower enclosed in a chamber connected with the outside of the motor.

The second relates to a general construction. The field magnets in this case are made in one piece and provided with removable frame heads. To economise space, these are designed with inwardly projecting portions to support the brasses for the bearings, and at the same time to overhang the armature winding and commutator. Other points worth mentioning are the curved flanges, which are arranged on the inner side of the frame to deal with the oil, which is cast off, and the pole piece laminations, which have their edges partly concentric and partly eccentric with the armature, whilst the commutator segments are held between a bevelled extension, and an adjustable clamping ring.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: Siemens Bros. Dynamo Works and E. A. Holmes [Searchlight type] 18,681/07; J. Y. Johnson (*Jupiter Elektrophotographische Ges.*) 19,014/07.

Distributing Systems, Cables, and Wires: A. E. H. and A. S. Dussek [Bituminous conduits] 18,849/07.

Dynamos and Motors: British Thomson-Houston Co. (*General Electric Co., U.S.A.*) [Motor control] 18,201/04; British Thomson-Houston Co. and W. F. Dawson [Rotor short-circuiting devices] 18,881/07; Rhodes Motors, Ltd., and S. H. Fielden [Controlling motors] 18,956/07.

Electric Ignition: J. Kwapil and O. Bihn, 18,868/07.

Electrometallurgy and Electrochemistry: J. Y. Johnson (*Badische Anilin & Soda Fabrik*) [Production of manganese sulphate by electrolysis] 17,981/03; H. Pauling [Obtaining nitric acid by electrolysis] 18,603/06; F. Wynne [Heating metals in molten state] 18,835/06.

Heating: D. B. Rawson and E. E. Sager [Water-heater] 19,101/07.

Incandescent Lamps: K. Füsser [Supporting] 19,073/07.

Switchgear: B. S. Hornby [Cut-outs, switches] 18,378/04; W. H. Laird [Time-switch mechanism] 18,790/07; Siemens Bros. Dynamo Works [Drum-type motor-controller] 18,833/07; R. W. Gudgeon [Commutator switch for semaphor signals] 18,843/07.

Telephony, Telegraphy, and Signalling: J. C. W. Humfrey [Signalling by perforated strips] 18,804/07; British Insulated & Helsby Cables, Ltd., and H. H. Harrison [Two-tone telegraph sounder] 18,921/07; R. R. Osman [Wireless telegraphy] 19,077/07.

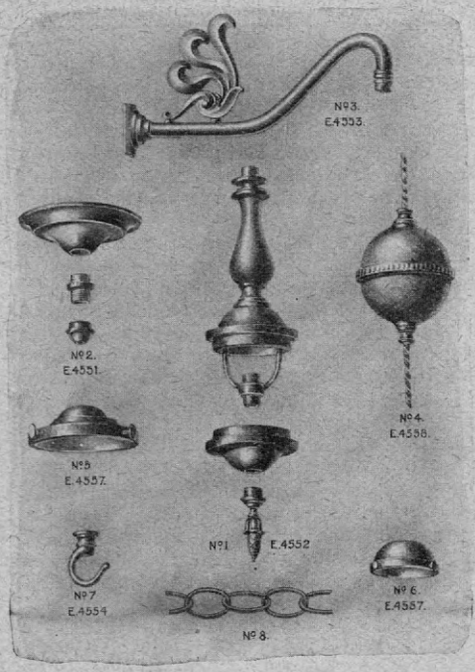
Traction: C. E. Leader [Railway signals] 18,764/07.

Miscellaneous: J. Mackenzie [Impulse transmitter for indicating movements at a distance] 18,762/07; F. E. Ryall [Thermal-electric contact device for alarms] 18,937/07; A. Jacobs [Electric thermometers] 19,102/07.

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"UNIT" FITTINGS

A NEW price sheet from Simplex Conduits, Ltd., deals with the latest developments of their unit system of making up electric light fittings. This system of adjustable parts has been devised and introduced in answer to a demand which is met with amongst contractors in outlying districts, but more particularly abroad, where the contractor cannot readily draw upon the manufacturer's stock. It is a practical impossibility for firms, particularly electrical houses in the Colonies, to carry a representative stock of electric light



Component Parts of Unit Fittings.

fittings, unless at a considerable outlay, and when one particular pattern of fitting is out of stock it often entails a wait of some months before the stock can be replenished. The Simplex "Unit" system consists of half-a-dozen parts which may be assembled in numerous ways, resulting in a handsome fitting, varying in design from a table lamp to a nine-light electrolier. The various component parts are illustrated here, and the attractive nature of the various combinations that can be made up will be readily imagined.

ELECTRIC TRACTION NOTES

A Paper on the single-phase system of main line railway traction, with the attractive title, "London to Brighton in 45 minutes," was read by Mr. Philip Dawson on Friday last at the Royal Automobile Club. After distinguishing between the main features of the continuous current third rail and single-phase systems, pointing out particularly that the latter is the only system capable of indefinite extension while at the same time quite as suitable for suburban working, the author described, with the aid of numerous lantern slides, the principal examples of main line electric traction in America and on the Continent, calling attention specially to the success of the Hamburg single-phase lines, and the decision of the Prussian Government to employ a single-phase system exclusively. The progress of railway electrification in England was briefly sketched, and some particulars were then given of the single-phase working on the South London and Crystal Palace lines of the L.B. & S.C.Ry. On the former, the first year's working resulted in a 97 per cent. increase of passengers, and the figure for the second year was 130 per cent. It was notable that they had experienced no stoppage of supply. Dealing generally with the advantages of electric traction, Mr. Dawson pointed out that whereas 1,500 h.p. was about the limit for steam locomotives, electric locomotives of 4,000 h.p. were already in regular use. Electric locomotives, on account of their regularity of torque, could exert a tractive effort 25 per cent. greater than could a steam locomotive for the same weight on the driving axles. Railways would probably in the future be able to purchase alternating current in this country at 0·4d. to 0·45d. per unit, and with the single-phase system there were no costs of conversion. With cheap electricity and a frequent train service, which enables the interest on the capital expended on the conductor system to be divided over a very large train mileage, electric traction, he said, becomes cheaper than steam, in addition to the numerous other advantages which it possesses.

The annual cost of maintenance of an electric locomotive was less than half that of a steam locomotive, and five electric locomotives would do the work of eight steam locomotives. Only one man was required to drive them, and considerable time and space was spared.

These points, he continued, are fully realised by the Brighton Railway Company, and a scheme for electrifying the whole of their services to Brighton is being investigated. The whole of the services between London Bridge and Brighton could easily be electrified, all steam, as regards this portion of the line, being entirely done away with. The Eastbourne and Hastings trains would be hauled electrically as far as Lewes, where a steam locomotive would take them to their destination. Many, if not all, the Portsmouth trains would be run electrically as far as Worthing, whence a steam locomotive would haul them to Portsmouth. Such a transformation would enable a 10 to 15 minute service to be given to Brighton, and a 20 to 30 minute service to all the intermediate stations; and the consequent traffic increase should be at least correspondingly large. It is proposed that the non-stop trains should do London to Brighton in about 45 minutes, and the stopping trains in about 60 minutes. The calculations in connection with this proposal are already far advanced, but it will be several months yet before any scheme will be ready to present to the Brighton Board for their consideration.

In the discussion that followed, Mr. O. H. Baldwin expressed regret that the equipments were of German manufacture, but Mr. Dawson explained in his reply that tenders were invited from the most important British, American, and Continental firms, but that the guarantees and prices of the particular German firm whose tender was accepted were so immeasurably better than any of the others that they could not help themselves. Lord Bessborough (Chairman of the L.B. & S.C. Railway), who was in the chair, said that Mr. Dawson's report as to the conversion of the line to Brighton would probably be presented to the Board about March next, when it would be most seriously considered, and if the advantages claimed were such as to justify it, the scheme would be put into operation. Both he and Mr. Forbes (general manager) were emphatic as to the success of the lines already converted, and the latter stated that in the year 1903-4, when the trams started running, the Brighton Company's traffic in this district suddenly dropped from eight millions to three millions. In the first year of electrification they got back to eight millions, and this year they would be up to ten millions. The results on the Victoria-Crystal Palace branch were equally satisfactory. The line was opened in May, and there had been an increase of 70 per cent. in the number of passengers. Among other speakers were Mr. E. Manville, who emphasised the advantages of single-phase working, and Mr. G. Partridge (Chief Engineer to the London Electric Supply Corporation), who said that one of the chief reasons that the supply has been so satisfactory was the simplicity of the system.

The fourth annual report of the London Traffic Branch of the Board of Trade gives at length, as usual, figures of traffic carried by railways, tramways, and omnibuses in Greater London. There is little of direct electrical interest in the report beyond a description of a proposed underground electric railway for the exclusive use of the General Post Office, in order to facilitate postal business about London. This, it is suggested, should run from east to west a distance of 6½ miles. The diameter of the tube would be 7 ft. 6 in., containing two 2-ft. tracks. The tube would be in the London clay. With a view to reducing the traffic congestion in the streets a number of suggestions are made for the provision of new arterial roads. Another point of some importance in the report is an expression of opinion that trolley omnibuses in the London area are as unsuitable as ordinary motor omnibuses. An officer of the Board of Trade who has been watching the trolley omnibuses at Leeds and Bradford states

OSRAM-LAMPS

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that the vehicles there are driven with excessive caution, such as the Commissioner of Police has never been able to obtain among drivers in London.

The arbitration proceedings in connection with the purchase of the Hammersmith lines of the London United Tramways Co. by the L.C.C.., concluded on Monday. Mr. C. C. Hutchinson, K.C., for the latter, argued that the Council had only to pay for the lines constructed ready for work, and not special payments to local authorities or the Kew Observatory, nor for Parliamentary expenses. They had also only to purchase plant that was needful for the undertaking, and not that "used" for the undertaking. The power station was "unsuitable," and should not be included in the award at all. If certain of the special payments were included in the award, he asked the Arbitrator to state a special case. Mr. Balfour Browne, K.C., replied for the Company.

The re-hearing of the arbitration to determine the price to be paid by the Belfast Corporation for the Cavehill and Whitewell tramways takes place in London to-morrow. As we pointed out in our last issue, the arbitrator's award has been remitted to him for further consideration on the ground that he has misinterpreted the terms of the reference under which he was appointed.

The *Board of Trade Journal*, quoting from a report by H.M. Trade Commissioner for New Zealand, states that the Government have informed a deputation that the electrification of the whole of the State railways is contemplated. A small branch line will probably be selected upon which to carry out experiments.

The accounts of the Bradford Tramways Department for the half-year to September 30th, show a record half-year's profit, amounting to £35,867. This exceeds the profit for the corresponding period of last year by £11,876. The Electricity Committee now supplies current to the Tramways Department at one-eighth of a penny per unit less than previously, and this has had the effect of reducing the cost of energy by £2,609.

A scheme for introducing a circular service of trolley omnibuses in North Shields and the surrounding district is under consideration.

In consequence of complaints with regard to the tramway officials assisting other municipal bodies, &c., a special committee of the Leeds Corporation was recently appointed to investigate and report. For several years past certain members of the Council have objected to Mr. J. B. Hamilton, the Tramway Manager, carrying on a private consulting practice, but the Tramways Committee have been fully cognisant of this, and it is, therefore, not surprising that the report in question is a complete exoneration of Mr. Hamilton's actions. The report contains recommendations as to the duties and privileges of Corporation officials. There was considerable discussion at the last meeting of the Leeds City Council upon the report. The Labour party on the Council have apparently taken up a very strong attitude against Mr. J. B. Hamilton, the Tramway Manager, but eventually the Committee's report was adopted, the Conservative and Liberal members of the Council voting together against the Labour group.

The Chiswick Council have before it a proposal to establish a system of trolley omnibuses in the district. The necessary powers were secured last session.

There was a net profit of £11,782 upon the Isle of Thanet Electric Trams & Lighting Co. for the year to September 30th. The directors propose to place £1,500 to reserve, £6,000 to maintenance of permanent way, £2,000 towards third-party insurance reserve, carrying forward the balance.

A sub-committee of the Todmorden Corporation has been appointed to visit the Leeds and Bradford trolley omnibus installations.

Speaking at the annual general meeting of the British Columbia Electric Railway Co., Ltd., last week, Mr. R. M. Horne-Payne stated that whilst the Corporation of Vancouver had the right in 1919 to purchase most of the railway property within the city limits on certain conditions, he personally held the opinion that the city would not wish to buy at that period or for many years to come.

In the scheme of the Brighton Corporation for the provision of trolley omnibuses, an expenditure of £137,400 is provided for.

Mr. Goodrich has given notice in the London County Council that it be referred to the Highways Committee to consider the question of an experimental installation of trolley omnibuses from West India Docks to South Hackney, and also to report as soon as possible on the adaptability or otherwise of the system in other parts of London where the existing traffic is not sufficient to justify the laying down of tramways. Mr. Johnson has given notice of an amendment to this to the effect that the Council should decline to subject the Borough of Stepney to any further experiments in view of the disastrous results of the last one there.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

A good deal of progress has been made with the arrangements for the transfer of the subscribers hitherto connected to the twenty-three exchanges of the National Telephone Co. which will not form a permanent part of the telephone system after the company's undertaking has been transferred to the Post Office. A certain number of these exchanges have been changed over already, and transfers are being made in various parts of the country every Saturday, that day of the week being chosen in order to have the Sunday for clearing any faults that may arise. In the London district, the Ealing and Esher exchanges have already been changed over, and several transfers have also taken place in South Wales. Practically all the Post Office exchange equipments are ready for the additional subscribers to be transferred to them, and the transfers are being made gradually in the order of their comparative urgency. With regard to London, the new "Avenue" exchange in Creechurch Lane is now complete, and the whole of the subscribers to the old Avenue exchange will be transferred *en bloc* on a date yet to be settled, but possibly during the first week of the new year. The whole of the Westminster subscribers will be transferred to the Victoria exchange on December 30th. This transfer is arranged to synchronise with the coming into force of the new directory, on account of the changes in the telephone numbers. At the Avenue exchange there will, of course, be no change in the numbers. The third of the London exchanges which will be discontinued is "Bank," but it will be some months before this will be transferred as, owing to the lease having still some time to run, the matter is not so urgent as in the case of those exchanges the leases of which expire at the end of the year. The Bank subscribers will eventually be connected to the "Central" exchange.

Automatic telephone exchange working is to be given a thorough trial in Australia. There is already a trial installation within a building in Sydney, and the Australian Postmaster-General has recently accepted a tender from the Automatic Telephone Co. of Chicago for an installation on the Strowger system at Geelong. This installation will have an initial capacity of 600 lines, but will be capable of considerable extension. In the case of several telephone exchanges in other parts of the Commonwealth, alternative tenders are being invited for C.B., semi-automatic, and automatic equipments. In view of the fact that every adult operator must receive £110 per annum, it would appear that there is room for considerable economy by the adoption of a satisfactory automatic system.

The Postmaster-General has introduced a Bill authorising the Government to make a payment of £3,000,000 to the National Telephone Co., on account of the telephone purchase money, before the total sum payable is finally ascertained.

In reply to a communication from the Islington Borough Council with reference to the rating of telephone wires after the Post Office has acquired the National Telephone Company's system next year, the Postmaster-General states that the Government are willing to authorise some contribution in lieu of rates on the transfer of the telephone plant, and that the precise basis of contribution is still under consideration.

Representatives of all the Manx municipal bodies met at Ramsey last week, and passed a resolution requesting the Lieutenant-Governor to petition the Government for telephonic communication with England.

The Executive Committee of the Farmers' Union have resolved to ask the Postmaster-General to reconsider the scheme of rural party telephones, and to arrange for farmers to be connected with the main telephone line separately at a much cheaper rate than at present.

It is stated that the dispute between the National Telephone Company and the Hythe Town Council has been settled, both parties paying their own costs.

Mr. Charles Bright, F.R.S.E., in an interesting article in the *Empire Review*, urges once more the importance of consolidating the telegraphic communications of the Empire. He

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deplores the control of most of the Atlantic cables passing into American hands. He outlines a scheme for the completing and duplicating of the existing network by additional British-owned cables, amounting to some 8,000 miles, and contrasts the German cable policy as compared with our own, and discusses the proportions in which the Colonial Governments should contribute to the scheme. Mr. Bright does not look forward to any great supplanting of cables by wireless telegraphy, unless great unlooked-for developments take place in the latter, and does not consider an Imperial wireless scheme as in any way a suitable substitute for the completion of the Imperial cable chain. Nor does he think much of the value of wireless communication in time of war, on account of the ease of interference, but he urged strongly the strategic value of a complete Imperial cable chain.

On the 6th inst. the cable between Bolama and Bissao was restored, while the route of the Indo-European Telegraph Company was down between Alep and Bagdad.—On the same day the cable between Cape Saintjacques and Doson was put into working order, and on the following day the Indo-European Company repaired its line.—The Norwegian Government, on the 7th, advised the opening of wireless telegraphy between Ingo in Norway and the Spitzbergen Islands, but this service is to be considered as an extension of the telegraph system.—The line between Bagdad and Bassorah was down on December 8th, and was repaired on the 10th.—In connection with the King's visit to India, two more special offices have been opened at Durbar Camps.—The route *viâ* Kiachta is working normally again.—The cable between the Faroe Islands and Iceland has suffered an interruption, and on the 11th inst. the French cable company repaired the section between Paramaribo and Cayenne.—Owing to the pressure of work on the Malta-Tripoli cable, the Eastern Telegraph Company states that messages can only be accepted at sender's risk.

According to a Reuter telegram from Melbourne, Marconi's Wireless Telegraph Co. has notified the Australian Commonwealth Government of its intention to take proceedings to test the right of other companies to use certain systems there, including the Telefunken system, which is used in the Commonwealth telegraph stations.

According to the *Daily Chronicle* Melbourne correspondent, the Australian Postmaster-General has announced that the Government have abandoned the Telefunken and Marconi systems of wireless telegraphy in favour of the Balsillie system.

LOCAL NOTES

Accrington: *Gas Plant.*—In further reference to our notice last week with regard to the installation of gas plant at the electricity works, the estimated cost is put at £27,000. It is intended to instal a 2,000-b.h.p. gas engine with a by-product recovery plant. It is estimated that on a 60 per cent. load feeder there will be a saving in favour of gas of £1,100 per annum, and that there will be a further sum of £1,250 per annum in revenue from by-products. Tenders for the plant have been received, but their acceptance is conditional upon the Local Government Board granting the loan.

Barcelona: *Electricity Supply.*—According to the *Financial Times*, the well-known Canadian group who control the Rio de Janeiro Tramway, Light & Power Co., Ltd., have acquired two large water power rights in Barcelona, and propose to erect two 120,000-h.p. power stations. A new company with a capital of £4,000,000 is to be promoted.

Bath: *Municipal Wiring.*—The Electricity Committee's recommendation that the Council should support the I.M.E.A. Bill on condition that the Council's share of the promotion expenses does not exceed £100, has been passed.

Carnarvon: *Street Lighting.*—At the last meeting of the Council the scheme for the electric lighting of the streets, which has been under discussion for many months, was rejected by a majority of twelve to ten.

Linlithgow: *Electric Supply.*—Some private promoters have placed an electric lighting scheme before the Council, which is to be considered at a special meeting.

Liverpool: *Price of Electricity.*—The Lighting and Tramways Committee have instructed the Electrical Engineer to draw up a report on the possibility of reducing the charges for electricity supply.

London: *Hammersmith: Supply of Fittings.*—Early this year the Council approved a scheme for the supply on hire of wiring and fittings for external lighting. This scheme only included the hiring of lanterns with clusters of incandescent lamps, but the Electricity Committee have now prepared an enlarged scheme, which includes the hiring of arc lamps. It is proposed that the Council shall supply the lamps direct and that the work of fixing and maintenance shall be carried out by its own workmen and not by contractors.

L.C.C.: Electric Lighting.—Tenders are to be invited from six selected firms for the electric lighting of the new engine house at the Abbey Mills Pumping Station.

Nelson: *Municipal Wiring.*—Consideration of the request from the I.M.E.A. for financial support to their Bill relating to Municipal Wiring, &c., has been deferred.

Swansea: *Electricity Accounts.*—The accounts of the electricity undertaking for the year to March 31st, which have just been issued, show a net profit of £2,802 against £2,722 for 1909-10. The total revenue increased from £26,300 to £29,800.

Teignmouth: *Electric Supply.*—Dr. Purvis, of Exeter, recently placed an electric lighting scheme before the Council, but the terms were considered too high. At the same time there is a strong feeling in the district that electricity should be available, and a resolution is to be brought forward at the next meeting urging the Council to apply for a provisional order.

Sheffield: *Street Lighting.*—The Electric Light Sub-Committee have placed before the Watch Committee proposals for street lighting by metal filament lamps in all streets in the city where electric mains are laid.

Topsham: *Fire at Electricity Works.*—A fire which practically destroyed the works of a Topsham electric lighting company occurred on Sunday night. According to accounts in the local papers, the only part of the works which has been at all saved is the battery room. The damage is estimated at £2,000.

Worthing: *Proposed Purchase of Electricity Works.*—Mr. F. C. Gates has written to the Electricity Committee offering, on behalf of himself and a number of friends, to take over the electricity undertaking from the Council. The Electricity Committee report that in their opinion the undertaking is in a satisfactory condition, and that the offer should not be entertained. This proposal was adopted at the last meeting of the Council.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Argentine.—It is stated that plans for the conversion to electric traction of the Central Argentine Railway line to the Tigre will shortly be presented to the Government. If negotiations with the electric supply company do not bring about a result, the Railway Company will erect its own power house.

Bexhill.—A Local Government Board inquiry was held last week concerning a loan of £3,200 for electric supply purposes.

Blackpool.—The Electrical Engineer has been authorised to lay a new high-tension feeder, and a new tramway feeder.

Bolton.—The Electrical Engineer has prepared a scheme for a new power house.

Bootle.—A loan of £41,255 is proposed for additional generating plant.

Burton-on-Trent.—The Electrical Engineer has presented a scheme of extensions at the electricity works at an estimated expenditure of £17,000. The scheme practically involves a duplication of the present plant.

Canada.—According to the *Board of Trade Journal*, an Ontario Municipality will shortly invite tenders for large quantities of electrical plant. An address may be obtained at the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

Carlisle.—An application is to be made for a loan of £5,100 for cables and £1,744 for lighting battery, booster balancing set and switchgear.

Croydon.—Extensions and renewals at the electricity works are to be carried out as follows:—Switchboards £4,000, cables £300, boiler extensions £250.

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Greenock.—There seems every possibility of arrangements being made between the Council and the Port Glasgow Council for supplying electricity. The estimated capital expenditure upon the scheme is £25,000.

Hornsey.—Tenders are invited for a steam dynamo set with either reciprocating engine or turbine. Full particulars from Borough Electrical Engineer.

Ireland.—A scheme for the electric lighting of Killeshandra by the Cavan Rural District Council has been approved by the Irish Local Government Board.

Llanbedr.—The Council have decided to adopt the electric lighting scheme, using water from the River Astro for driving the generating plant.

London: *Hackney.*—Mains extensions at an estimated cost of £2,000 are recommended.

Lytham.—Mr. P. J. S. Tiddeman, on behalf of the Lytham Electric Lighting Co., is endeavouring to promote an electric supply scheme there. An initial outlay of £10,000 is necessary, and up to the present £4,000 has been raised. The scheme is being placed before the Local Traders' Association.

Nelson.—A loan of £3,000 for mains and services is to be applied for.

New Zealand.—A proposal to borrow £12,000 for electric lighting extensions has been placed before the New Plymouth Council.

The Frankton Council have decided to establish an electricity works.

South Africa.—The Wynberg Council propose to undertake an electric supply installation.

Tunbridge Wells.—In consequence of the development of the electricity undertaking, the Electrical Engineer asks for a loan of £6,000.

Turton (Lancs.).—An inquiry was held last week concerning a loan of £4,500 for electric supply purposes. There was no opposition.

Wrexham.—An application is to made for a loan of £1,200 for mains and £600 for services.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Barking.—New post office. H.M. Office of Works, London.

Barrow-in-Furness.—Tenders are invited for an electrical installation at the central fire station, Abbey Road. Particulars from Borough Electrical Engineer.

Bexhill.—New drill hall for Territorial Association.

Birmingham.—New art gallery. Architects, Messrs. Crouch, Butler & Savage, Newhall Street.

Bridlington.—Extensions at the grammar school. Architect, J. Bilson, 23 Parliament Street, Hull.

Cambridge.—Schools in Melbourne Place. Borough Engineer.

Cheltenham.—New municipal offices.

Croydon.—Fifteen houses, Norton Gardens, W. F. Riley, London, S.W. Fourteen houses, Brockenhurst Road, R. Palmer, Sherwood Road. Ten houses, Cedar Road, C. Banks, Oakfield Road.

Fulham.—Cinematograph hall in High Street.

Hendon.—Elementary school for 1,000 scholars. Middlesex Education Committee.

Lancashire.—Elementary school near Rochdale. Girls' grammar school on High Street estate, Lancaster. Architect, Mr. H. Littler, 16, Ribblesdale Place.

Manchester.—Extensions in technical institute, Old Trafford. Architects, J. Bowden & Co., 14 Ridgefield, Manchester.

Northallerton.—School in Victoria Street. Architects, J. M. Bottomley & Wellburn, 28 Albert Road, Middlesbrough.

Rathmines.—New technical institute costing £10,000.

Wood Green.—Music-hall.

MISCELLANEOUS

Bedford.—The Electricity and Street Lighting Committee have prepared a scheme of street electric lighting.

Canada.—The *Board of Trade Journal*, quoting from a Toronto paper, states that surveys are being made for an electric railway from Port Hope through Peterboro' to Orillia. It is proposed to connect the lines at Port Hope with an electric railway from Montreal and Toronto. The Canadian Northern Railway Co. is said to be interested.

New Zealand.—The Nelson City Engineer, says the *Board of Trade Journal*, has been instructed to report upon a tramway scheme.

The Palmerston Borough Council has decided to obtain a report from Mr. F. Black, an electrical engineer of Wellington, with regard to tramways.

Rathmines.—The Council have applied for a loan of £1,000 for the purpose of an electric fire-escape and tender.

Russia.—The *Board of Trade Journal* states that the Russian Minister for Home Affairs proposes to allocate a sum of £950,000 for new telegraph lines.

Switzerland.—The Railway Budget for 1912 includes a sum for the equipment of eighty-four coaches with dynamos for electric lighting.

TENDERS RECEIVED AND ACCEPTED

Bournemouth.—An offer by the British Westinghouse Co. to fit brakes to thirty small cars at £22 5s. per brake has been accepted.

Brighton.—The Electric Lighting Committee have had before it tenders from a British firm for electric lamps at 6s. per lamp for street lighting, and from a German firm at 5s. 3d. They have decided to accept the former.

Bury.—The tender of the British Westinghouse Co. for two 750-kw. rotary transformers has been accepted.

London: *L.C.C.*—The tender of Messrs. L. Andrew & Co., of Manchester, has been accepted for a twelve-months' supply of insulated materials. Tenders by Messrs. Hooper's Telegraph Works and the Yorkshire Cable Co., for a twelve-months' supply of electric cables and wires, and for the supply of electric lamps for a similar period by the A.E.G. Electric Co., Brimsdown Lamp Works, The Brush Electrical Engineering Co., Ltd., and the General Electric Co., have also been accepted.

Hammersmith.—The following tenders have been received for cables:—Standard Cable Manufacturing Co., £277; General Electric Co., £292; Connolly Bros., £315; Union Cable Co., £316 5s.; Western Electric Co., £322; Electrical Engineering & Agency Co., £328; Aubert, Grenier & Co., £328; Siemens Bros. Co., £346 15s.; Callender's Cable & Construction Co., £348; British Insulated & Helsby Cables, £348 7s.; Johnson & Phillips, £348; W. T. Henley's Telegraph Works Co., £352 10s.; R. Todd, £354; Pirelli, £360; W. T. Glover & Co., £363 10s.; Craigpark Electric Cable Co., £370; Drake & Gorham, £392 14s. The tender of the Standard Cable Manufacturing Co. is recommended for acceptance.

Tottenham.—A tender by the North Metropolitan Supply Co. for the electric lighting of the Down Lane school has been accepted.

The Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—Members: T. J. H. Blackley, G. Dunn, R. S. Whipple. Associate Members: W. Arundell, R. C. Atkinson, B. J. Beasley, P. W. Beatty, P. E. Bolton, G. E. Carr, H. W. Devey, W. E. Downey, R. H. Friend, W. E. Highfield, H. D. Johnston, E. P. Jones, J. E. Jones, A. Kean, C. B. Kinnes, S. Y. Maling, I. W. Massie, T. Mills, R. D. Moss, H. W. Outram, A. J. Percival, W. Pleasance, E. B. Preston, J. S. Primrose, E. M. Redfern, G. Salter, J. H. Schnauber, H. Smith, J. Sykes, H. A. Tulloch, D. G. Vincent, D. B. Webbe, W. Wilson, J. Wright. Associates: E. J. Dutch, H. C. Houghton, W. W. Howie. Students: G. Arblaster, J. O. Archer, E. G. Batt, F. A. Broadhurst, J. P. Castle, H. N. Davis, S. W. Dunn, A. English, M. N. Ghose, H. Gibbs, A. Grad, W. H. Harris, A. V. Labayen, A. Sacré, C. E. Smith, E. M. Teare, B. P. Walsh.

"Zed" Fuses and "The Miracle."—Messrs. Siemens Brothers Dynamo Works, Ltd. (Caxton House, Westminster), inform us that they have received the order to supply the whole of the fuse distribution boxes and ironclad switch and fuse gear required in connection with the forthcoming production at Olympia of the wordless spectacle entitled "The Miracle." The "Zed" distribution boards will have to comply with the theatre regulations of the L.C.C., and the supply of these boards in record time (the order has to be completed in ten days) was only made possible by the firm's extensive experience of theatre installations, enabling them to standardise boards of suitable design. The whole of the ironclad switches will be of their standard "SW" type manufactured at Stafford Works. These boxes, we understand, are selling so well that the firm has been obliged to adopt special arrangements to keep pace with the demand.



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APPOINTMENTS AND PERSONAL NOTES

The recommendation that Mr. G. Claughton should be appointed Assistant Engineer, and Mr. G. T. Joyce Assistant Manager, at the Brighton electricity undertaking, referred to in our last issue, has been passed by the Council.

The list of candidates for the appointment of Borough Engineer at South Shields has been reduced to Mr. A. G. Cooper, of Colne, Mr. H. S. Ellis, of Bradford, and Mr. E. S. Rayner, of Doncaster.

The City of Birmingham Electric Supply Department has a few vacancies for dynamo attendants at the Summer Lane electricity works. Commencing wages, 25s. 9d. per week of 56 hours (see an advertisement on another page).

The salary of Mr. H. Baker, cashier in the Tramways Department of the Bournemouth Corporation, has been increased from £175 to £190 per annum with a maximum of £200 next year.

An assistant is required in the mains department of the Derby Corporation electricity undertaking. (See advertisement on another page.)

Mr. A. H. Burbidge, Electrical Engineer and Tramway Manager to the Kilmarnock Corporation, has been appointed Engineer and Manager of the Burmah Electric Lighting and Power Co.'s undertaking in Mandalay.

The Newport Corporation have received forty-nine applications for the post of Commercial Manager to the Electricity and Tramways undertakings. The salaries asked range from £200 to £1,000 per annum. A short list is to be prepared.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars c.i.f. port of arrival, quoted on Tuesday night, was £62 5s. to £62 15s. (last week, £61 to £61 10s.).

Patents for Sale.—The proprietors of a telephone patent are desirous of licensing it to British manufacturers. (See an advertisement on another page.)

The proprietor of British patent 17,062 of 1903, for improvements relating to ignition devices for internal combustion engines, desires to dispose of same or enter into working arrangements (see advertisement on another page).

Tantalum Lamps.—All the tantalum lamps supplied from Siemens Brothers Dynamo Works, Ltd., Works and Stores, at Tyssen Street, Dalston, will henceforth be marked on the bulb with the word "Tantalum," and in a short time all deliveries of "Tantalum" lamps from the firm's branches will bear the same mark.

Liquidations.—The British Tramways & General Construction Co. is to be wound up voluntarily. O. H. Smith, Mount Clare, Roehampton, S.W., and B. C. Molloy, 5 Paper Buildings, E.C., are liquidators. A meeting of creditors will be held at 83 Cannon Street, E.C., to-morrow (Friday) at 12 noon.

A meeting of the British Aluminium Co. will be held on January 15th, 1912, at Basildon House, Moorgate Street, at 10.30 a.m. to hear the account of the winding-up. This, of course, relates to the old company in voluntary liquidation.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

India Rubber, Gutta Percha & Telegraph Works Co.—The accounts for the year to Sept. 30th show a net loss of £55,457. The directors have transferred £50,000 from reserve to the balance brought forward last year of £22,614, and after meeting the preference dividend a balance of £4,657 is carried forward. No distribution is made to the ordinary shareholders. The report states that the general business of the company has been fully maintained, but it has unfortunately been absolutely impossible during the last eighteen months to vary the selling prices in step with the enormous fluctuations in the costs of raw material. The company's electrical work shows a slight improvement.

The Melbourne Electric Supply Co.—There is a net profit of £16,528 available from the year to August 31st. A dividend of 2½ per cent. is recommended on the consolidated ordinary stock, and a balance of £5,207 is carried forward.

NEW COMPANIES

DIMMING SWITCHES.—Registered by Jordan & Sons, 116 Chancery Lane, W.C. Capital, £2,000. To acquire from the Midland Electric Manufacturing Co., Ltd., a licence to use an invention for improvements in current-graduating devices or resistances.

ROMOLITE, Capel House, New Broad Street. Capital, £1,000. Electrical Engineers and Manufacturers.

KENT-MITCHELL. Registered by Jordan & Sons, 116 Chancery Lane, W.C. Capital, £600. To acquire patents for the Multiplex Advertising Machine, Lazilite electric fittings, and the Kent-Mitchell Gear.





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ELECTRICAL ENGINEERING

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SUMMARY

A Christmas story appears on page 691.

A letter in our correspondence column makes a suggestion regarding the control of the finances of the Institution of Electrical Engineers. A well-known firm writes to correct a wrong impression that might be gathered from a paper read recently on commutator construction. A letter from the Secretary of the Electrical Trades Benevolent Institution refers to the position of that deserving body. (Page 691.)

At the annual dinner of the Scottish Local Section of the Institution of Electrical Engineers, the economies of the Glasgow telephone system were referred to, and Mr. Ferranti expressed agreement with some of the criticisms of the proposed new Article of Association made by the Scottish Section. (Page 692.)

A draft set of rules for the proposed Association of Consulting Engineers has been drawn up. (Page 692.)

Mr. A. H. Seabrook read a Paper on "Residence Tariffs" at last Thursday's meeting of the Institution of Electrical Engineers. He discussed the pros and cons of the various methods of charging, describing in particular the so-called telephone system in use at Marylebone, where an amount depending on the number of active lamps is paid in advance, and a further charge of 1d. per unit made for electricity consumed for all purposes. Some difference of opinion as to the merits of this system was shown in the discussion. (Page 693.)

In the discussion at Leeds on Dr. Pohl's Paper on Standards for Electrical Machinery, the E.S.C. standards were severely criticised. The remarks throughout were of a thoroughly practical nature, and showed an appreciation of the various points of detail dealt with in the Paper as well as its general conclusions. (Page 695.)

Short articles describing some new fittings, &c., appear on pages 695 and 696.

In consequence of the estimates for the conversion of the street lamps in Hampstead from gas to electricity having been exceeded by £10,000, the chief electrical engineer to the Council has been asked to resign and the services of the chief assistant electrical engineer have been dispensed with. (Page 696.)

In our "Electric Traction Notes" we give the arbitrator's award as to the price to be paid for tramway energy at Gravesend, and refer to the Board of Trade inquiry into the tramway accident at Stalybridge in October; the refusal of the City Corporation to agree to the construction of tramways over the proposed new Southwark Bridge; and the "A.-L." system of "continuous" transportation. (Page 697.)

Under "Telephony and Telegraphy (including Wireless)," we report a paper read before the Institution of Post Office Electrical Engineers, in which the "parallel distribution" method of laying telephone cables in-

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stead of laying a large multiple cable to a distributing centre is advocated. We also mention the fact that the Government do not intend to undertake the expenditure involved in laying a State-owned Transatlantic cable, and the appointment of a joint solicitor to the G.P.O. (Page 697.)

A PATENT for a new type of brush gear, in which no current passes through the holder, was published last week. Another referred to a trolley-'bus system of traction, and described a crossing for wires of opposite polarity. Contacts for switches and controllers, and terminals for insulated conductors, were also dealt with, as well as a method of maintaining a constant speed on D.-C. motors. A patent has been granted, in spite of opposition, in connection with long electric arcs for producing a reaction between gases. A patent for a system of electric welding expires during the coming week, after a full life of fourteen years. (Page 698.)

A COMPANY has been fined for making unauthorised connection with the Hampstead electricity mains.—The L.C.C. and the Marylebone Borough Council have settled their dispute concerning pressure testing stations.—Farnham Council have refused a general consent to the system of supplying a number of houses from one service, but will consider individual cases. (Page 701.)

A 150-KW. Diesel-driven alternator is to be installed at Bray; a high-speed generating set, balancer, &c., are required at Dartford; mains at Epsom, Battersea, Poplar, Motherwell, and Tunbridge Wells; additional generating plant at Nuneaton and Swansea, and a new power station is contemplated at Torquay. (Page 701.)

THE COMPLIMENTS OF THE SEASON

OUR Editor and Assistant Editor have been very pleased to receive from Siemens Brothers & Co., Ltd., and Siemens Brothers Dynamo Works, Ltd., copies of the 1912 issue of their well-known morocco leather-covered pocket diary, which has proved of great utility on former occasions.

The Editor has received an elegant and extremely useful gift from Simplex Conduits, Ltd. It consists of a neat leather case of exactly the size and shape to fit into a waistcoat pocket, and contains a steel rule graduated in inches and centimetres, a knife, stylographic pen, and a pencil. It is beautifully made and finished, and is the neatest thing of its kind we have seen.

Mawdsley's, Ltd. (Zone Works, Dursley, Gloucestershire), are sending to their friends an artistic wall calendar with a reproduction in colour of a picture by Frank Haviland.

We have received a handsome and convenient blotter from Bruce, Peebles & Co., Ltd., with combined calendar and book of squared paper.

The Phœnix Electric Heating Co. accompany their season's greetings by a calendar on which is reproduced in colour a charming landscape by Yeend King.

The pocket diary issued by Simplex Conduits, Ltd., besides serving this purpose in a most convenient and practical shape, contains, without an undue increase in bulk, an abridged catalogue of "Simplex" specialities and a collection of the tables and "constants" most required for house-wiring work. It is an ideal pocket-book for the wiring contractor.

The Brimsdown Lamp Works, Ltd., have sent us a useful Christmas present in the shape of a pack of playing cards, on the backs of which a facsimile of their excellent "John Bull" poster is printed. The pack includes a "joker," so that it is presumably intended for the game of poker. We wish the company a flush sequence of really good orders during the coming year.

The wall calendar being issued by the D.P. Battery Co. is embellished with a series of views of the picturesque neighbourhood of the Company's works in Derbyshire.



ODD-MAN "ELECTRICIAN" NEWLY IN CHARGE OF COUNTRY HOUSE PLANT:—It's a shame the way the last man kept the place, Sir. Why, the water in these glass cisterns was *filthy* and these gridiron things were choked up with dirt, so I've cleaned 'em and given 'em all a coat of paint!

EMPLOYER (evidently pleased):—Ah! perhaps we'll have a better light, now!

***PUBLISHERS' NOTICE:—Books containing 48 Reprints of the Cartoons from Oct., 1910, to Sept., 1911, may be obtained, Price* 8d. *net (post free* 9½d.).**

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A CHRISTMAS STORY

IT was not yet midnight. I had been at the last Dynamicable dinner before Christmas, but had left early, and was sitting musing in front of the fire in my study. One of the performers in the after-dinner entertainment had been a conjurer, who had done many things that seemed impossible. I was wondering whether one could not enlist his services in the electrical industry to bring about an increase in the prices of motors and generators. It was doubtful, however, whether the Institution of Electrical Engineers would accept him as a Corporate Member, and he might refuse to help if he were made a mere Associate. Then suddenly I heard a voice in front of me saying, "You pay your increased subscription; we do the rest." The speaker stood between me and the fireplace, but the door of the room had not opened.

"You can't be Santa Claus," I said sleepily, "because your beard is r——, I mean, golden; and you can't be the Honorary Treasurer, because he wouldn't come down the chimney."

"I am Santa Claus," said the man with the golden beard; "my beard is getting white very quickly; you see, I must talk at all the meetings. Fifty-six hairs turned colour at Leeds alone, and it will be quite white before Christmas. Come along back to the Trocadero Restaurant; the Dynamicables are waiting for me."

Before I could recover from my surprise, I was back among the Dynamicables in the seat I had vacated half an hour previously, and I found that Santa Claus had already begun his speech.

"I wish to impress upon you," he was saying, "the dignity that is conferred on the Dynamicables—on every member of the Dynamicables—by the amplitude and magnificence of this noble hall in which we dine. Dignity is what we want, and it is dignity we must have. We ask you further to pay larger subscriptions to enhance that dignity. It is true that we do not require an increased revenue to maintain the magnificence or the dignity of this hall or the structure of the Trocadero; no, our finances are ample to meet all requirements in this respect. We want the increase for other matters—many other projects—they are so many that I will not weary you by naming them. It is sufficient for me to assure you that they are all dignified. You may trust them all to your Council: they know what they want, and they know what you ought to want.

"It is proposed to increase the subscriptions of members by fifty per cent.—think what this means in raising the status of the association! The Honorary Members and the present Life Members pay no subscriptions, but they must also have their dignity raised, and we intend to increase their subscriptions by one hundred per cent. We have members abroad, but the dignity of this hall throws its rays to the uttermost ends of the earth. The subscriptions of these members must be raised in proportion to the distance, for you are aware that the radiation of dignity cannot be done without money.

"Then there are others. The dignity conferred by the increased subscription will attract greater numbers of members. Unlike another Institution, the Dynamicables is limited to a membership of 101, and the already large waiting list will be greatly increased. The members on the waiting list are honoured by being proposed, seconded, and supported by members of an association upon whom this hall casts its dignity, and they too must pay subscriptions—large and dignified subscriptions. This class requires a designation, and we propose to call them "Expectants," but we are ready to consider any suggestion of an even more dignified title.

"Another desirable innovation is the holding of these meetings at an earlier and more dignified hour, and it is suggested that the Dynamicables shall dine at 4.30 instead of 7.30. The dignity . . ."

At this point the conversation of members who did not wish to listen to Santa Claus' speech had increased so much in volume that, in spite of his trenchant voice, his words were no longer audible.

A gentleman with a beard was protesting that the proper thing to do was to have fish dinners at Greenwich, and his neighbour was advocating a Dynamicable tennis court near Ponders End. A man with a jovial face suggested a winter meeting in Switzerland, and a polite gentleman with grey hair wanted the menus to take the form of pictorial posters. A clean-shaven man with a satirical smile clamoured for a picnic in the rooms devoted to commercial testing at Bushey, and refused to take the Chairman's advice that the proper thing to do was to have a hearing before the Comptroller of Patents. Finally, Santa Claus, fearing an adverse vote on his proposals, summoned the Trocadero orchestra, who drowned everybody's voice by playing "The Mistletoe Bough" in a depressing key —and then I awoke in my armchair in front of the fire, and sent my dog to howl at the Christmas waits.

Crystal Palace School of Practical Engineering.—The usual annual inspection and announcement of the list of certificates awarded by the examiners was held last Tuesday, Sir Douglas Fox in the chair.

CORRESPONDENCE

THE INSTITUTION OF ELECTRICAL ENGINEERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Now that the affairs of the Institution of Electrical Engineers are in the melting pot, the following proposition may possibly commend itself to members of the Institution with business training and instincts, namely, that the office of Treasurer be abolished, and the financial affairs of the Institution be controlled by the Finance Committee solely. It is an open secret that the Chairman of the Finance Committee is Mr. R. Kaye Gray, in whose business capacity every member, without exception, has the utmost confidence.

Yours, &c.,

A MEMBER OF TWENTY-SEVEN YEARS' STANDING.

December 15, 1911.

COMMUTATOR CONSTRUCTION OF TURBO-DYNAMOS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—In a paper on turbo-generator construction recently read by Mr. R. J. Roberts at Manchester, a brief reference was made to that form of turbo-dynamo commutator which consists in carrying the commutator from the outside by means of flexible steel discs attached to the end shrinking rings. Some doubt seems to exist as to the origin of this construction (the author's statement in this respect being incorrect), and hence the following particulars may be of interest.

This feature of design was got out by our Swiss house in the autumn of 1907, and duly patented in various countries, the German patent being dated November 9th, 1907, and the English patent July 11th, 1908. Since 1908 this type of commutator has been standard with us (several machines at work in England are provided with it), and has completely fulfilled expectations. The advantages of this somewhat daring construction are, firstly, that the commutator can be effectively ventilated by cool air forced through it from end to end, and secondly that circumferential distortion is practically eliminated, as the steel membranes allow the commutator to expand longitudinally almost as it likes. The nett result is, that the commutation of the machines (with carbon brushes) is quite as good as that of the best high-speed engine-driven dynamos. So far, we have found no disadvantages whatever from the above construction, but, of course, the greatest care has to be taken with the material and design of the flexible membranes.

There is an old British patent relating to a commutator construction in which the commutator is carried from the outside by means of solid supports, but as far as we know our Swiss company was the first to bring out and standardise a line of high-speed commutators embodying the principle of flexible connection to the driving shaft and the free internal air way indicated above.

We are, dear Sir,

Yours faithfully,

BROWN, BOVERI & Co., LTD.

Caxton House, Westminster,
December 18th, 1911.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Now that winter is upon us, and calls are sure to be made on the Electrical Trades Benevolent Institution, I must beg the members of the electrical industry to kindly give it their support.

The amount which has been invested since January 1st is £962 18s., and it is most important that this should be brought up to £1,200 before the end of the year. I therefore trust that I shall be forgiven for again begging.

Pensions must be paid only out of the interest on invested funds, and consequently it is essential that we should build up these more rapidly than has been the case.

Many questions are asked me from time to time regarding the position of the institution in view of the National Insurance Bill. Permit me to say that the majority of those who have benefited or are entitled to benefit by the funds of this institu-

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tion are outside the scope of the Insurance Bill. Beyond this, the benefits given by the institution differ in character and extent to those given by the Insurance Bill.

Yours faithfully,

F. B. O. HAWES,
Secretary, Electrical Trades Benevolent Institution.

18 Park Mansions, S.W. *Dec. 18th,* 1911.

ANNUAL DINNER OF THE SCOTTISH LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS

THE annual dinner of the Scottish Local Section of the Institution of Electrical Engineers was held on the 12th inst. in the Grosvenor Restaurant, Glasgow. Major James Lowson presided over a company of 240 guests in the absence of Mr. Frank A. Newington, Chairman of the Section.

After the toast of the Imperial Forces had been proposed by the Very Rev. Ll. Deane, and replied to by Sir G. T. Beatson, Sir J. H. A. Macdonald proposed the toast of the Corporation of the City of Glasgow. They had, he said, made great headway in the use of electricity for lighting and power, although he did not know whether it had succeeded in the telephone undertaking, but at least the attempt was a great credit to them. Lord Provost Stevenson, in his reply, said that the Corporation had 12,000 subscribers on their telephone system, each of whom saved £5 on his subscription during the five years that the Corporation owned the service, which meant a total saving of £300,000 to these subscribers. He was assured by the Postmaster-General that these rates would not be raised to any subscribers for eighteen months, so that a further £90,000 would be saved before the expiry of that time. The Electricity Department had progressed and developed enormously since the severance of its connection with the Gas Department, although he considered a mistake had been made by erecting the original generating station at Port Dundas, but hoped that in the near future electrical energy would be developed at the collieries outside the city boundaries.

Professor Barr proposed the Institution of Electrical Engineers. As a subscriber to both the telephone systems in Glasgow, he could not calculate that he had saved as a result of his Corporation and Post Office connection.

Mr. Ferranti, in his reply, said that there had been a great discussion and a great conflict of opinions within the Institution as to how they should frame their new rules. He had come to them a fortnight ago with fear and trembling, but he left with the highest possible opinion of their views and the sound business way in which they looked upon the whole matter. In the new rules he was sure that voting by proxy would be carried through. At present it was illegal to do this, with the result that members at a considerable distance from London had practically no voice in the management of the Institution. That, he hoped, would be altered. The result of all this difference of opinion and discussion was going to be a great revival of interest in the Institution on the part of the whole membership, and he had no doubt that their Institution was now to develop into a far more useful instrument for the benefit of the profession than it had been heretofore. There were, however, differences of opinion which had still to be reconciled, and he hoped that what would happen in the long-run would be for the greatest good of the majority. The Scottish Local Section had expressed itself definitely in favour of a uniform increased subscription and in favour of the broadening of the basis of membership as suggested in the new articles. Their largest Local Section —Manchester—held different views on these two points, but he hoped that with the interests of the whole Institution kept in view these differences would be reconciled.

Mr. W. A. Chamen proposed "The Scottish Local Section," which, he said, had risen in membership from 231 in 1906 to 355 in 1911, and Mr. Lowson replied. They were looking forward, he said, to a summer meeting of the Institution in Glasgow, when they expected some 200 guests from the South.

Underground Station Lighting.—Siemens Brothers Dynamo Works, Ltd., write us referring to our article on page 671 of ELECTRICAL ENGINEERING, December 7th, that an error arose as regards the figure which they gave for the illumination at Oxford Circus. This should have been 1½-ft. candles instead of 4½ at a height of 4 ft. above the platform. This is the value of an illumination which is practically uniform from end to end of the platform, and we can say from personal observation that a remarkably pleasant effect is produced.

THE ASSOCIATION OF CONSULTING ENGINEERS

A GOOD deal has been heard from time to time about the proposed formation of an association to protect the interests of consulting engineers as distinct from experts engaged in the commercial side of engineering work, but of the actual position arrived at comparatively little has been published. We have now before us a draft code of rules, which we have received from Mr. A. H. Dykes, who is acting as honorary secretary to the movement, which crystallises into more definite form its aims and objects. One class of members only is proposed, to pay one guinea subscription per annum, and the qualifications are that the candidate shall be in practice as a consulting engineer and shall be a full member of the Institution representing his particular branch of the profession, so that it is now quite clear that the original limitation to corporate members of the Institution of Civil Engineers has been abandoned. He is further required not to be a member or agent of any contracting firm with whom he may have occasion to deal on behalf of his clients, and not to be connected either with any company doing engineering insurance work or any firm who advertise or canvass for consulting work. The rules for professional conduct adopted by the Institutions of Civil and Electrical Engineers are, with certain slight modifications, included in the draft rules of the new Association. The election of members is to be primarily by the committee, but names of candidates are to be circulated to give the membership opportunity to offer objections. The committee are to be elected by a postal ballot, and any member may send in nominations.

These rules have been drawn up by a committee composed of the following gentlemen:—R. Hammond, B. Latham, S. R. Lowcock, E. L. Mansergh, T. L. Miller, W. M. Mordey, W. H. Patchell, W. H. Preece, H. Rofe, J. F. C. Snell, E. H. Stevenson, J. Swinburne, G. Midgley Taylor, and the Hon. Secretary, Mr. A. H. Dykes (11 Victoria Street, S.W.), to whom inquiries as to the Association may be addressed.

The Smoke Abatement Exhibition.—Considerable progress is being made with the arrangements for the International Smoke Abatement Exhibition to be held at the Royal Agricultural Hall, London, from March 25th to April 4th, 1912. The Exhibition, of which the Duke of Argyll is President, is being organised by the Coal Smoke Abatement Society, and a number of distinguished bodies have extended their support. Electrical interests are well represented in this way, as the patrons include the Institution of Electrical Engineers, which has nominated one of its Vice-Presidents, Mr. W. H. Patchell, to the Exhibition Council; the British Electrical and Allied Manufacturers' Association, with its Secretary, Mr. D. N. Dunlop, on the Council, and the Conference of Chief Officials of London Electric Supply Companies, represented by its Chairman, Mr. Frank Bailey (joint Managing Director of the City of London Electric Lighting Co., Ltd.), and Hon. Secretary, Mr. F. J. Walker (General Manager of the St. James' and Pall Mall Electric Light Co., Ltd.). Sir William Preece and Sir Oliver Lodge are Vice-Presidents of the Exhibition, and prominent members of the Advisory Council include Mr. W. Baynes (Chief Electrical Engineer, St. Pancras Borough Council), Mr. S. T. Dobson (Chief Engineer, St. James' and Pall Mall Electric Light Co., Ltd.), Mr. R. S. Erskine (Kensington and Knightsbridge Electric Light Co., Ltd.), Mr. Claude W. Hill, Professor A. Jamieson, Mr. E. L. Joseph (Ozonair, Ltd.), and Mr. J. B. Simpson (Chairman, Waste Heat and Gas Electrical Generating Stations, Ltd.). Sub-Committees have been appointed, and meet frequently to deal with the organisation of a comprehensive exhibit to demonstrate the uses of electricity for lighting, heating, and other domestic purposes, as well as for commercial and motive power purposes. A large block with a minimum area of 1,280 feet, near the centre of the Hall, has been reserved, and there will also be other shows by individual concerns. A number of the firms constituting the Manufacturers' Association are taking up the matter. Conferences and lectures will be held, and will be attended by delegates from municipalities and from the various societies. Mr. Bailey has undertaken to give an illustrated lecture with special reference to electricity. A considerable proportion of available space has been already applied for. The Organising Manager is Mr. F. W. Bridges, of 119, Finsbury Pavement, E.C.

The Society of Engineers.—Among the premiums announced at the annual meeting on December 11th was one of £3 3s. to Mr. E. Kilburn Scott for his Paper on nitrogen products made with the aid of electric power.

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RESIDENCE TARIFFS

SYSTEMS of charging residential consumers with electricity were discussed in a Paper read by Mr. A. H. Seabrook at the Institution of Electrical Engineers, London, on Thursday last.

No tariff was theoretically sound, said the author, which did not differentiate between standing and running costs, and did not charge the consumer separately with regard to them. Another important point was that of expediency, which must be taken into account from a business as well as a competitive point of view. A suitable tariff should ensure a proper return from each consumer, based upon the standing and running charges, the variables of which should be taken into account for each consumer; it should be simple and comprehensive; it should require only one meter with one system of wiring; it should offer special terms for the use of electricity for all purposes other than lighting, and encourage the long-hour use of energy for lighting; it should be cheap in application and should eliminate as far as possible complaints from customers; and, lastly, it should have great flexibility as regards the number of lamps installed, so that the consumer only pays for the light he requires.

The Paper then proceeded to review various systems at present in use. These may be classified as the flat rate per unit, the flat rate per kw. of maximum demand, with no charge per unit, and the various methods of applying the Hopkinson differential rate, which more or less combine the first two. The first is the most common system used; it charges so much per unit, regardless of the maximum demand, which ignores the costs of standing charges. It also makes no difference between the careful and the extravagant consumer, and above all it does not encourage the use of energy for heating or cooking, nor is it favourable to long-hour lighting, such as in basements and other dark places. The second system has very wide possibilities among small residence consumers where meters are impracticable on account of the cost. It charges weekly or monthly so much per lamp or per kw. or part of a kw. installed, the price per week per lamp including lamp renewals and a small charge towards the wiring, which is an instalment towards the whole cost. The system is used by the Fixed Price Light Co. in South London, and has been applied on a small scale in St. Marylebone for artisans' dwellings, consisting of one-, two-, and three-room tenements. The price per tenement is calculated, in the case of kitchens and sitting-rooms, in such a way that if the consumer uses his lamps day and night, the price per unit obtained would be a little under 1d., and lower in the case of bedrooms. The price per lamp per week includes lamp renewals, and also a sum calculated to write off within a reasonable period the capital expended in wiring. The charge for a single-room tenement is 7d. per week (one 25-c.p. osram) made up of current 4d., lamp renewals 2d., and installation repayment 1d. For a two-room tenement the kitchen is charged 7d. and the bedroom 5d. per week. This system is suitable for small long-hour users, but a limiter, which is sometimes used, spoils it, since what is saved by not having a meter is lost on the limiter.

The Hopkinson system, which has a primary and secondary rate for standing and running charges, is generally admitted to be the only correct basis of charge, but its adoption is hindered owing to the difficulty of bringing it before consumers in a simple and easily understood manner. The following are a few of the methods of putting this system into practice: The Wright system, which is well known, is difficult to understand, and almost prevents the consumer using electricity for purposes other than lighting; it is expensive in capital cost, application, and in settling complaints, and usually tends to restrict the use of electricity.

The Norwich rateable value system is a differential one, the primary rate is a fixed percentage on the rateable value of the house, and there is a secondary rate of a penny per unit. This is easily understood, cheap to apply, and encourages cooking and heating and the liberal use of energy for lighting, but it assumes that similarly rated houses will have similar installations, and that, therefore, the same amount of energy will be required by all consumers. This, however, would be a drawback in London, where the rateable value varies greatly with position.

A system not used in this country is that known as the Detroit system. This has a primary charge based on the number of rooms, a high price per unit being charged for a fixed number of units per room, all in excess being at a low secondary rate. The author quotes the *Electrical World* (New York), which compares this method with the connected load basis of primary charge. There it is stated that the latter favours the careful and not the liberal consumer, and that it is open to the consumer to increase his installation after it has been inspected. To the first of these objections the author points out that in assessing the primary charge on a "connected load" basis only "active" lamps are counted, all "convenience" lamps being ignored, which would, therefore, encourage the addition of these lights; the latter objection could be covered by prosecution. The Contract Demand system, proposed by Messrs. Handcock and Dykes, is based on the connected load principle, a limiter being installed which causes the light to flicker when the maximum demand, stated by the consumer, is exceeded. It is a very simple system, and ideal for lighting, but it is out of the question for all other uses of electricity.

The Metropolitan system, as used by the Metropolitan and Brompton Supply Companies in London, is based on the connected load, and consists of three charges, a primary kilowatt charge, a first energy charge of 2d. per unit up to the amount of the annual primary charge, and a second energy charge at 1d. per unit for all additional units. This low charge renders the use of energy possible for all purposes, and without the necessity of meters or separate circuits. It is argued that the 2d. units can be used for kettles, irons, &c., and the 1d. units for radiators, cookers, &c., but against this is the fact that the consumer cannot afford to pay even 2d. for this purpose, and he has no means of knowing when he is off this rate, so that he can make free use of the service at the lowest rate. This system depends on the method of assessing the maximum demand for lighting.

Finally, the author puts forward the so-called "telephone" system based by him on an idea suggested by Mr. Arthur Wright. This is a differential system, which bases its primary charge on 70 per cent. of the lighting load at £14 per kw. per annum, not including convenience or decorative lamps, nor watts for domestic purposes, these being charged at 1d. per unit. It is, however, stipulated that electricity is to be exclusively used for lighting, that it is to be paid annually in advance, but can be paid only a quarter at a time in advance at an increased charge of 10 per cent. It must be noted that the primary charge will always be the same as long as the watts assessed remain constant. In this way the consumer pays his share of running and standing charges; it also encourages long-hour lighting, and allows "other apparatus" to be connected without the expense of meters or separate circuits; it does not discourage the free installation of extra lights, as decorative lamps, &c., are not counted in the primary charge. The system is also simple and easy to understand, and practically eliminates complaints, as these can only refer to the number of penny units. It is maintained that 70 per cent. of the lighting watts is excessive, but the author points out that it should be remembered that no occasional lights, such as are used in cellars and other dark places, nor decorative lamps are counted, so that the larger the house the more nearly will this figure be right. In conclusion, it is stated that with a complete electric service, including heating and cooking, it will be found that the lighting portion is from one-third to one-half the total revenue of each residence, so that the lighting load factor will not be the chief factor, and cooking, taken in the aggregate, as well as fans, water heating, polishing, &c., will be largely non-peak. With regard to the cooking, it is found that at St. Marylebone the midday load is usually greater than the evening.

Mr. Seabrook announced that since the writing of the Paper, the Marylebone Electricity Department had further reduced the charge for current for heating, &c., which was now ¾d. per unit for the six summer months and 1d. per unit for the six winter months. He also circulated some tables of figures which he had worked out, showing how the annual charge worked out as an average per active room shows variation from 8s. 6d. to £3.

Discussion.

Mr. E. T. Ruthven-Murray (Engineer-in-Chief, North Metropolitan Electric Power Supply Co.) said that it was important that a tariff should be such as to encourage the "other uses" of electricity. A great deal had been made of the differentiation between standing and running costs, but no tariff should be considered sound only because it differentiated between these two kinds of costs. He was afraid that, in framing the "telephone system," expediency had weighed more

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than the other factors. The whole of the standing charges were allocated to the lighting account instead of being divided up with the other uses. In view of the fact that a house now taking, say, 750 watts might at any time put in 4 or 5 kw. of cooking plant, he thought that system was dangerous. Regarding the five essential features that the author had laid down for an ideal tariff, he scarcely thought that the telephone system really complied with any of them. No system could be considered satisfactory that assumed the honesty of the consumer, neglected load factor, and entailed invasion of the consumers' premises for inspection. The author condemned the flat rate as assuming constancy of load factor, but surely the telephone system did the very same thing. The speaker objected to the number of forms which the system entailed the filling up of, and suggested that, like the famous "Form IV.," these would eventually find their way into the waste paper basket. He did not see how the name telephone could be of any assistance.

Mr. G. WILKINSON (Borough Electrical Engineer, Harrogate) remarked that it was only the name of the telephone system of charging that was new. The system was practically the same as that used by himself at Harrogate, except that Mr. Seabrook obtained fat prices, while he obtained thin ones. While at Marylebone, £14 per kw. on a 90 per cent. load-factor basis was obtained; in his own system be obtained only £9 per kw. of maximum demand. Mr. Seabrook ought to be very glad to get his extra 1d. per unit after such large capital charges. The author, in comparing the cost of current limiters and meters, had evidently omitted the fact that the former had no shunt loss. He noted that Mr. Seabrook put demand indicators into the houses, and asked what was done when their readings were not such as were expected. The "other uses" could only be catered for as long as the mains and services would stand it without incurring enormous additional capital charges, and he would like to know what was to be done when this point was reached.

Mr. ARTHUR WRIGHT paid high tribute to Mr. Seabrook's business ability, and said that it was difficult to criticise a system which had turned a very dead concern into a very live one. He thought that difficulties must arise in differentiating between active and decorative lamps, and considered that a serious disadvantage of the system was that it omitted provision for commercial discounts. The best system for small houses was on the lamp contract basis, preferably with a limiter, without extra charge for units used, as in such cases the cost of current supplied was not more than 5 per cent. of the total cost of attending to the consumer.

Mr. C. A. BAKER (Chief Electrical Assistant, Engineers' Department, London County Council) spoke from the point of view of a large consumer, as the L.C.C. consumed some 2¼ million units per annum, of which about 1½ million were purchased from 27 different supply authorities. He had come in contact with the telephone system, but had never been tempted to adopt it. The standing charges were so large that he did much better on Mr. Seabrook's alternative maximum demand rate with 25 per cent. discount. He suggested that expediency had been depended on too much in framing the telephone system, and pointed out that in the case of a consumer who paid his standing charge in advance, and then went away for the greater part of the year, if the amount worked out at more than 3d. per actual unit consumed, the Corporation were not really entitled to retain all the money. He mentioned the use of the flat rate per kw. in Lombardy at about 15s. per lamp per annum. With regard to the system mentioned for small tenements, he thought that too much light was being supplied for the size of room, and too much was being paid for it. He had worked out from published figures that the Marylebone receipts were equivalent to 37s. per lamp, and would like to know how this compared with the price of supplying the public lamps. The flat rate had the advantage of easy intelligibility, as it involved only one factor, and he saw no reason why a satisfactory flat rate could not be based upon averages obtained from records just as the whole business of the insurance companies was based on averages. A factor which would greatly encourage business-getting would be the abolishing of all objectionable rules and regulations by supply authorities.

Mr. W. R. COOPER had for long advocated the Hopkinson system, and did not understand how anyone could now advocate a flat rate, on which heating and cooking were practically impossible. The system that had been suggested of charging a predetermined number of units at a price of, say, 6d., and all in excess at 1d., amounted substantially to the same result as Mr. Seabrook's system. Mr. Seabrook had a great eye for business, and he congratulated him on being able to obtain 10 per cent. extra on payments made a quarter instead of a year in advance. It was really more important to get plenty of business than to frame a scientifically-accurate tariff. He did not think that consumers could be relied on not to change the candle-power of their lamps, and wished to know what happened in the Marylebone system when a consumer put in more economical lamps.

Mr. A. H. DYKES (Handcock & Dykes) said the most suitable tariff for any given case depended on the nature of the station and the consumers. The flat rate would only be suitable if one could store electricity cheaply and had no apparatus outside the station. The modification of the Hopkinson system proposed by himself and Mr. Handcock three years ago was based on a fixed charge in advance instead of a varying primary charge. He advocated limiters at first, but thought that they could be dispensed with later on. Their system was not as generous as Mr. Seabrook's, as it did not allow current for other purposes at 1d. per unit. He noticed from the figures in one of the appendices to the Paper that the watts supplied for lighting were considerably less than those other purposes at Marylebone. This showed that the actual cost per unit of the lighting to the consumer was really very heavy. He did not think that a system relying on inspection and arbitrary differentiation between useful and "convenience" lights would ever be popular, and thought that the "two-rate" system would be heard of more in the future. With small consumers, however, the only possible system was a fixed charge per lamp, and in this connection he referred at some length to the operations of the Fixed Price Light Co., where a simple form of house-to-house wiring is employed.

Mr. K. A. SCOTT-MONCRIEFF (General Manager, Electric Supply Corporation) thought that the degree of loading of the cables should be taken into account in settling the tariff. He thought that a consumer who was away for the six winter months should certainly not pay as much for his units. The charging of high prices to consumers taking lighting only and a low price for those taking chiefly power or heating was akin to "dumping." Asking consumers to pay as much as five-sixths of the bill in advance could not be done in the majority of districts. There was something to be said, after all, for double wiring, but in time they would come to a very low flat rate all round. With capital expenditure down to £50 per kw., they could, he thought, at 28 per cent. load-factor charge at 1d. per unit. He suggested that the Institution might collect statistics and go into the whole matter.

Mr. F. M. LONG (City Electrical Engineer, Norwich) spoke of the success of his "rateable value" system. He did not claim, however, that it was suitable for every locality, but claimed that it would have advantages for most provincial towns of moderate size. He preferred having a charge on the number and size of the rooms, rather than the number of lamps. At Norwich the primary charge was £4 per kw. instead of £14, and the whole system worked out very satisfactorily.

Mr. J. A. B. HORSLEY (Electrical Engineer, Harrow Electric Light & Power Co.) gave some particulars of the shilling-in-the-slot meter system in use at Harrow. In the method of using these at present in force, the meters were estimated at 8d. per unit, but after the first five shillings in each quarter a rebate of one shilling in three was returned. The system was popular in small tenements, because, while the husbands put in the original shillings, the wives got those that were returned.

At this point a vote was taken as to whether the discussion should be adjourned, and it was finally announced that the subject would be returned to on January 25th.

Royal Institution.—Among the Friday evening discourses before Easter will be one on February 9th by Dr. J. B. Harker on "Very High Temperatures, with Electric Furnace Experiments," and one by Prof. Sir J. J. Thomson on "Results of the Application of Positive Rays to the Study of Chemical Problems."

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—*Member:* B. C. Wilson. *Associate Members:* Q. Arbuckle, A. W. Clegg, J. M. Crawford, A. E. V. Davies, M. B. Dewar, T. Duckitt, A. E. French, G. W. Hammond, A. F. Harmer, J. H. Hartley, W. C. Kennett, P. A. Lundberg, W. Moore, H. Nimmo, E. E. Rogers, H. Rottenburg, C. G. Slack, J. S. Terras, E. W. A. Thomas, W. Watson. *Associate:* G. H. E. Vivian. *Students:* P. C. Batstone, S. K. Chatterjee, A. B. Doyle, O. Howarth, A. S. Sarkeria, C. F. K. Sharrock, C. L. Underwood, V. H. Wells, T. P. Wilson.

Conversazione at Manchester.—A conversazione, arranged jointly by the Manchester local section of the Institution of Electrical Engineers and the Manchester Association of Engineers, was held at the Whitworth Institute, Manchester, on Friday evening last. A reception was held by the Chairman of the Local Section, Mr. Wm. Cramp and Mrs. Cramp, together with the President of the Manchester Association of Engineers, Mr. Michael Longridge, and Mrs. and Miss Longridge. The company present numbered about 260, including Messrs. S. L. Pearce, Miles Walker, M. B. Field, J. S. Peck, and S. J. Watson, Past-Chairmen of the Manchester Section of the I.E.E., and Messrs. W. Fox, J. H. Stubbs, and A. Saxon, Past-Presidents of the Manchester Association of Engineers. An excellent programme of vocal and instrumental music was afterwards provided, which was well rendered, the singing of Miss Florence Webster and Mr. Fowler Burton being greatly appreciated by the company present. The joint Committee are to be congratulated on the manner in which the gathering was arranged, which was an even greater social success than that held last year, and, judged from many personal expressions of appreciation made, it is hoped it may become one of the items on the annual programme of the two Societies.

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STANDARDS FOR ELECTRICAL MACHINES

WE give below a report of the discussion on Dr. Pohl's Paper on Standards for Electrical Machinery before the Leeds Local Section of the Institution of Electrical Engineers, on December 6th. An abstract of the Paper and a report of the discussion in London were given in our last issue.

Mr. Emmott (Halifax) said that he was in such general agreement with the author's recommendations that he would not discuss the few points of detail with which he differed. The standards for electrical machinery issued by the Engineering Standards Committee in 1907 had never been any good—he would almost like to say that they were not worth the paper they were written on. If the Institution of Electrical Engineers would get half-a-dozen manufacturers together for the purpose, they would soon lick something into shape.

Mr. Wright (Wright and Wood) said that the B.E.A.M.A. might take the matter up. He considered that the German standard specification was too lenient as regards commutation. He approved of Dr. Pohl's suggestion that the flash test should be at 1,500 volts; 2,000 volts was sometimes specified, but might be harmful to 500-volt machines, and leave a permanent strain. Standards for brushes and brush-holders would, he thought, be useful, and would be welcomed by central station engineers who might have many makes of motors to keep in repair. On the question of speeds, he pointed out that fan-makers required accurate speeds, but he thought that Dr. Pohl's list offered sufficient choice.

Mr. Foster (British Engine, Boiler, and Electrical Insurance Co.) said that coal-cutter motors were wrongly rated at present, and their temperature rises at full load were far too high. In all classes of motors the nameplate instructions were not always observed, and makers neglected to indicate whether the ratings were for continuous or intermittent work. He pointed out that the author had not included pipe-ventilated motors in his classification. He agreed with Dr. Pohl's remarks on commutators, but thought that emery cloth should not be used in any circumstances. The French, German, and Belgian standards were too lenient with regard to the shifting of brushes. In testing motors there was too much slackness in allowing for the C^2R losses at the brushes. On the question of temperature rise he said that his people worked to 40° C. surface rise on the armature, and employed the resistance test for the field coils. Dr. Pohl, in referring to the high temperatures that the insulation of field coils would stand, had mentioned the low P.D. between the turns, but the higher P.D. between the coils and frame must not be forgotten. Mr. Foster also asked whether presspahn would not become brittle at these high temperatures. He thought 110° C. too high a temperature rise to allow in the armatures of turbo-generators in view of the greater mechanical stress. One of his inspectors had suggested standardising the watt loss allowed per square inch of radiating surface. He had inquired of a leading firm of manufacturers what this allowance was in their machines, and had been given the following figures: Up to 5 h.p., 0·3 watt. Up to 20 h.p., 0·4. The whole surface area must be taken into account. Another formula was 100 times the watts expended in the coil, divided by the total surface in square inches; this gave an average of about 2 sq. ins. per watt. He agreed with Dr. Pohl that the recommendations of the Engineering Standards Committee as to temperature had made no impression; in fact, he had met specifications of 40° C. temperature rise measured by the resistance method. His company's practice was to allow a surface rise of 100° F. Dr. Pohl's suggestion for the duration of the temperature test was good, and he proposed to adopt it in his company's specifications. On the other hand, he could not endorse the author's proposal to delete 110 and 115 volts from the standard voltages, as the number of private plants at this pressure was increasing. He also disagreed with the omission of 25 cycles, as he said that this frequency did not cause perceptible flicker with metal filament lamps.

Mr. Yerbury (Leeds Corporation Tramways) advocated standardisation of mechanical as well as electrical details, and regretted that several firms considered themselves too big to adopt standards. He also said that he had obtained good results with asbestos insulated coils.

Mr. Wilson Hartnell said that the commutator depths of the E.S.C. were absurd. He could show machines which had run 20 years with copper brushes. In Japan and South Africa, people who tendered to British standard specifications were out of it altogether. On the question of temperature tests, he asked how many motors broke down through high temperature inside the coils.

Mr. French (Leeds University) said that Prof. Bone and himself had investigated the tests which had been made with flame-proof motors, and considered that the Bochum tests were fallacious, as they had been conducted in still atmosphere, and no account had been taken of the effect which the presence of coal dust would have. He proposed that there should be a standard nomenclature for degrees of sparking to avoid the use of such loose expressions as "practically no sparking."

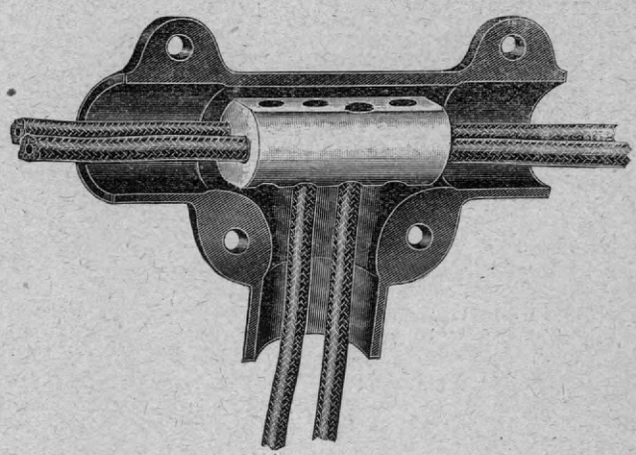
Mr. J. D. Bailie (C. A. Parsons and Co.) objected to the use of forced ventilation through internal tubes, and also advocated that temperature rise should be tested by applying the thermometer at the weakest spots.

The Chairman (Mr. Harding Churton) said that he was surprised that motors in coal mines could do their work at all, as they were handled so roughly. He pointed out that the 25 cycles must be retained as a standard, as it was the frequency of several large power companies. He thought that the importance of standardisation might be overrated, as there were already so many frequencies, and both two-phase and three-phase, and so many speeds, that it was impossible to keep motors in stock. There was also a danger in standardisation checking improvement in design. For instance, if the design of a motor on a standard 10-h.p. frame were improved sufficiently to enable it to be rated at 12 h.p., it would still have to be classified as a 10-h.p. machine if the next standard size were 12½ h.p. The main things that were wanted were standard methods of rating, and standard methods of testing.

Dr. Pohl, in the course of a brief reply to the discussion, said that the standardisation of brushes was a good idea; the Admiralty had already done this. He included pipe-ventilated motors in the classification of ventilated motors. His remark that a temperature of 257° F. would not damage the insulation referred only to the inside layers of field coils, and not armatures. He was surprised that Mr. Foster noticed no flicker on lamps supplied at 25 cycles; he had noticed decided flicker of the lamps on the L.B. & S.C. Railway. He believed in flange protection rather than plate protection for flame-proof motors.

PORCELAIN CONNECTORS

WE illustrate here a convenient form of T connection interior, which Simplex Conduits, Ltd., are introducing. This fits into standard ¾-in. split tee pieces, and is intended for making connections between small wires up to 3/22s. It can also be used in all types of circular boxes, and forms



Simplex Porcelain Connector Interior for Tee-piece.

a very useful and labour-saving accessory. Several other forms of porcelain interiors for making connections are supplied for taking connections to a switch point and a lamp point. The terminals in these are so arranged that it is not necessary to sever the main wires; about half an inch of the insulation is bared back, and the conductor thus exposed is dropped into the slot of the terminals provided and then clamped by means of a screwed ring.

Theatre Lighting.—There are in the United Kingdom 2,900 permanent entertainment houses open every night. They include 300 theatres, 800 music-halls and picture palaces where variety artistes are engaged, and 1,800 picturedromes; 400 of them light with gas, 2,500 have electrical installations, and 500 of these run their own plants. They light 10,000 arcs and 375,000 incandescent lamps nightly.

Electric Welding.—In the course of a Paper entitled "Experiments on the Strength and Fatigue Properties of Welded Joints in Iron and Steel," by Dr. T. E. Stanton and Mr. J. R. Pannell, read before the Institution of Civil Engineers on December 12th, results of experiments were given on the strength of welds made in various ways. The mean results of the tensile tests on the welded joints, expressed as a percentage of the strength of the original material from which the joints were made, were:—Hand-welded iron, 89·3 per cent.; hand-welded steel, 81·6 per cent.; electrically-welded iron, 89·2 per cent.; electrically-welded steel, 93·4 per cent. Joints made by the oxy-acetylene process were also tested, but it was stated that the results were not comparable with those obtained by the hand or electric processes.

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HAMPSTEAD STREET LIGHTING

Amazing Disclosures.

Resignation of Borough Electrical Engineer.

A REMARKABLE state of affairs has been disclosed in connection with the scheme for converting the whole of the gas lamps in the streets of the Borough of Hampstead to electricity. At various periods from July, 1909, the Council have sanctioned the conversion of 2,229 lamps, the estimated cost of which was put at £15,073. It appears, however, that the actual cost of the work has come out to £25,398, and this has, not unnaturally, created a considerable amount of consternation in the Council.

The matter has been discussed *in camerâ* by the Council, and also by the Lighting Committee, but there have been somewhat premature disclosures of what transpired there, and of the contents of a private report made by the Lighting Committee to the Council. The result is that the services of Mr. E. Sayer, the Chief Assistant Electrical Engineer, have been dispensed with, and Mr. G. H. Cottam, the Chief Electrical Engineer, has been asked to resign, which, in fact, he has now done. From the extracts of the private report which have been published, the following comparative table has been taken :—

	Estimated.	Actual.
	£	£
Cable	4,572	5,596
Troughing	2,146	4,668
Labour	4,174	6,297
Making good	3,136	7,670
Alterations	807	873
Time Switches ...	238	294
	£15,073	£25,398

These figures show an excess of 68 per cent. on the estimate, a fact which came to the Finance Committee's knowledge in October last. In their report, the Special Sub-Committee which dealt with the matter express the opinion that Mr. Sayer prepared all the estimates in a careless and slipshod manner, and that Mr. Cottam placed them before the Council without checking the figures. Mr. Sayer, it is said, had omitted to include in his estimate the compound used for filling in the cable troughs, which apparently was an item of £1,535. The explanation of the discrepancy on the cost of "making good" is that the estimate for making good the pavements was made upon the basis of Mr. Sayer's own figures, which were lower than those adopted by the Borough Engineer's Department, to whom the work was entrusted, and this fact was not mentioned at the time Mr. Cottam submitted his estimates. Another complaint is also made that certain items which should have been charged to street lighting have been charged to other accounts.

Condensation in Steam Pipes.—A Paper entitled "Methods of Dealing with Losses in Steam Plant due to Condensation," by Mr. G. Wilkinson (Chief Electrical Engineer, Harrogate) and Mr. J. R. Wilkinson, was read at a meeting of the Association of Engineers-in-Charge on December 13th, in which they emphasised the importance of removing the water by condensation regularly as it is formed, and of passing it back immediately at its highest temperature through closed heat insulated pipes direct to the steam generators. In referring to steam traps, they said that there was little to choose between the expansion, bucket, and float types, provided they were properly designed and selected. It was, however, often uneconomical to allow them to drain into the hot well, on account of the decrease in economiser efficiency involved. Proceeding to describe methods of returning the water direct to the boilers, the authors referred to the "steam loop" and Holly systems of the United States, and the modification due to one of the authors known as the "Wilkinson Thermal Column" (see Electrical Engineering, Vol. V., page 923, October 21st, 1909). The efficiency of this apparatus was stated to be so high that condensed steam can be lifted from the sump and returned to the boilers with a maximum drop in temperature of less than one degree per foot of lift. The Bundy tilting steam trap was also described, as well as the Pratt return steam trap with a float, and the Losles system designed by the authors to obviate certain defects in the foregoing systems. This has a separate bottom lifter and top feeder, the former of which has steam inlet and exhaust valves controlled by floats, while the latter contains no moving parts, a separate piece of apparatus called the controller serves to deliver and exhaust steam to and from the feeder in synchronism with the lifter by means of diaphragm-controlled valves. Another special piece of apparatus named the "equi-sump" allows the traps at points of different pressures to drain into one common return system without waste of heat or loss by evaporation.

"UNIT" FITTINGS

WE illustrated on page 683 of our last issue a set of component parts for making up electric light fittings, which Simplex Conduits, Ltd., have put on the market to assist contractors in readily supplying a variety of fittings for all requirements without the necessity of too extensive a stock. The full range of designs that can be formed from these combinations may not perhaps have been quite appreciated simply from the view of the components themselves, and we are very glad of the opportunity afforded us by Simplex



Fittings made up from Simplex "Unit" Components.

Conduits, Ltd., to illustrate two typical examples. It will be seen that, besides its use simply as a bracket, the ornamental bracket arm which is a special feature of the system can be combined with the central components to form a variety of branched pendants for several lamps. A list can be obtained from the company's offices, 116 Charing Cross Road, containing illustrations of a number of other combinations. Although we believe that something of this kind has been attempted previously on a smaller scale, the designs now being produced are entirely new.

The Explosion on Board the "Orion."—A peculiar explosion occurred in the dynamo-room of the *Orion* on Tuesday last week during the tests. So far as can be ascertained, the enclosed crank chamber of the reciprocating engine driving one of the dynamos exploded. Remarkable as it may seem, such accidents, though extremely rare, have happened on previous occasions. Several of those present at the test were slightly injured.

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CONDENSING PLANT

We have received from the Mirrlees, Watson Co., Ltd. (Scotland Street, Glasgow), a pamphlet containing an interesting description of a combined steam and water power station at Tuilière, France, for which the French Thomson-Houston Co. were main contractors, while the Mirrlees, Watson Co. supplied the condensing plant. Each of the two 3,500 kw. Curtis turbines has its own condenser, and each set consists of a cylindrical surface condenser with a cooling surface of 10,700 sq. ft., and a set of Mirrlees-Edwards' three throw air pumps, 20 in. diameter by 12 in. stroke, running at 120 revs. per min., driven through gearing from a 40-h.p. three-phase motor at 220 volts. The circulating water is delivered by two 14-in. centrifugal pumps working in parallel. These pumps draw the water from a culvert in the foundations, and the water is discharged into another culvert. The in-take culvert is fed through a conduit connecting to the high-level basin of the river. In the event of the level of the water being lowered, through the opening of the dam, circulating water can be obtained from the river below the station by means of a separate pumping installation, situated in a water-tight pit about 13 ft. above the minimum level of the discharge, and consisting of two centrifugal pumps driven by one 280-h.p. motor.

Another pamphlet draws attention to a new form of rotary air pump which the company are now manufacturing. This is the result of some years' investigations regarding rotary pumps, and embodies certain patented improvements on the original Leblanc pump.

ELECTRIC TRACTION NOTES

The Board of Trade inquiry into the tramway accident in October upon the Stalybridge, Mossley, Hyde and Dukinfield joint tramway system was resumed and concluded last week. We referred to the accident at the time in our issue for October 26th, page 586. A car got out of control upon a very steep road, which after a clear run of half a mile takes a sharp turn to the left, and crosses a railway bridge. At this curve the car left the rails and toppled over on to the railway lines thirty feet below, resulting in the death of five persons and injuries to six others. The Board of Trade inquiry was adjourned to allow of the injured driver giving evidence. He stated that although he had tested the magnetic brake once or twice and found it in good order, when he applied it on the hill he discovered that it was not acting, and the application of sand and the hand-brake had no effect on checking the speed of the car. The witness's opinion that the car left the rails at one part of the hill and regained them again was confirmed by the inspector, Colonel Von Donop, who stated that from his examination of the rails this seemed to have been the case. When nearing the bottom of the hill, the driver tried reversing the motors, which had no effect, and then continued working the magnetic brake, also without effect. The inspector will report in due course.

The Arbitrator's award as to the price to be paid for tramway energy by the Gravesend and Northfleet Electric Tramway Co. to the Gravesend Corporation has been issued. The price paid by the Tramway Co. at present for the first 180,000 units per annum is 2d. per unit, and this under the award remains. Above 180,000 and up to 350,000 units the Company now pay 1¾d., but the Arbitrator has fixed the price of 1·3d. for all units consumed between 180,000 and 280,000 per annum. Above that consumption the charge will be 0·8d. per unit.

The City Corporation have informed the L.C.C. that neither the Parliamentary Authority under which the Southwark Bridge is being reconstructed, nor the dimensions of the new bridge will permit of the construction of tramways. Whilst the City Corporation have stated that no good object could be served by further conference on the matter, the Highways Committee recommend that the Council again approach the City Corporation.

Mr. W. Y. Lewis read a Paper before the Royal Society of Arts on December 13th, in which he described his proposed "continuous" system of transportation, in which the cars are propelled by revolving shafts under the track, provided with screw thread of coarse pitch between stations, and fine pitch at stations, giving sufficient reduction of speed to enable passengers to board them. The system was described by him in a Paper before the British Association last summer (see ELECTRICAL ENGINEERING, September 14th, page 513).

An interesting rail-grinder is described in a recent issue of *The Electric Railway Journal* (New York), by which it is said that corrugations can be ground out at a cost of from ¾d. to 1d. per foot. The apparatus consists of a four-wheeled truck, on which is mounted a motor which drives through friction gear and belts a series of emery wheels, supported by a carriage 5 ft. 10 in. long, resting on four adjustable shoes for sliding along the rails. The machine can propel itself with the grinding wheels raised clear of the track. The trolley stand is 7½ ft. high, and the motor for moving the car is mounted on top of the frame, and drives through a belt and gearing.

According to the *Electric Railway Journal*, the conversion of the Washington, Baltimore & Annapolis Railway from single-phase 600-volt to D.-C. 1,200-volt working has been fully justified by results. The higher working pressure is stated to give no difficulties; the maintenance charges for the electrical equipment are said to have fallen from 0·185d. per car mile for A.-C. to 0·12d. per car mile for D.-C. working, The cost of power consumed from 2·9d. for A.-C. to 1·93d. per car mile for D.-C., and the total running costs from 11·6d. to 9·5d. per car mile. The gross receipts have also increased, and the trains are said to keep much better time.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

In a recent issue of the *Elektrotechnische Zeitschrift*, Prof. L. Zender drew attention to a method of directive wireless telegraphy without antennæ. The transmitter, which should generate at a frequency of about 100,000 cycles per second, is connected by conductors each equivalent to a quarter wave-length to two earth-plates sunk half a wave-length apart. If a similar tuned receiving circuit is placed so that the two receiving earth-plates are in a line with the two transmitting plates, the impulses from the latter will arrive at the coherer in phase, whereas interference between the two impulses will take place in a direction at right angles to the line of the plates, and no signals can be received. Directive telegraphy in two opposite directions is thus achieved. Prof. Zender patented this system in 1905, but states that he dropped the patents as he was unable to develop the system, as financial assistance was withheld on the ground that the method was opposed to the then theory that the atmosphere was the principal medium for the transference of the waves. At a recent meeting of the Deutsche Physikalische Gesellschaft, Herr F. Kiebitz, of the German Post Office, described experiments in directive telephony with very similar arrangements, with which it was stated communication had been established between Germany and Canada, and Prof. Zender has publicly complained that the arrangement used was covered by his patents, and demands recognition. Herr Kiebitz, in a letter to the *Elektrotechnische Zeitschrift*, states that his success was due to certain important modifications of his own, but Prof. Zender claims that these also were covered by his patents. In the original article, Prof. Zender offers an explanation of the fact that greater distances are reached at night, based on his theory that the earth is the main medium of transmission, and also suggests a system of secret codes in which a group of some 30 letters of the alphabet are used in succession for the ordinary letters, the order of the letters in the group being varied each time. This variation is effected automatically by a simple attachment to an ordinary typewriter, and a similar reversed device is used to decipher the message. It is stated that the code is impossible to decipher without the key.

In a Paper read before the Institution of Post Office Electrical Engineers last week, Mr. E. A. Pink advocated the "parallel distribution" method of laying telephone cables in place of the method used hitherto of laying a large multiple cable to a distributing centre, from which a number of smaller cables radiate. He recommended cables containing 40, 80, 120, 160, 200, and 400 wires weighing 10 lbs. to the mile, and laid up in bundles of ten pairs. By adopting a colour scheme, the single-pair subscribers' cables could be tapped off directly from the two smaller sizes. In the case of the larger sizes, he recommended the following arrangement. Assuming a 160-wire cable leaving an exchange, he would open the sheath at the first footway box in the thoroughfare to be served, cut one of the 10-pair bundles and connect to it a 10-pair distribution cable, which he would run in the same pipe as the main cable until it had passed the frontages of twenty probable subscribers. It would then be joined to the next 10-pair group of the main cable, and, by fixing a "traffic centre" between these two points

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Dec. 14, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

27,205/10. **Commutator Brushes.** THE ELECTRIC CONSTRUCTION COMPANY, LTD., and N. PENSABENE. A method of arranging brush gear so that the brush shall not stick in its holder, and require excessive pressure to keep it bedded on the commutator, is covered by this patent. The brush, which is carried by a metallic holder, obtains the required amount of pressure, which is much less than usual, from a main spring through a secondary spring arranged vertically above the brush. The holder is insulated from its support, and the current is taken direct from the brush by flexibles to a collecting plate fixed to the outside of the support, from which it is insulated, so that no current passes through the holder. Three figures.

29,706/10. **Overhead Conductor Crossings.** E. M. MUNRO and THE RAILLESS ELECTRIC TRACTION CO. In a traction system for trolley omnibuses, where wires of opposite polarity are required to cross, short circuits by arcing are avoided by arranging in the gap between the wires a series of blocks insulated from each other, and bridging a resistance in steps across the live and intermediate blocks, so that after each break current passes to the motors through a step or steps of this resistance and is consequently diminished, thereby reducing the chances of arcing. Another advantage is that the vehicle cannot come to rest on an insulated part and have to be pushed over. One figure.

5,856/11. **Controller Contacts.** E. GARSIDE. To avoid any rocking movement of the contacts when the switch arm passes over them, each contact strip is bent over at one end, on which a tooth and shoulder are formed. This fits into a hole in an insulating base, from which it is spaced a certain distance by the shoulder. The other end is secured by a screw to a bolt, which passes through the base to form a terminal on the rear side for the conductor. This enables renewals to be easily effected, and also reduces the number of parts. Three figures.

10,342/11. **Constant Speed for D.-C. Motors.**—SIEMENS BROS. DYNAMO WORKS, LTD. A speed sufficiently constant for practical purposes can be maintained by connecting an auxiliary machine in parallel with the motor to be controlled, through a field winding, which is in addition to the normal motor field. The field of the auxiliary machine is also connected across the motor terminals, so that should the voltage of the supply drop, the field of the machine will weaken, and a current will flow through the additional field winding, weaken the motor field, and bring the speed up. The two machines can be either mechanically or electrically connected. Four figures.

13,948/11. **Holders for Telephone Receivers.** C. S. BANN. This device has been designed so that the telephone can be used without holding the receiver. It comprises a flexible metal tube, which is detachably fixed to a base piece by a clip. The end has a holder made of springy material, so that the receiver can be pressed in and securely held. The part containing the transmitter and hook switch is fixed to the same base by four claws, one of which is adjustable. Five figures.

15,091/11. **Insulated Wire Terminals.** A. MORGAN. A small flat brass or copper washer is fixed to a thin copper star, and has a central hole of suitable size, wide enough on its face to make good contact. The pared ends of the wire are passed half way round the washer in opposite directions to meet at the top. The arms of the star are then folded over to meet the rim of the hole, and are tapped down on to the wire. Eight figures.

Opposition to Grant of Patents

5,934/10. **Long Electric Arcs.** G. W. JOHNSON. This specification has been granted in spite of opposition. It describes a process for the production and maintenance of long arcs for producing reaction between gases, by means of a blowing device. This consists of two parallel tubes with outlets at any angle to the axis, through which the gas currents flow, and meet together adjacent to the arc.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

30,544 of December 24th, 1897. **Electric Welding.** O. PARPART. This patent relates to apparatus for welding longitudinal tubes. The poles of a transformer are connected to standards, which are insulated from the frame of the machine, and carry supports from copper discs, which revolve in contact with the tube on opposite sides of the joint. These can be adjusted for inclination as well as position. Pressure rolls are provided in front of the discs to complete the welding. The tubes are fed forward by other rolls, and to ensure the joint being upwards a guide is placed before the first pair of feed rolls, and a second guide between them and the welding apparatus. Additional rolls are provided on the delivery side to keep the tubes straight.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad.

Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Electrodes] 710/11; GEB. SIEMENS & CO. [Electrodes] 13,817/11.

Distributing Systems, Cables and Wires, Insulating Materials: THOMAS [Insulating compound] 28,069/10; BEAVER and CLAREMONT [Twin or multicore cables] 9,523/11.

Dynamos and Motors: SIR W. G. ARMSTRONG, WHITWORTH & CO. and HARLOW [Method of synchronising motors for use on cranes, &c.] 27,814/10; MOULD [Reversible variable-speed dynamo] 28,307/10; SIEMENS BROS. DYNAMO WORKS, LTD. [Regulating the frequency of rotary field generators] 2,794/11.

Electric Ignition: SCHTSCHERBAKOFF, 27,300/10.

Electrochemistry: KING'S NORTON METAL CO., BAYLISS and BROWNSDON [Producing metallic coatings on materials] 21,260/10.

Heating and Cooking: READ [Electric heaters] 27,954/10; NIGHTINGALL [Cooking appliances] 79/11 and 15,899/11.

Switchgear, Fuses, and Fittings: SCHEIDEMANN [Electric light switch control] 29,125/10; CHEADLE [Joint fastenings for bayonet lamp holders] 29,425/10; VERITYS, LTD., and HIRSCH [Circuit breaker] 14,812/11.

Traction: MATHER and BARLOW [Trolley wire couplings] 27,711/10; GOTTSCHALK [Overhead wires, safety support] 548/11; THOMPSON and FINNIGAN [Overhead trolley wires] 1,295/11; SIEMENS BROS. & CO. (*Siemens & Halske Akt.-Ges.*) [Devices for supervising the working of points and signals] 18,658/11; WOOD [Railway signalling apparatus] 20,545/11.

Miscellaneous: LOWNE, and LOWNE ELECTRIC CLOCK & APPLIANCES CO. [Electric clocks, &c.] 27,293/10; OLDHAM [Miners' electric lamps] 27,641/10; HENRY MILWARD & SONS, LTD., and SMITH [Electroplating apparatus] 1,573/11; GAUNT and DAIRY OUTFIT CO. [Electric alarm] 4,580/11; ROSING [Electrical telescopy] 5,259/11; MACGREGOR [Means for supporting battery cells] 14,586/11; REBSAMEN [Electric sewing machine] 15,690/11; ROBERT BOSCH [Process for making condensers] 17,438/11; CHEMISCHE FABRIC GRIESHEIM-ELEKTRON [Method of using batteries to supply lamps] 22,441/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Insulating Material: SPECIALFABRIK FUR ALUMINIUM-SPULEN UND LIETUNGEN GES. [Insulation of conductors, coils, &c.] 25,672/11.

Motors: SCHRAGE [Commutator motors] 25,358/11.

Electric Ignition: DIEHL, 25,161/11.

Electrometallurgy: AKTIEBOLAGET ELEKTROMETALL [Electric furnace for ore smelting] 25,862/11.

Telegraphy: AKTIESELSKABET HOVLANDS RADIOTELEGRAF [Type printing telegraph apparatus] 26,039/11.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: H. BREMER, 15,225/00; J. A. RIGNON [Enclosed clutch type] 19,468/06.

Electric Ignition: R. FOX, W. and W. FAWCETT, 19,190/07; M. A. CODD [Magneto-armatures] 19,546/07.

Electrochemistry: S. O. COWPER-COLES [Electro-deposition] 19,411/06; H. CHAUMAT [Electrolysis; dyes] 19,027/07.

Storage Batteries: H. WADE (*H. Rodman, U.S.A.*) 18,485/03.

Switchgear and Fittings: H. A. AND H. PENDLEBURY [Conduits] 19,113/07; J. LECOCHE [Electro-magnetic circuit-breakers] 19,241/07; E. W. MOORE [Automatic time switch mechanism] 19,447/07.

Telephony and Telegraphy: S. EISENSTEIN [Wireless telegraphy; means to reduce damping] 19,274/07; B. FETT [Clock method of closing telephone circuits] 19,612/07.

Traction: S. P. WOOD [Railway signals] 18,674/98; L. GERARD [Electric tractors] 17,643/05; A. C. BOURNEVIALLE [Signal contacts] 19,378/06.

Miscellaneous: P. LUCAS [Illuminated advertising] 19,185/07.

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twenty subscribers could be tapped off from the distributing cable, ten on wires coming from the first footway box, and ten on wires coming back from the second point of connection. From this second point the main cable would be reduced to a 120-wire cable, and another 10-pair cable would be connected to the third set of wires in the main cable and be run in the same pipe to a third point, at which it would be connected to the fourth group. From here onwards the main cable would be reduced to an 80-wire cable and the distribution would be direct. All the joints would be plumbed in the usual manner. This is a modification of the "parallel distribution" system which has already been employed by the Post Office to some extent during the past two years with ordinary multiple cables and 14-wire distributing cables. Both arrangements have the same feature that the main cable and one distributing cable are laid in the same pipe, and that each pair of the latter can be cut and employed for connecting two subscribers, one on each side of the traffic centre. One of the advantages claimed by the author for the use of 10-pair cables is that 10-lb. conductors can be employed in the distributing cable as well as in the main cable, whereas with 7-pair distributors 20-lb. copper was employed to give mechanical strength; the diminution in the size of the cable due to the smaller conductor will also enable a thicker lead covering to be employed without increasing the diameter to a greater size than the 14-wire 20-lb. cable. A further advantage is simplification of the system and the jointing arrangements, and a reduction in the number of joints. The Paper was illustrated with a number of slides showing methods of jointing, &c., and was throughout of a thoroughly practical and informative nature.

The Bill authorising the Postmaster-General to pay a sum of £3,000,000 to the National Telephone Co. on account of the purchase price of the company's undertaking has passed all its stages in Parliament.

In answer to a question in the House of Commons last week, bearing upon the question raised by Mr. Charles Bright in his recent lecture before the London Chamber of Commerce (ELECTRICAL ENGINEERING, December 7th, p. 669), the Postmaster stated that in view of the conditions appertaining to the ownership of the present submarine cables and land lines in Canada and the United States, and of the substantial reductions now being made in many of the Transatlantic cable rates, the Government have no intention of embarking on the large capital expenditure and annual commitments which would be involved in laying a State-owned cable.

In the House of Commons last week the Postmaster-General was asked on behalf of the Dundee Chamber of Commerce when the conditional promise made last year to carry the underground telegraph system to Dundee would be put into effect. The Postmaster-General replied that he had the matter under consideration.

Arrangements have now been completed by which practically every town of any importance in Great Britain will be placed in telephonic communication with Paris. The main factor in these extensions of the distance over which telephonic speech can be maintained has, of course, been the laying of the cable between England and France fitted with loading coils. A full description of this appeared in our issues for March 17th, 1910, p. 179, and December 22nd, 1910, p. 807.

Mr. C. Llewelyn Davies has been appointed Solicitor to the General Post Office jointly with Sir Robert Hunter, K.C.B., who will continue to act until the arrangements connected with the transfer of the National Telephone Co.'s undertaking are completed.

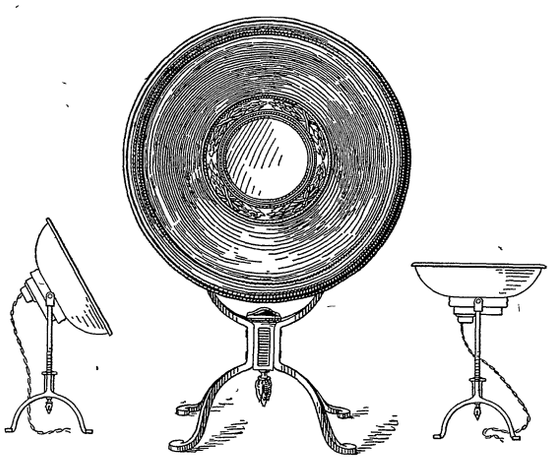
The Faroe-Iceland cable did not suffer a long interruption, as repairs were effected within a few days, and this rather points to trouble near the shore ends.—We learn that telegrams for Ras el Dabbaa, Marsa, Matroul, Sidi Barrani, and Siwa can only be accepted in plain language and at sender's risk, owing to the war.—No sooner has the French Company put the Paramaribo-Cayenne cable into working order than it is interrupted again. This section ceased working on 18th inst., and telegrams for French Guiana can only be sent "*vid* Salinas," South America.—We have further information that the Malta-Tripoli cable is now working normally, which means that the war traffic is being easily coped with.—The Saint Louis-Teneriffe cable was put into working order on the 19th inst.—We are also able to announce that the Direct United States Cable Company will have to dip into the repair fund, for not only is the main section interrupted, but also the section from Newfoundland to Halifax. It will be remembered that under the lease of the cables to the Western Union Telegraph Company, the Direct Company retained the reserve fund of over £500,000, and undertook the responsibility for the upkeep of the cables.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

ELECTRIC LAMPS.—The Silent Electric Clock Co. (192 Goswell Road, London, E.C.) has issued a second edition of their catalogue. It is profusely illustrated, showing very clearly the various mechanisms which we referred to in this column on August 24th, 1911, p. 479. The popularity of these clocks is evident from a long list of users which accompanies the above issue.

ELECTRICAL NOVELTIES.—A booklet giving details of some new novelties manufactured by Donnison, Sillem & Co. (116 Great Portland Street, London, W.), includes the "ever-ready" electric candles for intermittent use, a torch fitted with a metal filament lamp, and a two-cell dry battery; a combined hand and reading lamp, in which the reflector can be moved up and down, and a travelling lamp with a detachable reflector, as well as the lantern *de luxe*, which is fitted with folding handles and a clip for fastening to a belt, &c.

HEATING AND COOKING APPARATUS.—A revised edition of the catalogue of heating and cooking apparatus of Ferranti, Ltd., gives particulars of a series of appliances utilising the Ferranti-Royce disc-shaped heating unit of mica insulated coiled strip. These include disc stoves of various



FERRANTI "ELECTRIC FIRE."

forms, for which special flat-bottoms utensils are made, and various accessories, ovens, flat-irons, &c. The most attractive item in appearance, however, is the Ferranti "Electric Fire," one of the many patterns of which is illustrated here. This has a quartz-covered heating element in the centre, which emits a pleasant red glow.

ELECTRICALLY-DRIVEN PUMPS.—A leaflet from the Electrical Engineering & Agency, Ltd. (Bank Buildings, 109-111 New Oxford Street, W.C.) gives particulars of a special pattern of high lift centrifugal pumps for electrical driving.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

LIQUID STARTERS.—The Adnil Electric Co., Ltd. (Adnil Building, Artillery Lane, E.C.), have sent us a copy of a new list describing their liquid starters. They claim that these are more satisfactory and cheaper than metallic starters for large motors, and that they do not require the care and attention that a metallic starter does, nor are they nearly so complicated. The tanks and blades are of sheet iron carried on substantial insulators, and the electrolyte used is a solution of soda. Worm gear is provided to ensure slow starting, and a sheet iron protecting cover is fitted over the tanks and blades, and suitable short-circuiting contacts are provided. For direct-current starters field-breaking switches can be mounted on the liquid starters and fitted with an interlocking gear to render it impossible to start the motor up against a weak field. These starters can be supplied in various sizes from 15 up to 1,000 h.p.

TANTALUM LAMPS.—Siemens Brothers Dynamo Works, Ltd. (Tyssen Street, Dalston, N.E.), are issuing their well-known "Little Bill" prize poster in the form of a postcard, which can be overprinted free of charge with the name and address of any contractor.

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LOCAL NOTES

Burton-on-Trent: *Change of System.*—The scheme referred to in our last issue involving an expenditure of £17,000 upon alterations at the electricity works includes the provision of a 1,000-kw. three-phase generator. At present generation at Burton is upon the high-tension single-phase system with street transformers and two-wire distribution.

Canterbury: *Free Wiring.*—The Corporation have decided to oppose the Bill of the National Electric Construction Co., which seeks to legalise the agreements entered into by various Corporations—Canterbury being one—and the National Free Wiring Co.

Cheltenham: *Municipal Wiring.*—The Chairman of the Electricity Committee disagrees with the decision of the Committee not to recommend that support be given to the Bill of the Incorporated Municipal Electrical Association relating to electric wiring, &c. Mr. Merrett, the gentleman in question, states that the absence of the powers which the Bill seeks to confer had been responsible for retarding the progress of the Cheltenham electricity undertaking, and he was entirely in favour of the Corporation having the necessary powers and using them discreetly and sensibly.

Farnham: *Wiring Small Properties.*—The Farnham Gas and Electricity Co. have applied for the Council's consent to the system of having one service to supply a group of houses, the supply being carried from one to the other by means of a special cable fixed to the fronts of the houses. The Council have informed the company that they are not prepared to give a general consent for the whole of the district, but will be prepared to consider special cases from time to time. We notified in our issue for November 23rd that the Board of Trade had given their consent to this system.

London: *Fulham: Supply to Guardians.*—The electric battery at the workhouse is quite inefficient, and a Committee has been appointed to meet the Electric Light Committee with a view to ascertaining upon what terms the Council will supply electricity to the Guardians.

Hackney: Electricity Works Accounts.—The financial result of the past year's working of the electricity undertaking is a net profit, after meeting capital charges, of £7,186. Of this, the sum of £4,702 is credited to the general rate, £238 is deducted as one-third the cost of the equipment of showroom and offices, and the balance carried forward. The turnover of the Sales Department was £4,172, against £4,272 in the previous twelve months, and after meeting all charges there is a credit balance of £129. The reserve fund stands at £21,261. A table of comparative costs in the Engineer's report shows that the total costs, exclusive of capital charges at Hackney, are 0·62d. per unit with an output of 5,662,795. This is lower than any other Metropolitan electricity undertaking. The load factor was 20·36 per cent.

Hampstead.—At the Marylebone Police Court on Friday, the Electromotor Equipment Co., Ltd., of Old Street, E.C., were fined £5 and two guineas costs for unlawfully making connection with the Borough Council's mains without their consent. It appears that the company, for the purpose of testing some electric lifts which they are erecting at the Home for Incurable Children in College Crescent, Hampstead, temporarily connected up with the Council's mains without consent and without a meter. The Town Clerk, who prosecuted for the Borough Council, pointed out that the company could have been summoned for "stealing" electricity, but it was not the desire to proceed on that charge.

Marylebone: Electricity Testing Stations.—Last year the London County Council were recommended to take proceedings against the Marylebone Borough Council with a view to enforcing the County Council's requirements in regard to the establishment of electricity testing stations (Electrical Engineering, Vol. VI., December 15th, 1910). The County Council required the establishment of five testing stations, but the Borough Council protested against the provision of special premises or boxes in the streets, and pointed out that it had already provided, at a number of places in the borough, instruments for recording the pressure, and that arrangements could be made for a representative of the County Council to inspect these. Further, it was pointed out that there were forty-six pilot cables, and it was possible to ascertain at the generating station the pressure at forty-six feeding points. In February, 1909, the Council agreed that in certain cases generating stations and sub-stations with pilot wires from distant points, should be accepted as testing stations, and, in view of this decision, the Highways Committee now recommend that, subject to certain minor alterations, the pilot wires and recording instruments in the central station be accepted as all that is necessary, on the understanding that the Borough Council provide a standard volt meter for checking the recording instruments, the County Council at the same time reserving the right to make tests from time to time on consumer's premises.

St. Pancras: Electrical Inspector.—The Highways Committee recommend the Council to sanction the appointment of Mr. C. A. Baker as the electrical inspector under the St. Pancras electric lighting Order of 1883. This sanction was necessary under the County Council's Standing Orders, and is the outcome of the recent proceedings at the Clerkenwell Police Court, when two consumers on the St. Pancras mains applied for the appointment of an electrical inspector, owing to a dispute with regard to the Borough Council's regulations concerning fuses. The full facts of the dispute were given in Electrical Engineering for October 12th, November 9th, and November 30th.

Lowestoft: *Electricity Accounts.*—The accounts of the electricity undertaking for the past year show a net profit of £808 after meeting capital expenditure. During the year, interest and sinking fund charges have increased considerably, entirely due to the reduction in periods for the repayment of loans granted by the Local Government Board. Mr. G. A. Bruce, in his report, points out that where originally fifteen or twenty years were granted, the period has been cut down to six or eight years, according to the nature of the plant.

Torquay: *Charges for Heating and Power.*—The Electrical Engineer has been instructed to prepare a report on the possibility of reducing the price of electricity for heating and power purposes.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bray.—The Electrical Engineer, Mr. W. J. U. Sowter, has prepared a report dealing with the proposed extension of the electricity works. He recommends that application be made to the Local Government Board for sanction to borrow £3,500. It is proposed to put down a 150-kw. Diesel-driven alternator, overhead travelling crane, and make certain structural alterations to the existing buildings to accommodate the new plant. The low-tension mains are also to be extended. Mr. Sowter reports that the working of the small Diesel engine, installed some two years ago, has proved so satisfactory that he anticipates it will be possible to reduce the fuel cost by some £350 per annum if the larger set is installed as recommended. The Committee recommend the Council to adopt the Engineer's suggestions.

Burton-on-Trent.—Mains are to be extended at an estimated cost of £678.

Canada.—A company has been formed in Montreal with a capital of £200,000 to carry on an electric light, heat and power business. The name of the company can be obtained at 73 Basinghall Street, E.C.

Dartford.—The Council invite tenders for a high-speed generating set (tandem generators) and three-wire balancer, superheaters, switchboard, and electrically-driven centrifugal pump. Particulars from the Borough Electrical Engineer, and tenders by January 23rd.

Epsom.—New plant is to be provided for the electricity works. Certain mains are to be renewed at an estimated cost of £1,317.

London: *Battersea.*—Services are to be laid to fourteen premises at an estimated cost of £64, and mains are to be laid at an estimated cost of £108.



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Islington.—The Finance Committee of the L.C.C. recommend sanction to a loan of £2,400 for mains, electrical pressure recorders, and telephones in connection with the electricity undertaking.

Poplar.—The Finance Committee of the L.C.C. recommend sanction to a loan of £3,418 for mains, &c.

Motherwell.—Additional cable is to be laid at a cost of £160.

New Zealand.—The time for receiving tenders for an electric tramway, lighting and power works at Napier has been extended to March 7th. Tenders should be addressed to the Town Clerk, Napier. Copies of the plans and specifications may be seen at 73 Basinghall Street, London, E.C.

Nuneaton.—The Electricity Committee recommend the purchase of new plant at an estimated cost of £7,500.

Swansea.—Tenders are invited by January 6th for water tube boilers, superheaters, and mechanical stokers. Particulars from Borough Electrical Engineer.

Torquay.—The Electricity Committee are contemplating the erection of a new power station.

Tunbridge Wells.—The Electricity Committee recommend application being made for a loan of £6,000 for high and low-tension cable, transformers, services, &c.

Turkey.—Tenders are invited by February 20th for an electric light and power installation in the town of Adalia. Particulars of the concession may be seen at 73 Basinghall Street, London, E.C.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Barnsley.—New public baths.

Bournemouth.—New Law Courts.

Cardiff.—New technical institute in Cathays Park.

Clyde Bank.—New public library.

Dumbarton.—Wiring new poor house and hospital.

Edinburgh.—Tenders are invited by December 28th for an electric lighting and power installation in the Works laboratories at George Heriot's school. Particulars from the Superintendent of Works.

Hamilton.—New Municipal offices.

Hull.—Rebuilding and extension of the Town Hall.

Keighley.—Extensions to the technical institute. Architects, W. H. and A. Sugden, North Street.

Kendal.—Allen Technical Institute. Architects, Stephen Shaw, Kendal.

Leith.—Reconstruction of Bonnington Flour Mills. North British Railway Co.

London.—The sum of £4,000 is to be expended upon renewing the electrical installation in the Blackwall Tunnel.

Macclesfield.—Nurses' Home, extension to Infirmary, &c. Architects, Messrs. Whittaker & Bradburn, 19 King Edward Street.

Manchester.—New Municipal school of domestic economy, High Street.

Portsmouth.—Extensions to Head Post Office. H.M. Office of Works, Storey's Gate, London.

MISCELLANEOUS

Dublin.—The Port and Docks Board require two electric 4-ton portal cranes. Particulars from the Engineer, and tenders to the Secretary, by January 30th.

London: *L.C.C.*—Additional feeder pillars, cable ducts, and cable supports are to be installed in connection with the Victoria Embankment tramways.

South Africa.—The *Board of Trade Journal* states that the Germiston Council propose to raise a loan of £106,690 for electric tramway purposes.

John E. Raworth,
Queen Anne's Chambers, 30, Broadway, Westminster, London, S.W.
Chartered Patent Agent.

REMOVAL. MR. J. G. LORRAIN, M.I.E.E., M.I.Mech.E., Chartered Patent Agent, has removed his office from Norfolk House, Norfolk Street, Strand, W.C., to
Staple Inn Buildings, High Holborn, London, W.C.

TENDERS RECEIVED AND ACCEPTED

Blackpool.—The Electricity Committee have accepted the tenders of the Brush Electrical Engineering Co. for a 800-kw. traction generating set, and the British Thomson-Houston Co. for a 1,500-kw. turbo-alternator.

Dundalk.—Messrs. Siemens Bros. & Co. are supplying the whole of the street-lighting material, comprising standards, cast-iron brackets, lanterns, and "one-watt" lamps for the new street-lighting scheme.

APPOINTMENTS AND PERSONAL NOTES

The salary of Mr. T. P. Wilmshurst, Chief Electrical Engineer to the Derby Corporation, has been increased from £600 to £650 per annum, with a further increase to £700 per annum on January 1st, 1913.

Mr. H. S. Ellis, Deputy City Electrical Engineer and Manager, Bradford, has been appointed Chief Electrical Engineer to the South Shields Corporation at a salary of £400 per annum.

Mr. W. C. Bexon, Chief Assistant Electrical Engineer at Kilmarnock, has been appointed Chief Electrical Engineer in succession to Mr. A. H. Burbidge, who, as we have already announced, has been appointed Manager of the Burmah Electric Tramways & Lighting Co., in Mandalay. Mr. Burbidge sails early next month.

Mr. P. H. Buzza, Senior Assistant Electrical Engineer to the Colchester Town Council, has resigned on receiving an appointment in the North of England. The Council have received 134 applications for the post of Shift Engineer, and three applicants have been selected for interview by the Electricity Committee.

Mr. H. Collings Bishop, Engineer and Manager to the Newport (Mon.) Electricity and Tramways undertakings, has resigned.

The following is the short list for the post of Manager to the Newport Electricity and Tramways undertakings:—Messrs. S. T. Allen, Borough Electrical Engineer, Carlisle; H. M. Taylor, Borough Electrical Engineer, Middlesbrough; G. R. Spurr, Borough Electrical Engineer and Tramways Manager, Walthamstow; T. P. Easton, Deputy Manager of the Newcastle-on-Tyne Tramways; A. T. Eardley, Tramway Manager, Stockport; J. H. Rothwell, Commercial Assistant, Wolverhampton Electricity and Tramways Department, and N. J. Young, Bristol Tramways and Carriage Co.

Mr. A. R. Fearnley has resigned his position as Hon. Secretary and Treasurer of the Municipal Tramways Association. In recognition of Mr. Fearnley's services to the Association, he has been presented with an inlaid writing bureau, a set of bookcases, bronze electric lamp, and a pendant for Mrs. Fearnley.

MISCELLANEOUS BUSINESS NOTES

Price of Copper.—Messrs. G. Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars c.i.f. port of arrival, quoted on Tuesday night, was £64 to £64 10s. (last week, £62 5s. to £62 15s.).

Football Challenge Cup.—The following are the results of matches played last Saturday for the "Davis" Challenge Cup:—G.E.C. 9, Edmundsons 0; St. James 6, Drake & Gorham 4; Anti-Attritian 0, Ediswan 9; Siemens 2, Electrical Installations 2.

Change of Address.—Mr. F. B. O. Hawes has now changed his business address to 18 Park Mansions, Vauxhall Park, South Lambeth Road, S.W., to which address all communications both for him and for the Electrical Trades Benevolent Institution should be sent on and after December 23rd.

Mawdsley's, Ltd.—Owing to alterations and extensions to their power plant necessitated by increased output, this firm will be closing their works at Dursley, Gloucestershire, from Friday night, December 22nd, to Tuesday morning, January 2nd.

Meter Approved.—The Board of Trade on Monday last signified their approval of the Electrical Co.'s type E.C. ampere-hour continuous-current meter with self-adjusting brushes and twisted commutator.

The Electrical Apparatus Co.—The new telephone number of the Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, is Brixton 2075 and 2076.

Liquidations.—A meeting of the Automatic Trolley Head Co. is to be held at 82 Victoria Street, London, on January 23rd, to hear the liquidator's account of the winding up.

Bankruptcies.—Thomas Topping, electrical and mechanical engineer, 361, Lord Street, Southport, has been adjudicated a bankrupt.

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ELECTRICAL ENGINEERING

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ELECTRICAL ENGINEERING.

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SUMMARY

Under "Electrometallurgy" some notes are given on the electric smelting of iron at Trollhättan, Sweden. (Page 704.)

Two papers have been read before the Birmingham Section of the Institution of Electrical Engineers, dealing respectively with an automatic centrifugal starting device for asynchronous motors, and a circle diagram for three-phase induction motors. In the former a variable ratio gear of particular shape is introduced between the centrifugal force and the tension of the controlling spring. (Page 705.)

At the Newcastle Local Section of the Institution of Electrical Engineers, Mr. A. S. M. Sörensen read an interesting Paper, "A Summary of the Theory of the Production of Electrical Oscillations." (Page 706.)

In an illustrated article the principal features of the equipment of the electrical engineering laboratories of the Birmingham Municipal Technical School are described, with some notes on the methods employed. (Page 707.)

At the last meeting of the Illuminating Engineering Society, Mr. Haydn T. Harrison read a Paper on the lighting of railway premises, drawing attention to the desirability of a definite minimum illumination being agreed upon for railway platforms. (Page 708.)

In his address to the Newcastle Section of the Institution of Electrical Engineers, Mr. C. S. Vesey Brown referred to a number of topics, and gave an interesting comparison of the growth of the capacity and output of central stations and the capital invested in them. He also referred to the wide field now covered by electrical engineering. (Page 708.)

A Paper was read by Mr. P. A. Spalding on small electricity supply undertakings on December 14th, before the Dublin Local Section of the Institution of Electrical Engineers. He favoured suction gas plant for very small stations, and Diesel engines for small towns of over 5,000 population. (Page 709.)

Two patent specifications in connection with overhead trolley wires were published last week. One relates to a coupling which requires no previous preparation of the wires, and the other provides a device for easily replacing and keeping the trolley-wheel on the wire. A bayonet-joint locking device for lampholders is also protected. A patent for a tungsten-nickel alloy has been granted to Siemens & Halske in spite of opposition. Two patents expire during the coming week, after a full life of fourteen years. One describes an electric lift in which two motors drive through worm gear, and the other refers to railway points. (Page 710.)

An illustrated pamphlet on "Motor Drive for Metal Working Machinery" is reviewed on p. 711.

A new shop or shop-window advertising device for displaying goods is described on p. 711.

We describe and illustrate a new high-lift centrifugal pump with several special features, including a patented hydraulic balancing arrangement to eliminate end-thrust. (Page 711.)

In our "Electric Traction Notes" we give some particulars of the Aurora, Elgin and Chicago Railroad Co.'s power house, which supplies current to 175 miles of third-rail track and 73 miles of trolley lines, besides lighting and power to eight towns. In consequence of a strike the Llanelly tram service has been entirely suspended. (Page 712.)

The automatic telephone exchange at Epsom is expected to be ready by January 15th.—The Postmaster-General is unable at present to continue the underground telegraph line to Dundee and Aberdeen.—Under "Telephony and Telegraphy (including Wireless)" we also give particulars of the present position of the Helsby Wireless Telegraph Co., Ltd. (Page 712.)

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EXPERIMENTS are to be carried out with street electric lighting in Belfast.—The excess in the estimates of the street lighting at Hampstead is to be met out of reserve and repaid in seven annual instalments.—The Newport (Mon.) Electricity and Tramways Committee are meeting with some criticism of their methods of dealing with the managership of the undertakings.—The output at the Greenock Electricity Works has now reached 1,000,000 units per month. (Page 713.)

A LOAN of £20,000 is to be applied for at Greenock and one for £19,000 at Norwich.—Tramway extensions at an estimated cost of £151,000 are contemplated at Belfast; twelve new tramcars are to be built at Southampton, and fifty at Birmingham.—A scheme for considerable extensions at the Hackney Electricity Works is being prepared. (Page 713.)

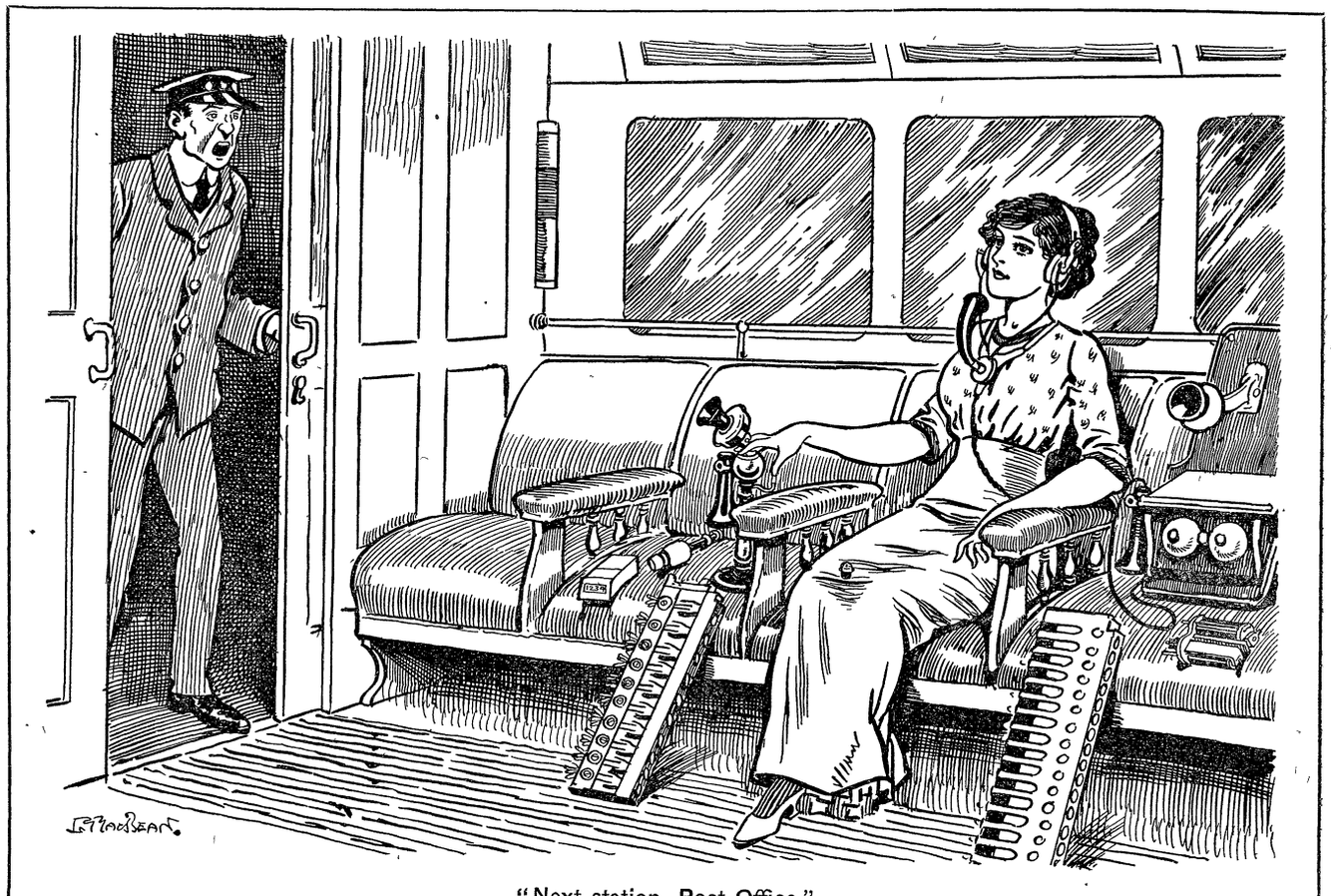
THE Newcastle Local Section of the Institution of Electrical Engineers have formed a Students' Section. There is every prospect of a large membership. (Page 714.)

ELECTROMETALLURGY

ACCORDING to Mr. J. A. Leffler's report to the Swedish Association of Iron Masters, the electric smelting of iron ores at Trollhättan in Sweden is making great progress. The furnace, which is the design of Grönwall, Lindblad, and Stahlane, was made to produce 23 tons per day of 24 hours. It consists of two main portions—the shaft and the crucible, or hearth, which is connected by a sand seal. The structure is 45½ ft. high, and the distance from the bottom of the hearth to the furnace top 42 ft. The hearth is made of a shell of steel plates lined with firebrick. A Tholander charging bell and cone is supported at the top of the shaft. The hearth rests on a concrete foundation, and is enclosed by a sheet-iron shell. This hearth or crucible has an arched roof of firebrick, and is supported by the top of the casing, which is suitably reinforced. The hearth is lined with firebrick and magnesite bricks. The bottom, which is dish-shaped, consists of a mixture of magnesite and pitch rammed in so as to extend some way up and along the walls. Four converging electrodes, each made up of four carbons, project through the roof into the crucible at an angle of 65° to the horizontal. The electrodes are surrounded by cooling jackets of copper, which are asbestos packed to prevent leakage of the gases. The gases are drawn from the cool upper portion of the furnace by means of a fan, and, after being freed from dust, are blown under the hot roof of the crucible, the life of which is considerably prolonged thereby, as overheating is prevented. Also the gases, being thus heated, assist in the reduction of the ore within the shaft.

Electrical energy is supplied at 10,000 volts, three-phase, 25 cycles, and two 1,100-kw. transformers step down to 50 to 90 volts, or 100 to 180 volts two-phase. The low tension leads from the transformers are made of six copper bars for each electrode, and 48 cables are used to conduct the current to each electrode. During five months' working the following are the mean results obtained: Iron in ore, 61·54 per cent.; iron in charge, 57·00 per cent.; slag per ton of iron, 327 kilog.; energy used per ton of iron, 2,391 kw. hours; iron per kilowatt-year, 3·66 tons; electrode consumption per ton of iron gross, 10·28 kilog; nett 5·27 kilog. The pig iron contained on the average carbon 3·2 per cent., silicon 0·3 per cent., manganese 0·3 per cent., sulphur 0·028 per cent., and phosphorus 0·015 per cent.

T. D. Robertson gives some further particulars in *Metallurgical and Chemical Engineering*, 1911, IX., 525. After working for five months, the thermal efficiency was found to be 80 per cent. This compares with 82 per cent. in the Swedish charcoal blast furnace, and 70 per cent. in the British blast furnace. The conditions which govern the grade of the iron produced in this electric furnace are the same as those which obtain in the ordinary blast furnace, with this difference, that the irregular influence of the air-blast is absent. The best output of the furnace is obtained when white iron is being made. Grey iron requires a higher temperature, and, therefore, a greater power consumption. Certain improvements have been made in the electrodes, which are now cylindrical and have screw joints; consequently, when an electrode gets too short, a new one can be screwed on above it, thus preventing loss owing to stump ends. The electrical contact also is now made at the point at which the electrode enters the roof of the furnace. Owing to this there is a saving of 60 kws., and the furnace can now take up 3,000 h.p. instead of 2,500 h.p. Improvements have also been made in connection with the gas circulation.



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INDUCTION MOTOR PROBLEMS

Automatic Starting

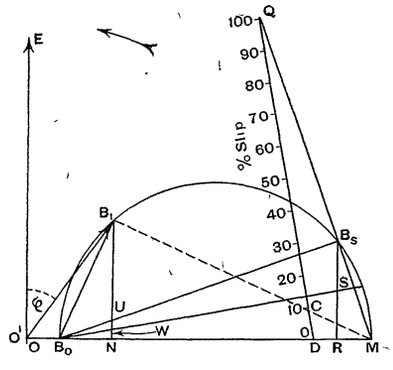
A PAPER was read on December 13th by N. Pensabene-Perez before the Birmingham Section of the Institution of Electrical Engineers, dealing with the automatic starting of induction motors. The arrangement considered is that of resistances placed in the rotor phases, which are cut out gradually by contacts attached to arms by centrifugal force against the action of a spring, as the speed increases. In order to keep the starting current constant, there must be equilibrium between the centrifugal force, the tension of the spring, and the friction for any position of the contacts, that is, for a certain resistance of the starter and a speed corresponding to the slip at this resistance. These three functions are then embodied in a general equation of equilibrium for constant current starting, in which a variable ratio gear is introduced between the centrifugal force and the tension of the spring, so that the equation may be satisfied for all positions of the contacts if the value of the ratio gear be conveniently varied.

The author then proceeded to describe his device for a three-phase wound rotor that will fulfil the above conditions. This consists of three discs wound with flat German silver strip, insulated with asbestos paper, and clamped together with two cast-iron end discs. On the periphery of these, a pivoted bar is mounted for carrying the arms and contacts, which slide along the polished faces of the discs. The resistances are so connected to the phases that the weight of the arms opposes the motion of the contacts. Besides the ratio gear, an auxiliary weight is also provided, the combination of the two moving the arms, by centrifugal force, against the action of the spring.

A differential equation is deduced analytically for determining the shape of the ratio gear, and a graphical solution is also given. In considering the reliability of working, it was found that the sticking action, that is, the difference between the dynamic and static friction, caused very irregular working; the motor would stop accelerating if the load exceeded a certain value, while if it were reduced, the speed would suddenly increase to that of full load, accompanied by a rush of current. In order to reduce this increase of speed to overcome this action, the ratio between the spring tension and the static friction must be as large as possible. The time necessary for starting is calculated by a graphical method, which shows clearly the advantage of having a large number of contacts.

The Circle Diagram for Induction Motors

THE performance of the induction motor as shown by a circle diagram was the subject of a Paper read by T. F. Wall, at the Birmingham Section of the Institution of Electrical Engineers, on Wednesday, December 13th. As a preliminary, curves were given to show that the rotating field lagged by 90° in phase behind the current, the rotating field vector being drawn in the same direction as the e.m.f. induced by it. A figure showing vectors drawn in this way



CURRENT CIRCLE DIAGRAM.

was then considered, from which an expression for the torque of the motor was deduced, namely, the height of the extremity of the current vector above the diameter of the circle. This is represented in the accompanying diagram by B_1N, on which the author now proceeds to represent the power, slip and losses of the machine. Neglecting the stator resistance, which is very small, the power developed is given by the

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input minus the C^2R losses in the rotor winding. If OB_1 is the stator current, and the applied pressure be assumed constant, then B_1N also represents the stator input. From the similar triangles B_0B_1N and B_0MB_1 it can be proved that UN is proportional to the square of the rotor current. Again, when B_1 coincides with the short-circuit point B_s the stator input B_sR is equal to the rotor C^2R loss, so that B_1U is proportional to the stator input minus the rotor C^2R losses, that is, to the motor horse-power. The difference between the power supplied to, and the power developed by, the rotor, viz., the torque multiplied by the slip, gives the power lost in the rotor windings, and since the iron losses are very small, the product of the torque and the slip may be said to be equal to the rotor C^2R loss, that is, on the diagram

$$\text{slip} = \text{constant } \frac{UN}{B_1N}.$$

Then, by joining MB_s and producing to Q, from which a perpendicular QD is dropped, and taking similar triangles MCD and B_1NB_0, QMD and UB_0N, the slip is proved to be proportional to CD. The stator resistance is now introduced, and assumed to be so small that the stator flux remains constant. The current necessary to supply the iron losses assumed constant is represented by O_1O. If O be taken as the origin of the stator current vectors instead of O_1, the circle diagram will give the total stator current per phase. Supposing that B_0B_1 be the stator current vector, which, by neglecting the C^2R loss due to the magnetising current O_1B_1, makes B_0B_1 equal to O_1B_1. Then, by similar reasoning as before, UN will give the C^2R losses for the stator current O^1B_1, and this will be the case for any point B_1 on the circle. These losses may be split up between the stator and the rotor, by dividing B_sR into two parts, SR and SB_s, representing the stator and rotor resistances respectively. Then UW will always give the rotor C^2R loss, and WN that of the stator, so that B_1W will be the power supplied to the rotor, that is, the torque of the motor. The slip is found, as before, to be proportional to CD. An example to show the accuracy of this diagram was then given.

DISCUSSION.

The discussion of the two Papers was taken together.

Mr. LINDSAY FORSTER (Chance Bros.), in commenting on the first of the two Papers, pointed out that the problem resembled to a considerable extent that involved in the design of centrifugal governor gear for steam engines. If the direction of rotation was clockwise, the outward movement of the weight and arms would be assisted and *vice versâ* for counter-clockwise rotation. In governor design it was very essential to provide for a considerable excess of operating force over the pull of the spring so as to overcome the difficulty due to static friction. The position in which the spring was fixed was of great importance.

Dr. C. G. GARRARD (General Electric Co.) disagreed with the claim of Mr. Pensabene-Perez that a considerable saving was effected by his arrangement as compared with the cost of a slip-ring motor and separate starter. Mr. Pensabene-Perez started by a mathematical analysis of the problem, and further on in the Paper discarded mathematics for graphics. The whole point of this analysis was to prove that the operating force must be large in comparison with the friction, and it did not appear to him necessary to make use of mathematics to demonstrate. As far as he could understand the device, it was only suited for starting against a particular torque; he wished to know whether it would adjust itself to torques of different values.

Mr. S. P. SMITH congratulated Mr. Wall on the new method of developing the circle diagram, but he confessed that he did not think it simple. He could not understand the rotating vector to represent the rotating field, nor did he see how the E.M.F. vector could be made to coincide with that of the rotating field. Further, he could not follow the author in his statement that the rotor current was in phase with the rotor flux which produced it. The rotor current was practically in phase with the rotor E.M.F., and the rotor E.M.F. was 90° behind the rotor flux. He considered the circle diagram was not of much use for small motors up to 50 h.p., but found it very valuable for the design of large motors.

Dr. COALES thought the method indicated by Mr. Wall for finding the B.H.P. and torque would be very useful. He described a method of developing the circle diagram which was derived from Dr. Kapp's transformer diagram. In view of a demonstration by Dr. Kapp at the same meeting of an apparatus for testing the endurance of metals under often-repeated stresses, the two authors were requested to communicate their replies to the discussion in writing.

At the end of the meeting an oscillograph demonstration was given of the starting current of two motors, one fitted with the Pensabene centrifugal starting device, and the other connected to an ordinary starting rheostat. The current reached far higher momentary values with the latter motor.

ELECTRIC OSCILLATIONS

A PAPER entitled "A Summary of the Theory of the Production of Electric Oscillations," by Mr. A. S. M. Sörensen, was read on November 27th before the Newcastle Local Section of the Institution of Electrieal Engineers. Treating first the single circuit, the author deduced the Thomson-Kirchhoff approximate value $2\pi\sqrt{LC}$ for the period of the discharge, and the expression R/2NL for the logarithmic decrement. He distinguished between the reckoning of the decrement on the basis of the full and half period, but showed that it was possible for two consecutive periods to show a considerable difference, while all complete periods were exactly alike. It was more consistent to distinguish between damping in relation to a wave train and distortion in wave form in relation to a single oscillation. The selectivity of a wave train depended on the damping of the train.

Formulæ were then worked out for coupled circuits, and it was then pointed out that in practice the logarithmic decrement was not constant, owing to the various additional losses due to such causes as dielectric hysteresis, brush discharge, radiation, and the spark itself. It was necessary to know the relation between the difference of potential at the electrodes, and the current in the discharge, or, as it was sometimes called, the characteristic. For an ordinary conductor possessing only ohmic resistance, the characteristic was a straight line, and for a continuous current arc it was a hyperbola. In the case of an alternating arc, or a continuous current arc with superimposed alternations, it was a closed curve called the dynamic characteristic, exhibiting a sort of arc-hysteresis.

There were three different types of oscillations to be considered. The first type of oscillations occur when the amplitude of the oscillations is smaller than the direct current. The dynamic characteristic is of the closed (elliptical) type, and the current curve nearly a pure sine-wave. With increasing frequency the arc-hysteresis will increase the phase-difference between potential and current, and therefore the output decreases. This case is represented by the Duddell singing arc, and as is known, this generator cannot produce any appreciable amount of energy for the frequencies used in radiotelegraphy. In the second type, the oscillation amplitude is greater than the direct current, showing a very different procedure. The current in the arc must be the sum of the direct current and the alternating current, and consequently at a certain moment becomes zero, *i.e.*, the arc is extinguished, and the potential difference at the electrodes falls from the value belonging to the burning arc to that of the condenser, which will then charge up under constant current (the direct current), and the potential will accordingly rise, along a straight line. At the moment this potential reaches a sufficiently high value to bridge the arc-gap, the arc is re-lighted, and the arc potential immediately falls to that corresponding to the arc when burning. When the arc is re-lighted the condenser discharges through the burning arc until this again causes the arc to be extinguished, and so on; but if at this moment the condenser potential is sufficient to break down the gap, the arc will re-light in the opposite direction—in other words, the condenser discharge will be continued; and this may go on for several oscillations, until the arc finally dies out; then a second interval, as in the case of oscillations of the second type, sets in, the condenser charges up, and the process is repeated. During the condenser discharge, however, no energy is supplied to the condenser, so that a short train of strongly damped oscillations of the third type is generated in each period. A special case of the third type of oscillation with a very long second interval is nothing but the ordinary oscillatory spark discharge.

New Squirrel-cage Induction Motor.—A recent issue of the *Elektrotechnische Zeitschrift* describes an induction motor constructed by the firm of Paul Dassenoy, of Metz. The stator is of the normal design, but the rotor is divided into two portions. One is simply a short length of unwound stampings, while the other is an ordinary squirrel-rotor. These two are connected together and are moved relatively to the stator automatically or by means of a lever or screw action. When the machine is connected, the squirrel-cage rotor is hardly in the field, and the auxiliary rotor merely provides a magnetic circuit of low resistance, so that the starting current is low. On pushing in the other rotor, both torque and speed increase.

Faraday House.—The next term opens on January 8th, when a fresh course of instruction will be commenced. The entrance examination will be held on Friday, January 5th.

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THE ADVANCED ELECTRICAL ENGINEERING LABORATORIES OF THE BIRMINGHAM MUNICIPAL TECHNICAL SCHOOL

THE Electrical Engineering Department of the Municipal Technical School, Suffolk Street, Birmingham, has not only an extensive and complete equipment, but there are a number of points of interest in the way it is used for educational purposes, and the systematic scheme which has been developed for the students to follow the various tests and experiments, after having completed two years' elementary work. Mr. H. B. Matthews, who is senior lecturer and demonstrator in electrical engineering under Dr. W. E. Sumpner, the Principal, has put before us a quantity of information regarding the department, from which we have made the following notes on the general features of the equipment and the methods employed. A general view of the main dynamo room with its switchboard is seen in Fig. 1, while Fig. 2 shows another test room.

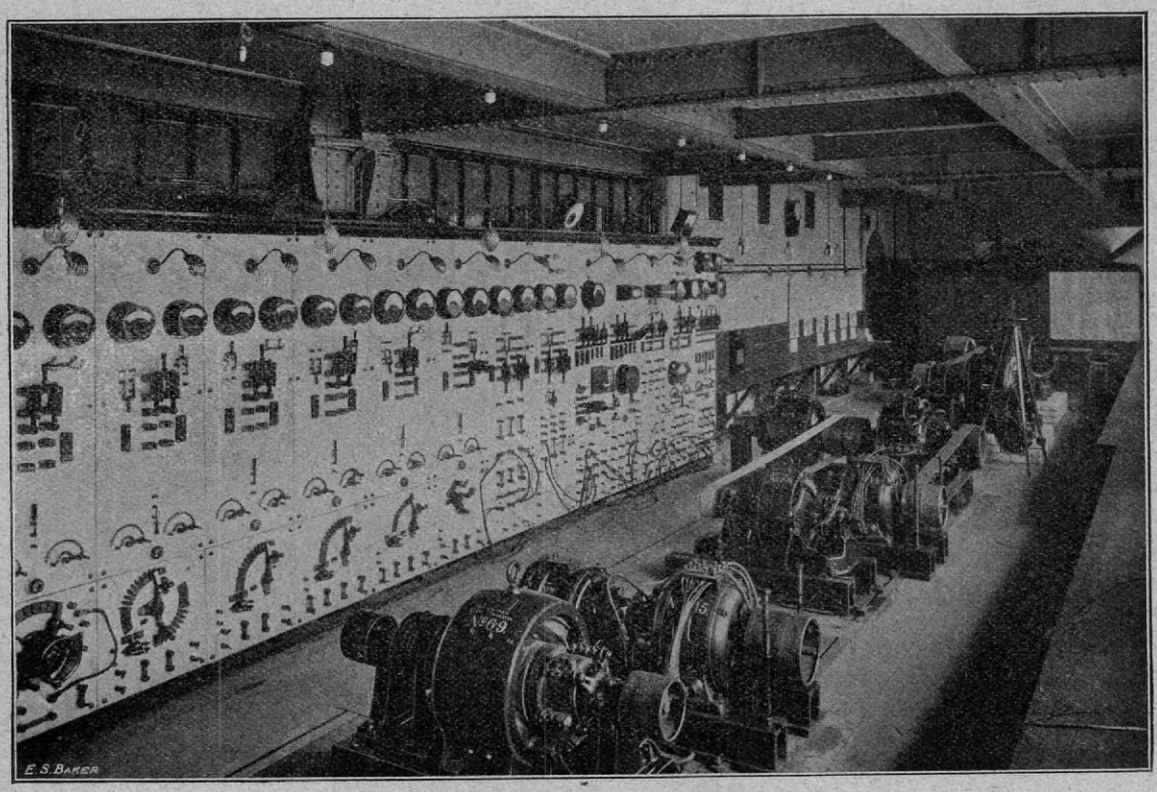


FIG. 1.—MAIN DYNAMO ROOM, SHOWING SWITCHBOARD.

As far as possible the design of the different panels of the switchboards is uniform; double or triple pole switches and fuses are employed throughout, and the respective poles or phases are distinguished by colours as well as position. All D.-C. generators are connected directly to switch centres, and A.-C. generators to terminals easily linked to switch centres. By switching the double throw switches up the machine is put on its bus-bars, and by switching down it is put on experimental terminals and may then be easily linked to experimental bus-bars or other points. All instruments and fuses are, of course, on the machine side of these switches. Wattmeter and distribution panels are disposed in the centre of the alternating-current part of the large main 14-panel switchboard, and the latter are arranged somewhat on the plan of a telephone board, so that it is possible with very little trouble to insert extra instruments in any part of the laboratory in the circuit of any generator, and also to connect any other board with the main switchboard. The labelling and numbering of terminals, &c., is very complete. The proper storage places are marked on all portable instruments, as well as being given in printed lists. Everything is standardised where possible. The normal peripheral speed of all the driving pulleys is the same, so that any machine may be used for driving any other, and the disposition of the machines in the large laboratory is such that all may be driven by any one as motor by means of direct coupling, belts and special double pulleys. Also, in general, any machine may be driven by any of the three neighbouring machines without change of position.

In allotting the work to the students, a large chart is first made showing work for seventeen evenings employing a maximum of 36 students in six groups, giving a separate duty for each student. Each group has one machine assigned to it to carry out various tests on successive attendances. A large diagram shows the permanent and temporary connections

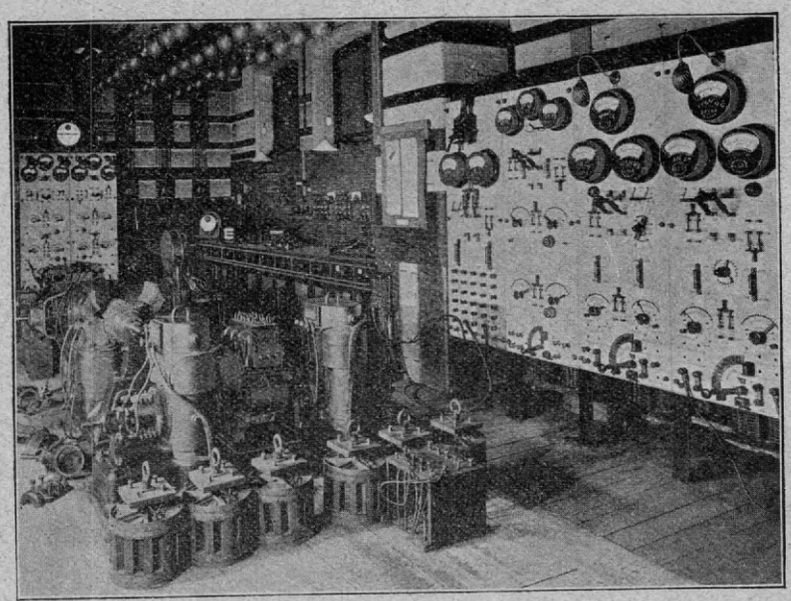


FIG. 2.—ONE OF THE SMALLER ELECTRICAL LABORATORIES.

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for each evening's work with those relating to each group, in different colours, and each student is supplied a week in advance with a six-page book relating to the test, consisting of a text sheet with a general description of the test, a tabulated sheet of typical results, a similar blank sheet to enter up the results, a typical curve sheet, a blank curve sheet, and a diagram of connections. Inserted in each book is a direction form, which indicates the individual duties of the student, the instruments he uses, with any necessary caution concerning them, and the columns of record sheet, for which he is responsible. At the beginning of the course, the student is supplied with a file for these test books containing also diagrams of connections of the switchboard panels which he will use, explanatory sheets relating to the organisation and arrangement of the laboratory, the procedure in group testing, &c., and lists of instruments, machines, tests, and official abbreviations, symbols, &c. Each group is under a "charge man," who is supplied with an assignment form indicating the duties of each member of the group.

A special feature of the equipment is a Duddell double projection oscillograph, fitted up in a dark room in such a way that while testing students are able to see wave forms from their machines. A special switchboard enables this to be connected to any two circuits in the laboratory. Various demonstrations are given with the apparatus.

It is impossible to particularise all the plant and apparatus composing the equipment, but some idea of the extent may be gained from the statements that there are about 60 voltmeters and 60 ammeters; 12 wattmeters, and 6 power factor meters, in addition to frequency meters and synchronisers mentioned in the lists, 24 machines ranging from 0·75 to 25 kw., over a dozen transformers, and that the eight switchboards include over thirty panels, in addition to 22 terminal boards in various parts of the laboratories. There are many other details which could be mentioned to show the completeness of the organisation, which is evidently well suited to the handling of numbers of students too large to rely on individual attention, and at the same time avoiding delays in the work and inculcating methodical habits.

ILLUMINATION OF RAILWAY PREMISES.

IN a paper read before the Illuminating Engineering Society on December 19th, Mr. Haydn T. Harrison dealt with some aspects of railway station and goods yard illumination. He drew attention to the desirability of a definite minimum illumination being agreed upon for railway stations of various classes, and suggested 0·25ft. candles. In the case of stations with lofty roofs, his contention that arc lamps hung high up should be used as a general illumination, in addition to small units of light, such as tungsten lamps, at a lower level, received the assent of most of the speakers on the discussion, including Mr. Roger T. Smith, of the Great Western Railway Co. Mr. Smith, however, regards the minimum of 0·25ft. candles as unduly extravagant, and whilst willing to adopt it for terminal stations, preferred to take 0·15ft. candles for large intermediate stations and for small wayside stations, what Mr. Trotter once called "beacon" lighting only would be necessary. Mr. Harrison's views may be summarised as follows: as all railway stations are used for similar purposes, though in different degrees, the standard of illumination should be similar, but means should be provided at those stations where such a degree of illumination is not required except at rare intervals, whereby the cost of lighting is reduced, but by reducing the illumination to a lower value when the platforms are not in use. For goods-yard lighting, Mr. Harrison recommends large units of light, such as 12 amp. flame arc lamps with dioptric or similar globes on masts 50ft. high. Such a lamp would, he said, cover a radius of 125ft. with a minimum horizontal illumination of 0·1ft. candle. The maximum illumination would not exceed 2ft. candles.

The discussion rather tended to emphasise that the lighting of railway premises is taken somewhat out of the category of ordinary illumination to the extent that policy plays a very important part indeed, and frequently outweighs any question of merit. For instance, Mr. Roger Smith gave a case where with gas at 5s. 6d. per thousand and electricity at ½d. per unit, it would pay the railway company to use gas on account of the business it had of carrying the coals for the gas undertaking. Further, whilst the railway companies give sufficient illumination to ensure the safety of the public, they do not feel called upon to aim at any ideal, especially where this entails considerable expense.

In the case of the London tube railways, the position is very different. Here, as Mr. Harrison pointed out, every care has been taken to give ample illumination at the stations. Especially good are the stations where 100 c.p. tungsten lamps with obscured lower parts are used, suspended in large opal glass shades. Not only is the average illumination good, viz., 0·3 ft. candles, but the maximum, which is generally found to be 2·5, is not excessive. Further, the cost is very moderate, as the total candle-power and watts per 1,000 ft. of platform being about 3,500, the consumption of energy is very low. At the same time, Mr. Harrison expressed surprise that more advantage is not taken of the excellent reflecting properties of the glazed white walls which predominate in these stations. Mr. J. S. Dow had taken a reading of the illumination at a considerable number of London tube stations, and obtained figures more or less in agreement with those given by Mr. Harrison. In many cases they showed that a great development is taking place towards getting an absolutely uniform illumination, this being particularly noticeable at the British Museum and Golders Green stations. The use of lamps fitted in recesses in the roof and covered with Holophane reflectors are important factors in this result. With regard to taking more advantage of the reflecting properties of the white glazed tiles in tube railway stations, Mr. C. Grove, of the Central London Railway, said that these were now becoming more and more covered with advertisements, and hinted that this was, at any rate, one of the reasons for the improved lighting schemes now being put into force, viz., to fulfil the railway company's side of the bargain with the advertiser.

INAUGURAL ADDRESS TO THE NEWCASTLE SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS

MR. C. S. VESEY BROWN delivered his inaugural address as Chairman of the Newcastle Local Section of the Institution of Electrical Engineers, on Monday, December 11th. After thanking the members for electing him to be Chairman for the current session, he proceeded to review briefly the history of the Institution, the formation of Local Sections, and the training of electrical engineers. He pointed out that the Local Sections were formed some ten or eleven years ago to obviate the multiplication of local societies, which were being formed by groups of engineers interested in particular applications of electricity. It had been arranged to form a Students' Section in Newcastle, as it was felt that there was a large number of young engineers in the district who did not care to speak at the meetings held at present, but who would willingly take part in discussions amongst younger members. The kw. capacity of public generating stations had increased nearly tenfold during the last ten years, while the output in units had increased about fiftyfold and the capital invested nearly eightfold. The only large increase he could foresee was in the direction of railway electrification, and in electrochemical and metallurgical processes requiring a cheap and reliable power supply. Regarding the training of electrical engineers, he pointed out how wide a knowledge a man in their profession had to have, and how this could only be compared with the medical profession in the variety and rigidness of the knowledge required.

He thought that the objects outlined in the Charter of the I.C.E. applied to the I.E.E., as nearly all the members were engaged in the application of "one of the great sources of power in Nature." In his opinion the mental training induced by the logical sequence of problems which Euclid presented was the finest exercise for the balanced mind required in the solution of engineering problems. With regard to examinations, he thought that little or no account could be taken in them of a student's ability to express his ideas in writing. The system of allotting marks was also open to criticism.

NEW PUBLICATIONS

"Boiler Draught." By H. K. Pratt. 138 pp. 7½ by 5 in. 29 figures. (London: Constable & Co., Ltd.) 4s. net; abroad, 4s. 3d.

"The Principles and Practice of Electric Wiring." By A. Bursill. 215 pp. 7¼ by 4¾ in. 166 figures. (London: Longmans, Green & Co.) 3s. net; by post, 3s. 3d.

"Manuel Elémentaire de Télégraphie Sans Fil." By C. Tissot. 274 pp. 9 by 5¾ ins. 143 figures. (Paris: Augustin Challamel.) Paper covers, 5s. net; by post, 5s. 4d.; cloth, 6s. net; by post, 6s. 6d.

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SMALL ELECTRICITY SUPPLY UNDERTAKINGS

A PAPER, by Mr. P. A. Spalding, with the above title was read before the Dublin Local Section of the Institution of Electrical Engineers on December 14th. The author remarked that it was the ambition of some of the larger supply companies to control as extensive an area as possible, and to supply in bulk all the small towns and villages that are within this area. Under the improved conditions brought about by recent developments in gas and oil engines, and the introduction of the metal filament lamp, however, electricity could now be generated locally at a price against which the large supply company would find it hard to compete.

Taking first small areas and populations from 1,000 to 5,000, the importance of initial capital expenditure being just within the smallest possible limits was emphasised. The station buildings should be of simple design and economically constructed, and the site should be central in the area of supply. Below 100 b.h.p. the author preferred suction gas engines to any other form of plant, although the repairs and depreciation were, in his opinion, higher than with Diesel engines, and regarded accumulators as essential. The size of the initial plant installed should be based on the estimated probable maximum demand during the first two years only. The distribution should be on the 220-volt continuous current two-wire system, using overhead uninsulated mains wherever possible. The tariff should be on the contract system for lighting, with a free wiring scheme for small consumers, and meters should be avoided.

For small towns of population 5,000 to 15,000, the generating plant will be of such a size that Diesel oil engines will have a decided advantage, especially as regards their rapid starting up and economy on light load, although their capital cost is higher than that of suction plants. Steam plant cannot compete unless coal can be obtained at less than 9s. per ton. Even for undertakings of this size, the author sees little advantage with the three-wire system, while with pressures above 220 volts it will probably be forbidden. The only real necessity for 400 or 500 volts is for power or traction purposes. The author briefly reviews the subject of tariffs, favouring generally some form of contract system rather than prepayment meters for small consumers.

The latter part of the Paper describes some features of the system at Galway put down twenty years ago, where water power is used, with a suction gas plant as a stand-by. The mains originally laid were thin split copper tubes covered with shellac varnish, supported on glazed earthenware insulators at 6-ft. intervals in 6-in. sewer pipes, with six conductors in each pipe. Recently some new feeders of this tubing were put down in fibre conduits. The latter were ordered in 6-ft. lengths; each tube is of split, hard-drawn copper, tinned at the ends; the internal and external diameters are respectively $\frac{3}{4}$ in. and $\frac{7}{8}$ in. The fibre conduit was supplied in 5-ft. lengths, each 2 in. internal diameter, with sleeve joints which were made watertight by means of a paste composed of linseed oil and whiting. The copper tubes were joined by driving the ends into one another and running solder through the joints. A special ring insulator of glazed porcelain was fitted to each length before the tubes were jointed; these insulators are an easy fit inside the conduit, and serve the purpose of supporting the copper tubes centrally along and clear of the conduit. The capacity of each conductor is 200 amperes, at a density of 800 amperes per square inch; the total cost of each feeder, including all material and labour, averaged, roughly, 7s. 6d. per yard of trench. A special overhead bare copper main supplies a seaside suburb $1\frac{3}{4}$ miles from the generating station.

In conclusion, the author analyses some average figures from electricity supply accounts, and observes that to ensure a reasonable profit, the average revenue per unit sold should not be less than twice the working costs.

Discussion.

Mr. W. J. U. Sowter (Electrical Engineer, Bray) thought many people rather lost sight of the fact that the cost of maintenance of water-power plant was often so heavy that it would have been a better policy to have gone in for internal combustion engines. He was under the impression that suction gas plants were too troublesome and unreliable for small schemes where they had to be run with as little skilled labour as possible. He had had some experience with Diesel plant, and was of opinion that it was entirely suitable for any scheme up to 600 kw., and even for larger plants where coal was expensive. With Wolf locomobile plant, the working costs would probably be substantially less than either suction gas or Diesels if steam coal could be obtained at a reasonable price. There were very few districts in which anthacite beans, suitable for producer plants, could be obtained under 25s. per ton. Mr. Sowter doubted whether it was always policy to instal accumulators in these small places owing to the difficulty of expert supervision. Gas or Diesel engines cost very little to run continuously, and if there was any day load at all, it would probably be better to dispense with batteries altogether. Continuous current had had altogether too good a time in the Paper, and the speaker suggested that there were many quite small places where alternating current could be used with advantage, particularly on the score of low capital cost.

Mr. A. E. Porte had put down a small scheme recently, and the prices he obtained for a complete system, including mains, wiring, buildings, and general equipment, including two 30-kw. generating sets, were, for Diesel plant, £4,400, and suction gas plant, £3,830. The Diesel plant was undoubtedly better in every way than the gas plant. There was only one-half the weight of fuel to handle, while there was no dirt or refuse to be dealt with. The running costs of three similar plants with the different type engines were as follows: Diesel, £189; ordinary oil engines, £383; and suction gas, £224. Mr. Porte did not consider that the prospects of these small undertakings were any better than a few years ago, as the plant was no cheaper, and, owing to the introduction of metal filament lamps, very much larger areas had to be covered than formerly to sell the same amount of energy, which naturally added to the capital costs.

Mr. G. F. Pilditch (Chief Electrical Engineer, Rathmines) thought that the plant of the future for small undertakings was undoubtedly either gas or oil engines, as their low running cost was a generally accepted fact. It was impossible to say generally whether batteries should be used or not—each case must be decided individually. Regarding the contract system, the cost of meters was now very low, and, moreover, they could obtain sufficient rental to pay for repairs and capital charges. He would like to know how the author proposed to deal with heating and cooking demands where the contract system was in use; double systems of wiring for the two classes of supply were bad. Free wiring was an absolute necessity in many cases. The hiring charge, however, should be based on the cost of the installation, and not be an extra charge per unit consumed.

Mr. G. M. Harriss (Dublin United Tramway Co.) considered that alternating current was preferable in many cases, and he did not think balancing was a very difficult matter where three-wire systems were used. Overhead mains where the houses to be supplied were near each other were a mistake, and underground mains came out cheaper in the end. Having had experience of contract systems, he could not say too much to condemn them, and any undertaking starting such a system was putting a millstone round its neck—it was not business, and consumers should pay for what they actually used.

Major Davy considered that a low voltage was preferable to a higher one for the object in view. He had noticed that in Switzerland every village had its supply, which was probably due to cheap power, cheap distribution, and cheap house wiring. Major Davy thought that the reason why developments were so slow was probably due to the fact that the new lamps were so efficient that it was realised the demand was now so small that it would not pay in many cases to put down a station at all in many instances; he did not agree with the contract system, and noticed that while Mr. Spalding got more revenue per lamp on the contract system, he did not state how much the cost of supplying a lamp on that system had increased.

Mr. Wm. Tailow thought that low-pressure systems would be difficult to work in many small places, because the houses were very straggly and covered a large area. Overhead wiring need not be the unsightly job it was often made. Prepayment meters would be the most suitable method of supplying the working classes, but, unfortunately, he had never seen a prepayment meter which was mechanically good.

Mr. P. A. Spalding, who briefly replied, said he thought that most of the apathy in starting these schemes was due to the action of local authorities, who obtained an order simply for the purpose of stopping private enterprise, or else were afraid to embark upon a scheme which might not be financially successful. With reference to contract systems of charging, the running costs of charging, the running costs of modern plant were very small, and the contract charge guaranteed all the fixed charges and a good deal over for running costs and profit; in Galway he had succeeded in doubling the number of consumers in a period of four years, while the station had previously been running seventeen years, which, he thought, was strong testimony as to the popularity and efficacy of the system. He was strongly in favour of the I.M.E.A. Bill; free wiring was very remunerative; he advocated two systems; one deferred payment spread over, say, 18 months, or possibly a pure hire system, charging 10 per cent. of the cost of the installation as rental.

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"ELECTRICAL ENGINEERING" PATENT RECORD

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Specifications Published Dec. 21, 1911

A full list of these was published in our last issue. The following are abstracts of some of the more important specifications.

27,711/10. **Trolley Wire Couplings.** A. MATHER and A. BARLOW. A tubular casing is provided with two pairs of lugs, between each of which a steel grip is eccentrically pivoted. The tops of the grips are connected by a spring, while the bottom of each, which extend through slots in the casing, is toothed. The teeth are directed towards one another, so that the greater the outer pull on the wire the tighter will be the grip. This makes a simple device, as the wires have only to be inserted in the casing. Three figures.

29,425/10. **Lamp Locking Device.** E. CHEADLE. A metal ring, which is grooved inside, contains a tongue spring with a catch and two slots parallel with the existing bayonet slots in the holder, so that the action of inserting the lamp causes an automatic movement of the ring, the spring fixing itself into the slots in the holder, and forming a perfect lock, which can only be released by a special key. Fourteen figures.

1,295/11. **Overhead Trolley Wires.** J. W. THOMPSON and J. FINNIGAN. A device for easily replacing the trolley wheel on the wire, consists of attaching a metallic cover of angular shape in electrical contact with a support which is fixed to the wire. The trolley wheel coming into contact with the inclined sides of the cover at once lights up the car, and is directed on to the wire at the apex. Four figures.

Specifications Published To-day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, E.C., at the price of 8d. each, post free.

Names in italics indicate communicators of inventions from abroad. Summaries of some of the more important of these patents will appear in our next issue.

Arc Lamps: GES. FÜR MASCHINEN- UND METALL-INDUSTRIE, 27,942/10; SCHIFF [Carbon electrodes] 17,690/11.

Dynamos and Motors: BROWN, BOVERI ET CIE. [Excitation of induction machines] 25,397/10; SIEMENS BROS. DYNAMO WORKS [Regulating frequency of rotary field generators] 28,081/10; BOTTONE [Current generators] 28,612/10; SIEMENS SCHUCKERTWERKE GES. [Speed regulation of polyphase series motors] 13,877/11.

Heating and Cooking: OGDEN, HAY, and TEMPLETON [Ovens] 28,129/10; TRUMPLER [Regulation of heating apparatus] 30,201/10; VERITY'S, LTD., and FLETCHER [Oven construction] 22,021/11.

Storage Batteries: KAMPERDYK [Plates] 28,419/10.

Switchgear: LOFQUIST [Electromagnetic switches] 10,652/11; TURNER and WILKINSON [Controller for lifts] 13,469/11; FAGERLUND [Automatic switches] 17,284/11.

Telephony, Telegraphy, and Signalling: VARLEY [Making and breaking contacts in wireless signalling] 20,585/10; LEETE [Cover for telephone mouthpieces] 4,000/11; O'NEIL [Signalling apparatus for ships] 9.428/11; VON KRAMER [Inductive wireless installations] 10,857/11.

Traction: FEHR [Automatically actuating track points] 29,410/10; KLOSE [Actuating signals on trains, &c.] 2,600/11; LAKE (*United States Light & Heating Co.*) [Mounting dynamos on trains, &c.] 3,722/11; BALACHOWSKY and CAIRE [Electrically-propelled vehicles] 7,062/11.

Miscellaneous: RAY [Massage, electric, &c.] 23,225/10; ALEXANDER (*Anderson Winding Machine Co.*) [Winding coil machines] 28,330/10, and [Windings, and methods of binding turns and layers] 18,921/11 and 18,922/11; MERSHON [Forming dielectric films in electrolytic cells] 28,352/10; MCNEIL [Automatic fire-alarm systems] 28,978/10; RUSSELL [Batteries] 28,986/10; THOMPSON [Magnetic separators] 29,052/10; WESTMANCOTT [Hand-lamp] 3,374/11; MCQUOWN [Lantern for exterior illumination] 3,392/11; GOLDSTEIN [Electric alarm system] 7,671/11; SANDRINI and SANGUINETI [Primary batteries] 9,528/11; ANDERSON and BURNSIDE [Vapour-electric apparatus] 16,187/11.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution: PAUL [Overhead transmitting system] 25,364/11.

Electric Ignition: SOC. RÉNÉ GILLET ET CIE. [Timing method] 9,948/11; DAIMLER MOTOREN GES., 13,788/11; DIEHL [Automatic timing control] 24,697/11.

Electrometallurgy: HELFENSTEIN [Gas-reactions in electric furnace] 26,371/11.

Telephony: GWOZDZ [Telephones] 17,278/11 and 17,300/11.

Miscellaneous: ANSCHÜTZ & Co., [Electrical contacts] 16,440/11.

The following amended Specification can now be obtained.

ROSENBERG and PECK [Braking induction motors] 17,010/10.

Opposition to Grant of Patents

17,438/08. **Tungsten-Nickel Alloy.** SIEMENS & HALSKE AKT.-GES. This patent has been granted in spite of appeal, an account of which appeared in our issue of January 6th, 1910, p. 5. It relates to a method of producing tungsten filaments by mixing it with nickel and sintering the metals together by heating below the melting point of tungsten, the nickel being subsequently expelled by strongly heating in a vacuum. A fuller abstract appeared in ELECTRICAL ENGINEERING, April 29th, 1909, p. 406.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

30,848, of December 31st, 1897. **Railway Point Operation.** I. A. TIMMIS. A motor is placed near the points to be operated, to which it is connected by worm gearing. A bolt locking the points is first drawn out, the points being moved over, and on completing their travel, the bolt locks them again automatically. The points are controlled from the signal cabin, in which interlocked levers or switches are fitted to control the current passing to the points. They are so arranged that they cannot be operated until all the signals in the section are at danger.

30,923, of December 31st, 1897. **Electric Lifts.** H. H. LEIGH (*F. J. Sprague, U.S.A.*). Two motors in series are employed, each armature shaft having a pair of worms, one of each engaging with worm-wheels on the shaft of the driving drum, whilst the other two engage wheels on another shaft which is geared to the drum shaft by spur wheels, thus ensuring synchronous working of the motors. Right and left hand grooves are provided on the two halves of the drum. The middle of the drum is occupied by two pairs of ropes leading to the cage, the balance weight ropes being coiled on the ends. Guide pulleys for the cage ropes are mounted on a shaft threaded oppositely at its ends with a pitch equal to that of the drum grooves, and driven from the shaft which is spur geared to the drum shaft, through gearing and an intermediate shaft. The armature shafts have shoe brakes applied by springs, and kept out of action by solenoids acting through topple levers, and a switch is provided to stop the motors should the ropes slacken or mount the grooves.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: O. GROSS, 19,734/07; D. TIMAR and K. VON DREGER [Solenoid feed] 23,199/07, [Feed by electromagnetic device] 23,225/07, and [Parallel carbon type] 24,027/07.

Distributing Systems, Cables, and Wires: BRITISH THOMSON-HOUSTON CO. (*General Electric Co., U.S.A.*) [Machine for coating conductors] 17,842/05; H. HIRST and C. E. GUNNER [Couplings for mains] 19,690/06.

Dynamos, Motors, and Transformers: C. CONTAL and P. GASNIER [Construction of enclosed motor] 15,957/00; W. P. THOMSON (*Berliner Maschinenbau Akt.-Ges. vorm Schwartzkopff*) [Armatures, field magnets] 19,168/04; F. DARLINGTON [Cooling transformers] 18,876/06; SIEMENS BROS. DYNAMO WORKS [Motor control] 19,593/06, and [Couplings] 19,856/07; H. W. LAKE (*Fabrik Elektrischer Zünder Ges.*) [Dynamo for exploding mines] 19,800/07.

Incandescent Lamps: W. E. BARRAS and G. WEDDELL [Method for closing neck of bulb] 19,808/07; H. GILMORE [Reflector supported inside bulb] 19,829/07.

Switchgear and Fuses: J. H. HOLMES [Combined switches and automatic circuit-breakers] 17,888/05; T. L. BOYDEN [Switches] 19,855/07; F. F. BOURDIL [Cut-outs] 19,891/07; J. HUNTINGTON [Combined switch and plug] 20,068/07; K. EDGCUMBE and E. I. EVERETT [Cut-outs and relays] 20,095/07; J. N. KELMAN [Oil switches] 20,110/07.

Telephony and Telegraphy: T. CUSHING [Insulators] 17,997/05; J. GARDNER [Controlling apparatus by sound waves] 18,173/05; K. WACKERMANN [Telegraphs] 19,805/07; S. EISENSTEIN [Wireless telegraphy] 20,128/07.

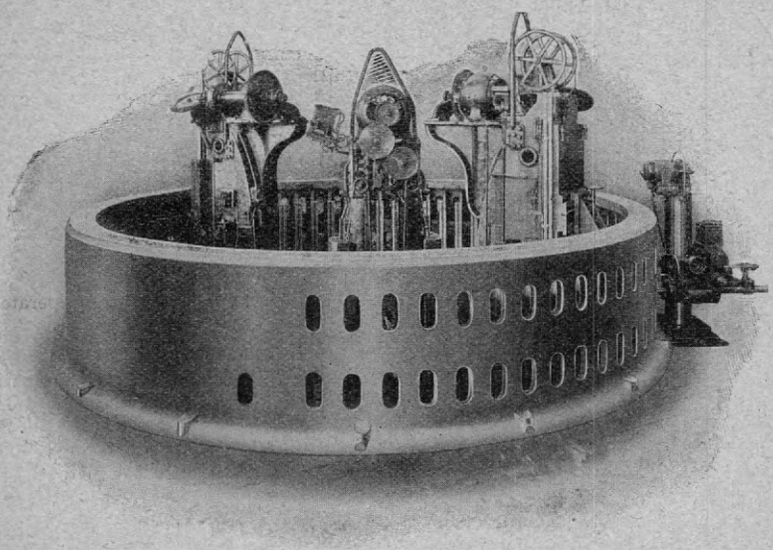
Traction: M. ALBRECHT [Power transmission for motor vehicles] 5,996/07; E. SUGHROUE [Signals: stopping trains] 19,755/07.

Miscellaneous: T. B. POWERS, M. R. JEWELL, and MAGNETIC PIANO CO. [Electrical piano] 17,617/01; W. J. L. SANDY and H. T. MIDDLETON [Primary batteries] 19,623/06; B. KOHLEN [Electric fire-alarm, &c.] 19,870/07.

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ELECTRIC DRIVING OF MACHINE TOOLS

A VERY attractive pamphlet entitled "Motor drive for Metal Working Machinery" has just been issued by the British Thomson-Houston Co. This takes the form of a book of illustrations indicating a few of the many excellent methods of properly and economically applying either alternating or continuous current motor drive to machine tools. As electric driving has been successfully employed for a number of years and the resultant benefits are so widely appreciated, only a few of the particularly salient points of merit attending the adaptation of this efficient, flexible, and economical form of power are given in the pamphlet. We reproduce here an illustration showing the application of individually-driven tools to machinery, the frame casting of a large alternator enabling the tools to be taken to the work rather than the work to the tools, an important consideration where the work is of a heavy character. Other illustrations show individually driven drills, shapers, punches and shears, wheel presses, lathes, slotters, planers, grinders, millers, rotary planers, and boring mills.



Portable Individually-Driven Tools at Work on Large Alternator Frame.

A NEW ADVERTISING DEVICE

A MOST ingenious piece of apparatus has been brought out by the Sun Electrical Co., Ltd. (118 and 124 Charing Cross Road, W.C.). This appliance, known as the "Fortuna" is described in a booklet which the firm are issuing, entitled "The Story of a Dumb Salesman," and the apparatus consists of an upright polished metal cylinder with a dome-shaped top on a stand. When in use the goods that are to be displayed are seen to adhere without any visible means of attachment to the metal jacket in all sorts of positions, and to travel slowly round, although no external part of the apparatus is rotating. The whole device is about two feet high and one foot in diameter, and is suitable for standing on a counter or in the window. The booklet does not reveal the mystery of "how it is done," but a little imagination regarding rotating magnetic systems and masses of iron concealed in cigar-boxes, &c., may suggest an explanation to our readers. Anyway, the appliance is no more greedy of current than a 16-c.p. lamp.

CATALOGUES AND PAMPHLETS, &c., RECEIVED

SUPPLY ADVERTISING.—We have received a copy of the first number of the *Journal of the Electric Supply Publicity Committee*, which is intended to keep the committee in touch with its supporters and stimulate supply advertising campaigns. The work already accomplished by the committee is reviewed in a special article.

RADIATORS AND CONVECTORS.—Some very effective designs of electric radiators and convectors appear in a catalogue from the Sun Electrical Co., Ltd. (118-120 Charing Cross Road, London, W.C.), in which we note a special cheap line of radiator, wrought iron with copper convector, complete for 22s. with two lamps, or 30s. with four lamps. They can be had in combined form, each of which can be switched on independently. The standard size radiator lamp consumes ¼ unit each per hour, and the convector elements are standardised for a similar consumption for all standard voltages. Factory heaters and fresh air heaters are also included.

D.-C. MOTORS.—A complete and up-to-date list of direct-current motors of ¼ to 50 h.p., for voltages from 110 to 550, has been received from the Union Electric Co., Ltd. (Park Street, Southwark, London, S.E.). Details of the component parts are given as well as the prices and the usual weights and dimensions.

THE COMPLIMENTS OF THE SEASON

A collection of useful small writing pads accompany the compliments of the Union Electric Co.

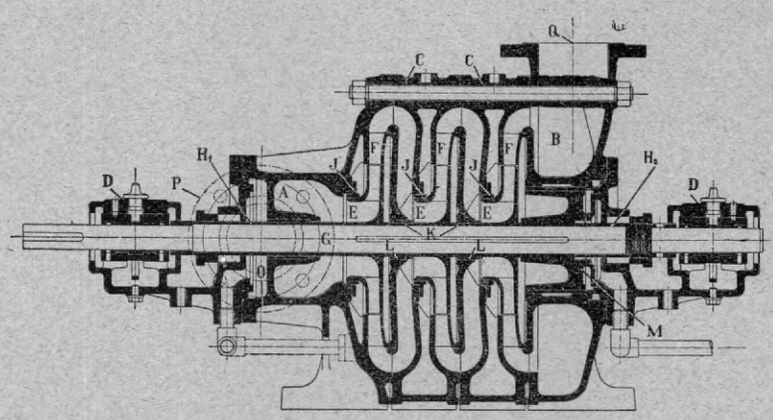
A most effective calendar is being issued by the United States Metallic Packing Co., Ltd., decorated with a statue of "Echo" embossed in relief.

The Electric Construction Co. have sent us a particularly neat leather card and stamp case with almanac.

HIGH LIFT CENTRIFUGAL PUMPS

A PATTERN of high lift centrifugal pump which is being put on the market by the Electrical Engineering and Agency Co., Ltd. (109 to 111 New Oxford Street, W.C.), is illustrated in section here. The design has several special features which ensure high efficiency as well as reliability, and a patented hydraulic balancing arrangement eliminates all end-thrust. The pump illustrated is of the three-stage type.

The pump shell consists of the suction stage A, the delivery stage B, and the intermediate stage C. Uniform sections similar to C may be interposed between A and B for four, five, or six stage pumps. All these parts are held together by strong through-bolts. The bearings D are bolted to the suction and delivery sections. The parts A, B, and C are all provided with substantial feet, so that each section will stand separately when the pump is being dismantled. The runners or impellers E and guide channels F are made of special bronze, and these, together with the cast-iron intermediate pieces C form the water passage in the interior of the pump. In most cases the guide channel and intermediate piece for each stage are one casting. The shaft is of steel or nickel steel, and of ample size. In the larger sizes of pumps the shaft is provided with interchangeable sleeves H1 and H2. Renewable packing rings J are also fitted to reduce to a minimum the leakage back to the impeller inlet. Distance bushes K between the various impellers on the shaft run in interchangeable boxes L. The balancing of the end thrust is effected by means of the patent hydraulic balancing arrangement M, which automatically adjusts itself while the pump is running for any variation of head and output, or for any wear that may take place. No special stuffing boxes are required at the delivery, or pressure end, and this is usually a constant source of trouble, being ordinarily subjected to maximum pump pressure. Air leakage into the pump on the suction side is prevented by the gland O, which, in addition to ordinary packing, is water sealed.



Section of High-lift Centrifugal Pump.

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ELECTRIC TRACTION NOTES

The Llanelly and District Electric Lighting and Traction Co., which only started operations a few months ago, has early met with labour troubles. Last week the tramway-men struck, and the Company were at first forced to run a limited service of cars during daylight hours only, with the managers and other officials in charge. As the authorities were unable to guarantee protection, the whole service was suspended on Tuesday. The stokers at the power station have since joined the strikers, but at the time of going to press a supply of current for public lighting was being maintained. The dispute concerns the recognition of the tramway workers' union.

Some interesting articles on the Aurora, Elgin & Chicago Railroad Co.'s power house were published this year in three issues of the *Electric Railway Journal* of New York. Current is supplied to a frequent service of trains on a high-speed, third-rail line between Chicago and 40 miles west, covering altogether 175 miles of track. It also supplies three trolley lines in Elgin and Aurora, covering 73 miles, besides lighting and power to eight other towns. There are four 1,500-kw., 2,300-volt, three-phase, 25-cycle alternators in the station, driven by Cooper-Corliss horizontal cross-compound engines, and to increase the capacity of the station a new mixed pressure turbo-generator has now been put in. At present the high pressure is only used for starting, and as soon as the turbo-generator has been synchronised with the engine-driven sets the steam supply is cut off, and the unit run on the exhaust from the combined two of the four reciprocating-engine sets. By means of suitable motor-driven sectionalising valves in the exhaust header, any combination of two engines supplying the turbine can be obtained, leaving the other two to work independently on their own condensers. The turbo-generator was purchased as a 2,500-kw. machine on the old railway rating of a 35° C. rise for continuous operation. On the basis of the so-called "maximum continuous load" rating, however, this corresponds to about 3,700 kw., at which the machine worked for considerable periods, and even generated 4,000 kw. for short intervals. With the turbine floating on the system it has been found that most of the load fluctuations are absorbed by the turbine, and the engines can run with approximately constant load.

The articles contains some notes on the overhead transmission system, which is at 26,400 volts. Aluminium cable is employed, and the three cables were originally spaced 30 ins. apart, but this was increased to 65 inches, as it was found that short circuiting could easily take place, and a 26,400-volt arc would hold long enough to burn through or blister the wires, so that they would snap in cold weather. The high-tension line was reconstructed without stopping the service. The railway is supplied at 600 volts by seven rotary converter sub-stations, in which 500-kw. units are now employed, but for future additions 1,000-kw. units will be installed. The third rail is of 100 lb. T-section of soft steel, and is supported by white oak sleepers, 6 in. by 8 in. by 9 ft., spaced 10 ft. apart. The steel is low carbon, and has a conductivity as compared with copper of 1 to 8. The insulators are of wood impregnated with paraffin, and provided with malleable-iron bores and caps.

Tests have shown that the leakage from the third rail averages 0·6 amperes per mile of track. Four-motor passenger cars and trailers were originally employed on the line, but the severity of the service made it advisable to equip most of the former trailers with motors. At the beginning, there was considerable difficulty in collecting current from the third-rail during sleet storms, and a method of melting the sleet by the distribution of a solution of calcium chloride was devised. Cans of the solution were carried in the front ends of trains, and the mixture was led to the top of the third-rail and distributed in advance of the shoe. While this method served to keep the trains running during severe sleet conditions, it had a bad effect on the insulation of the third-rail and the car wiring, and led to the development of a side-contact shoe. These shoes as now used have a cross-section similar to the letter "V" inverted. They ride on the edges of the rail head, and thus either remove the sleet mechanically or make contact where it is thinnest. The article contains an interesting table of the causes of failure on the third-rail lines during 1910. The number of passenger car-miles run was 3,199,044, and the total number of failures 651. Of these 20 per cent. were motor troubles, 16 per cent. hot journals, 4·9 per cent. hot motor bearings, 14·5 per cent. due to control apparatus, 7·8 per cent. brake troubles, 2 per cent. gears and pinions, and only 0·4 per cent. due to third-rail shoes.

It was rumoured in the City last week that the London General Omnibus Co. have come to an agreement with the Underground Electric Railways Co. of London, by which a new company will come into existence which will control both the Railway Company and the Omnibus Company.

The Newcastle Corporation have put into service a new type of tramcar with glass shields for the protection of the drivers.

OSRAM·LAMPS

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The *New York Times* recently forwarded a telegram round the world to its own address *viâ* Honolulu, Manila, Hong Kong, Singapore, Bombay, Suez, Gibraltar, and Fayal. The whole distance of some 32,000 miles was travelled in 16½ minutes. This is greater than the "record" time of 9½ minutes, which record was accomplished at the opening of the Pacific cable in 1900. On that occasion, however, careful preparations were made beforehand, whereas the *New York Times* telegram was handled as an ordinary business telegram.

The new wireless telegraph station at Port Said is now in full working order, and has been in communication with vessels 900 miles distant.

Following on his answer in the House of Commons a short time ago with regard to the extensions of the underground telegraph system to Dundee, the Postmaster-General has now informed the Local Chamber of Commerce that owing to the cost, viz., £70,000, such an extension cannot at present be justified. He also states that experiments are being made to ascertain to what extent it will be possible to send telegrams by means of the telephone trunk wires, with a view to improving the present service. In a similar letter to the Aberdeen Chamber of Commerce, the Postmaster-General points out that the cost of extending the underground route to that town would be £130,000.

It is stated that the automatic telephone exchange which the Post Office authorities are installing at Epsom is expected to be ready by January 15th.

The report of the Helsby Wireless Telegraph Co. for the year to July 4th, contains the directors' regrets that the year's working has not been a satisfactory one. When the judgment in favour of the Marconi Co. was given against the British Radio Telegraph Co., the Helsby Co., approached the former with a view to working under a licence, but the negotiations fell through. Shortly afterwards the Lodge-Muirhead Syndicate obtained an extension of the patent for seven years, and negotiations were opened up with that company with a view to a licence, but these were suddenly broken off when the Lodge-Muirhead Syndicate amalgamated with the Marconi Co. An arbitrator has since been appointed to settle the terms upon which the company shall take a licence from the Marconi Co., and it is hoped that these will shortly be fixed. In the meantime the company's business has been practically at a standstill, and in an endeavour to put it upon a satisfactory basis, the commercial management has been placed in the hands of the British Insulated & Helsby Cables, Ltd., and their subsidiary company, the Automatic Telephone Manufacturing Co., Ltd., and at the same time the capital of the Helsby Co. is to be reduced by £10,000.

Junior Institution of Engineers.—Mr. G. Marconi will deliver his Presidential Address on January 5th.

Association of Mining Electrical Engineers.—An ordinary meeting of the South Wales Branch will be held on Saturday, December 30th, at the offices of Messrs. Haslam & Schontheil, Ltd., Windsor Place, Cardiff. The discussion on the paper by Mr. C. Jones, "Earthing, Earth-plates, and Earth Detectors," will be resumed, and a paper will be read by Mr. E. Beadsmore on "Shaft Signalling."

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LOCAL NOTES

Belfast: *Street Lighting.*—The Tramways Committee have agreed to the Police Committee, which has control of the public lighting, carrying out experiments with gas lamps on the tramway poles for a month on condition that similar experiments with electric lamps are subsequently carried out.

Chester: *Refuse Destruction and Electricity.*—A motion that the Electricity and Sub-Committee should consider the advisability of the erection of a joint electricity and refuse destructor works has been adopted by the Council.

Chili: *State Power Supply.*—According to the *Board of Trade Journal*, the Chilian Ministry of Industry and Public Works proposes to divide the Hydraulic Works Department into three sub-sections, viz., Hydraulic Surveys, Power Stations, and Power Transmission. It is also considered expedient to expropriate as soon as possible all Hydraulic Works which it may be thought suitable for the State to work, for the purpose of electric supply in connection with the State railways as well as for military and naval purposes. Further particulars may be obtained at the Commercial Intelligence Branch of the Board of Trade.

Greenock: *Electricity Output.*—At the last meeting of the Corporation it was reported that the output from the electricity works now reaches 1,000,000 units per month, which is 61 per cent. higher than at the same period of last year.

Grimsby: *Additional Generating Plant.*—Mr. W. A. Vignoles, the Borough Electrical Engineer, who will shortly be on the Continent, proposes to take the opportunity of inspecting a number of engine works with a view to helping him to come to a decision as to whether an exhaust steam turbine or Diesel engine should be used for extensions at the electricity works.

Holyhead: *Electric Lighting Tariff:* A recommendation by the Electric Light Committee that the charge for current should be reduced to 4½d. per unit has been referred back.

Launceston (Tas.): *Electric Lighting Accounts.*—The electric lighting accounts for the year to July 31st, 1911, show a net surplus of £4,218, an increase of £1,319 over the previous year. The reserve fund stands at £8,359. The past year has been one of the most prosperous in the history of the undertaking, and the output of the works will be still further increased in the future by the demands of the tramway system which is now under construction.

London: *Bethnal Green: Electricity Supply.*—The Council have agreed to the Shoreditch Borough Council giving a supply of electricity to certain premises in Bethnal Green on the condition that their interests are not prejudiced in any way.

Hampstead: Street Lighting Cost.—In connection with the estimates for the conversion of the street lighting in Hampstead, referred to in our last issue, the Finance Committee now report that an additional sum of £10,398 is required, the loan which was passed upon the original estimates being £15,000. A sum of £1,536 has already been transferred from the reserve fund, and it is proposed to transfer the remainder from reserve and repay it in seven annual instalments as from April 1st last.

Islington: Street Lighting.—The question of improving the street lighting by the adoption of metal filament lamps has come under discussion. The Lighting Committee's recommendation that they should inspect the lighting of streets in other districts has been passed by the Council.

Mexico: *Electric Supply and Tramways.*—The *Board of Trade Journal* states that a company has been incorporated in Canada with a capital of £3,000,000 for the purpose of carrying on in Mexico an electric light, heat, and power business, and also for the construction of railways, tramways, telephone and telegraph works, &c. The company proposes to obtain power from certain rivers, and it is stated that contracts have been let for the hydraulic works and power station, and also for the transmission lines. Names and addresses to which communications may be sent can be obtained at 73 Basinghall Street, London.

Newport, Mon.: *Management of Electricity Undertaking.*—The methods which are being adopted by the Electricity and Tramways Committee with regard to the management of their undertaking are meeting with some criticism. A short while ago the Committee reported that it was not in the best interests of the undertaking that the Engineer and Manager should be one and the same person. They consequently decided to appoint a commercial manager of the undertakings and to relieve Mr. H. Collings Bishop of the commercial side of the undertaking, leaving him free to develop to the full the technical aspect. Advertisements were then issued for a manager, but it has been pointed out that most of the applications for the post have come from engineers. Mr. Collings Bishop has since resigned, and so far as can be gathered at present, the Committee's intention appears to be to appoint one gentleman to manage the undertakings, and presumably to follow a policy which they themselves have said is not the best for the undertaking. Mr. Collings Bishop's resignation takes place in the spring, and, of course, there is yet time for the Committee to reconsider the whole matter.

TENDERS INVITED AND PROSPECTIVE BUSINESS

GENERATING STATIONS, SUB-STATIONS, MAINS, &c.

Bolton.—The Engineer has submitted his plans for the proposed new electricity works recently referred to in our columns. He also calls the attention of the Electricity Committee to the fact that unless additional plant is installed immediately he will not be in a position to entertain applications for the supply of current during the next winter. The Engineer has been instructed to submit a report upon the additional plant which, in his opinion, it will be necessary to instal.

Greenock.—A loan of £20,000 is to be taken up for extensions at the electricity works.

London: *Hackney.*—The Borough Electrical Engineer has submitted a report pointing out that in his opinion the safe load of the generating plant has been reached, and he is preparing details and estimates of a comprehensive scheme for dealing with future demands. The Electricity Committee recommend that an independent electrical engineer be called in to report upon the scheme at a fee of fifty guineas.

Norwich.—An application is to be made to the Local Government Board for a loan of £19,000 for mains, services, and a steam turbine with tandem generators.

WIRING

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Barking.—Elementary school in Ripple Road. Architect, C. J. Dawson, 16 Cambridge Road, Barking.

Blackburn.—Asylum for 2,000 patients. Architect, Mr. H. Littler, 16 Ribblesdale Place, Preston.

Bradford.—Warehouse. Architect, W. Illingworth, 9 Market Street.

Additions at Ryan Street School. City Architect, Town Hall.

Croydon.—Eighteen houses in Alderton Road. J. W. Hall, 315 Portland Road, Croydon.

Glasgow.—New buildings for Glasgow Royal Infirmary in Cathedral Street. Architect, James Miller.

Large additions to Messrs. J. Buchanan and Brothers' works in Ann Street.

Hamilton.—New school at Silvertonhill.

Launceston.—Inquiries are being made as to the cost of installing electric light at the Town Hall, Guildhall, and Free Library.

London.—New church at Golders Green.

Sheffield.—New telephone exchange at Attercliffe. H.M. Office of Works, London.

Southsea.—New Art Gallery near Town Hall.

South Shields.—Cinematograph theatre. R. Scott, Newcastle-on-Tyne.

Walthamstow.—County High School for girls at Church Hill. Architect, C. J. Dawson, 11 Cranbrook Road, Ilford.



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MISCELLANEOUS

Belfast.—The Tramway Manager recommends the Corporation to proceed at once with a number of tramway extensions at an estimated cost of £151,000.

Birmingham.—Tenders are invited by January 8th for fifty electric tramcars. Particulars from General Manager.

Bradford.—The Council have been asked to authorise the commencement of the extensions of the tramways from Wyke terminus to Bailiffe Bridge, a distance of one and three-quarter miles.

Southampton.—Application is to be made to the Local Government Board for sanction to borrow £7,200, the estimated cost of building twelve new tramcars.

TENDERS RECEIVED AND ACCEPTED

Liverpool.—At the meeting of the City Council on Wednesday, considerable discussion took place upon the proposal of the Tramways and Electric Power and Lighting Committee to accept tenders by the British Westinghouse Co., the British Thomson-Houston Co., and the Worthington Pump Co., for new generating plant at the Lister Drive power station. The recommendation was finally adopted. Previously, an amendment had been moved to send the report back to the committee with instructions to engage an independent expert to report on the existing system of generating electricity and generally to advise the committee on their future action. Although this received some support, there was considerable feeling that this implied a want of confidence in the existing officials. Sir Charles Petrie, chairman of the committee, said that this was the first portion of a scheme to re-model the Lister Drive station, and would involve the scrapping of a considerable amount of old plant. At the same time the cost would come out of the reserve fund, which now amounts to £300,000, and from which only £56,000 has been withdrawn since the commencement of the undertaking.

London.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract for the supply of tantalum traction-type lamps for ship lighting, &c., from the Royal Mail Steam Packet Co., for a period of six months commencing January 1st.

APPOINTMENTS AND PERSONAL NOTES

Applications are invited for a commercial assistant in the Bradford Electricity Department. Salary £250 per annum. (See an advertisement on another page.)

Mr. J. Pilling, Borough Electrical Engineer at Kings Lynn, has resigned his appointment. Mr. C. W. Jackson, at present Chief Assistant Electrical Engineer, has been appointed Mr. Pilling's successor at a salary of £150 per annum, rising by increments of £10 to £200, with house, coal, rates, and light provided, and with permission to take two pupils.

The Bradford Tramways Committee have again recommended an increase in the salary of the Manager, Mr. C. J. Spencer.

It is announced that Sir Charles Rivers-Wilson and Sir Charles Freemantle have resigned from the Board of the British Electric Traction Co.

The Bridlington Electric Lighting Committee recommend that the salary of the Borough Electrical Engineer, Mr. A. J. Beckett, be increased from £300 per annum, by five annual increments of £20, to £400, commencing from January 12th, 1912. This recommendation is subject to Mr. Beckett agreeing to remain with the Corporation for five years, and to forego the commission which he at present receives as consulting engineer.

Mr. E. C. Reed, chief publicity writer to the Westinghouse Companies Publishing Department, has been appointed Sales Manager to Messrs. Miles, Sykes & Sons, Calder Works, Sowerby Bridge. Mr. Reed will take up his new duties early in the new year.

Mr. A. S. M. Sörensen has taken up a position as radio-telegraph engineer with Professor Dr. Goldschmidt, of Berlin.

MISCELLANEOUS BUSINESS NOTES

Meter Approved.—The Board of Trade have approved of the "Gunfire" time-switch supplied by the British, Foreign and Colonial Automatic Light Controlling Co., Ltd., Bournemouth, and of the means provided for fixing same.

Change of Address.—The Adams Manufacturing Co., Ltd., have transferred their head office from New Bond Street to Balfour House, Finsbury Pavement, E.C. Telephone: City 4,841; telegrams, Admocar, London.

Moncrieff P. Ford and Co., 57 Colmore Row, Birmingham, are moving on January 1st to more commodious premises at 12 Bromsgrove Street, and 64–65 Dean Street, where they are fitting up large showrooms for machine tools.

Illuminating Engineering.—The British Thomson-Houston Co. have opened an illuminating engineering department with offices at Rugby, London, Manchester, and Sheffield, to give expert assistance to architects, engineers, and contractors in the planning of large or small lighting schemes.

"Foster Festivities."—The Foster Engineering Co., Ltd., celebrated the opening of their metal lamp factory extensions at a tea and concert on December 22nd. Both events were a distinct success. About three hundred sat down to tea, and the subsequent concert was given solely by the workers in the metal lamp factory, the members of the staff being in the position of honoured guests. The proceedings throughout emphasised the cordial relations which exist between all departments and the directors and staff.

Liquidations.—A meeting of the Tramways Extension Syndicate, Ltd., will be held on January 31st at 3 p.m., at 5 London Wall Buildings, E.C., to hear the liquidator's account of the winding-up.

The Rugby School Electric Lighting Co. is to be wound up voluntarily. Mr. E. Donkin is liquidator.

A petition for the compulsory winding up of the Davis Electrical Co., Ltd., will be heard before Mr. Justice Neville.

Dissolution of Partnership.—J. N. Davenport and H. A. Sparrow, Electrical Engineers and Factors, 44 Brazenose Street, Manchester, have dissolved partnership. Debts by J. N. Davenport.

Bankruptcy.—The public examination of Thomas Topping, 361 Lord Street, Southport, will take place at 35 Victoria Street, Liverpool, on January 15th.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Siemens-Schuckert Works.—The report for the last completed year states that in spite of the large extensions made to the company's works, a considerable amount of night work has been necessary, and this activity seems likely to continue. Orders booked since the beginning of the current financial year are much in excess of those of the corresponding period of last year. The most unsatisfactory feature, it is pointed out, is the further fall in prices. The total horse-power of engines, motors, and transformers turned out during the year was 2,646,327, against 2,071,970 in the previous twelve months.

Siemens & Halske.—The report just issued refers to the agreement between the General Electric Co., the A.E.G. and the Auer Co., with regard to the sale of metal filament lamps. Messrs. Siemens & Halske, it is stated, are finding an increased demand for their tantalum lamps, and it is not thought that the agreement with regard to Osram lamps will injure them.

Newcastle Students' Section, I.E.E.—Mr. Vesey-Brown, chairman of the Newcastle Local Section, presided over a meeting of students at Armstrong College on Friday, December 15th, at which it was decided to hold meetings for students every fortnight and to arrange visits. The following Committee of students was appointed:—Messrs. A. H. Browett, B. A. M. Cooper, W. A. Hatch, A. G. Stamatopoulos, W. A. Aldridge, E. G. Townshend, J. D. Dodds, M. Shuttleworth, E. H. E. Woodward, Christianson, Armstrong, B. A. Robinson, A. Douglas. The chairman clearly explained the working of students' sections in London, Manchester, and other sections. As regards the proposed modifications to the Articles, he stated that advice had been received from London of the present intention of the Council that students should not exceed the age of 27 years, and that the subscription for students should be one guinea per annum up to the twenty-first birthday, and one and a half guineas after. There was to be no entrance fee. A large number of engineers engaged in the district signified their intention of joining the Institution. The enthusiasm shown at this and other recent meetings by students augurs well for the organisation of a strong and successful Students' Section in Newcastle. Those interested in this movement who have not already obtained application forms are advised to communicate without delay with the honorary secretary, Mr. H. W. Clothier, Hawthorn Villas, The Green, Wallsend-on-Tyne.



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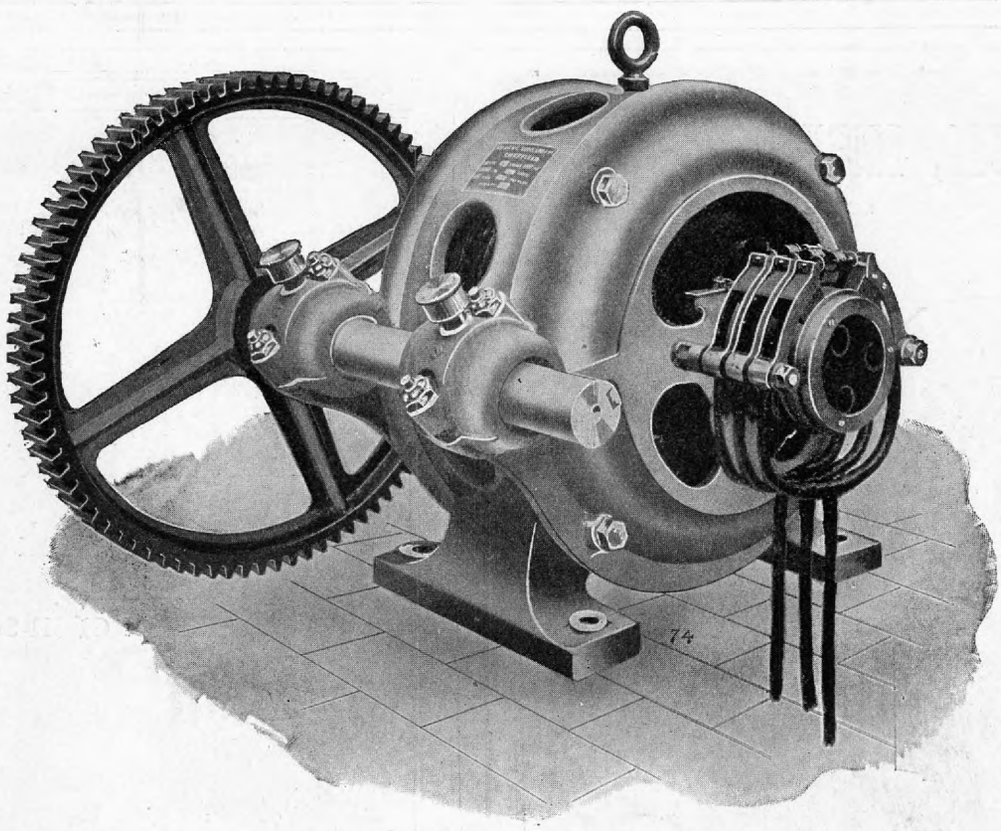
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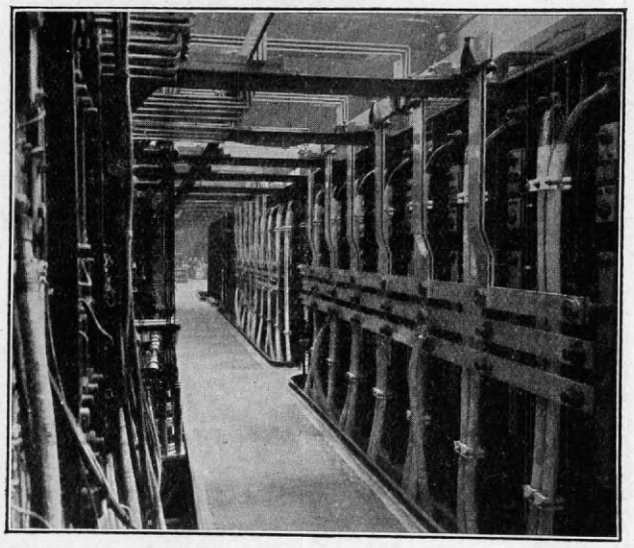
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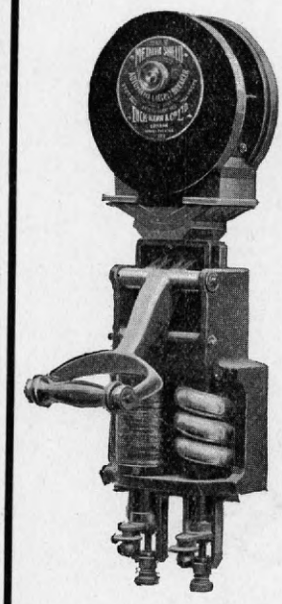
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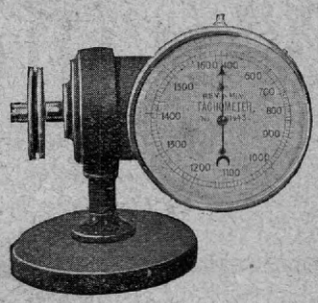
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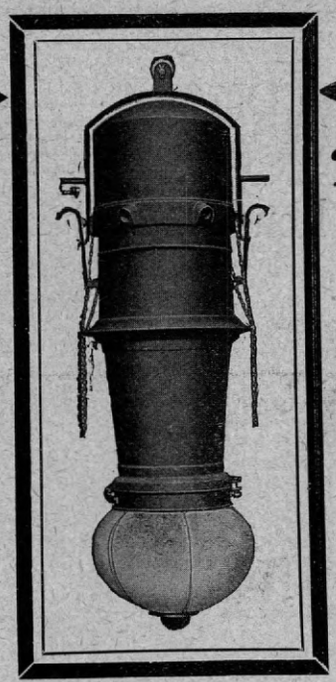
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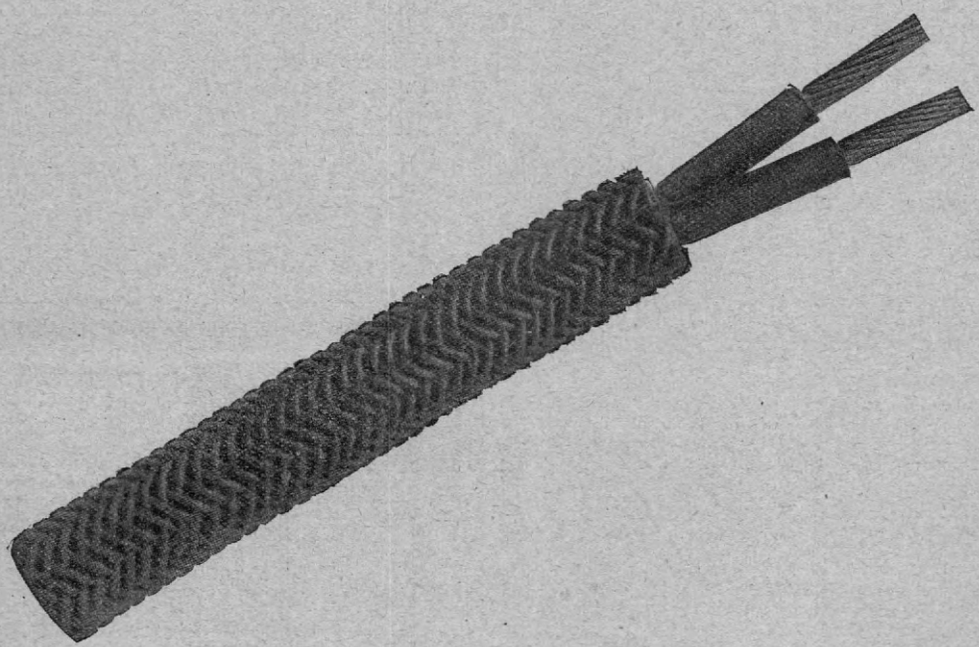
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Letters should be addressed to The Kilowatt Publishing Co., Ltd., 203–6, Temple Chambers, London, E C.

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Electricity Department.

COMMERCIAL ASSISTANT.

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Applicants, who must not be over 40 years of age, must have had a sound technical education in subjects relating to electrical and mechanical engineering, and practical training as electrical engineers, and preferably should have obtained commercial experience with a firm of electrical engineers whose business is to supply motors, arc lamps, heating, cooking, and other apparatus. Experience in connection with an electricity supply undertaking is desirable, but not absolutely necessary.

The chief duties will be to supervise all canvassing and publicity work and the staff engaged in connection therewith, to personally interview power users and other persons with a view to securing the use of electrical energy in textile works, factories, workshops, &c., and in other ways extend the use of electricity in the City; and to carry out such other work and perform such duties as required by the City Electrical Engineer and Manager.

Canvassing is strictly prohibited.

The person appointed will be required to devote his whole time to the duties of the office, and to reside within the City.

Salary, £250 per annum.

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By order,
FREDERICK STEVENS,
Town Clerk.

Town Hall, Bradford,
23rd December, 1911.

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Mexican General Electric Company,
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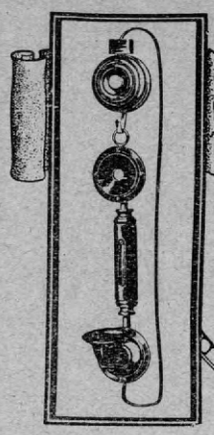
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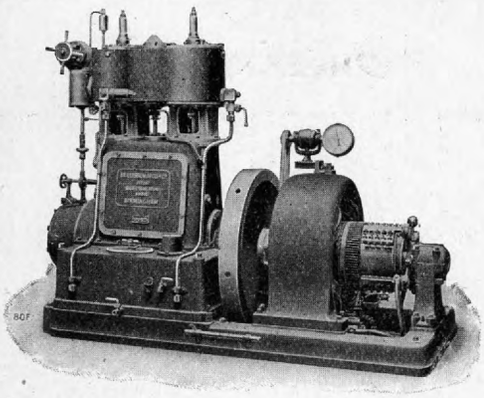
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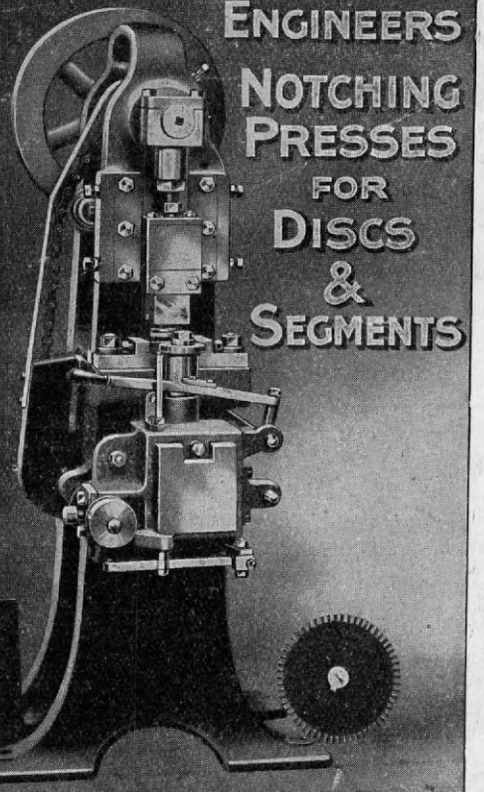
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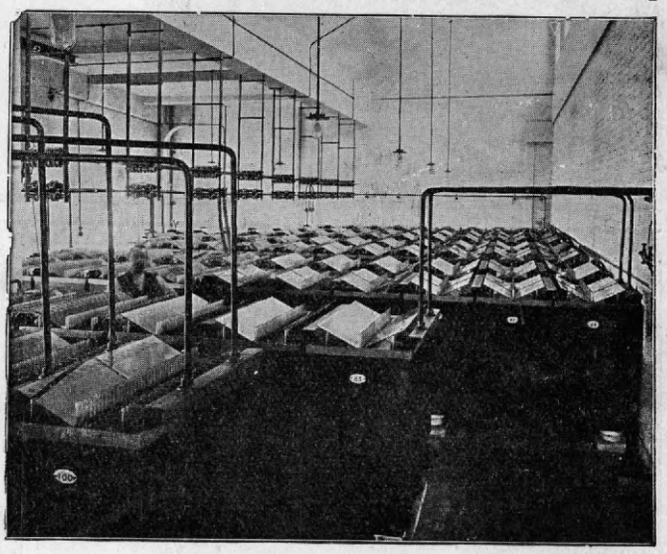
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